Know the quality of your soil or aquatic sediment: clarifying the risks

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Contents

Introduction

The entry into force of the Soil Quality Decree makes it easier to deal with excavated soil, dredged material and building materials in a responsible way. The Decree guarantees an unequivocal policy on sustainable soil management. The new Decree endeavors to achieve a balance between man and the environment and to allow scope for social developments. To balance a healthy living environment with the use of the soil for various purposes; for housing, work, leisure and to grow crops and more. Sound standards and assessment systems are of crucial importance in the endeavor to achieve this balance.

This report presents an overview of the underpinning of all the standards and assessment systems for the chemical quality of the soil, aquatic sediment, excavated soil and dredged material. These are the standards in the Decree and Regulation on Soil Quality, the 2006 Circular on soil remediation and the 2007 Circular on aquatic sediment remediation. Never before has such a complete overview been presented. It can be regarded as a milestone on the way towards a clear and consistent set of standards for the soil and aquatic sediment.

1 Target group and outline of contents

1.1 Who is the report for?

The information in this report is of vital importance for all those who are professionally concerned with standards for soil and aquatic sediment. In particular the report is intended for local government officials working with the local authorities, water boards and provincial authorities, consultancies, contractors and soil banks. It is important for local government officials who want to urge competent authorities to opt for the development of a local policy on soil to facilitate all kinds of social developments. It is important for the soil professionals who assess soil quality as part of their daily work. And it is important for the problem owners who want to activate the development of a local soil policy by way of making their own problems more manageable.

1.2 What is this report about?

For the remediation of soil and aquatic sediment Central government has set a single limit as given in the blue section (figure 1.1), right in the figure. To assess whether in a particular location the limit set has been exceeded a step-by-step system is followed. First a simple check is carried out in which the Intervention Value plays a major role. If necessary the next step is a detailed assessment of the environmental risks on the basis of the Remediation criterion system. That assessment is very much specific to a location. That is why there is a separate Remediation criterion for soil and for aquatic sediment.

For the reuse of excavated soil and dredged material Central government has devised two hazard ranking systems:

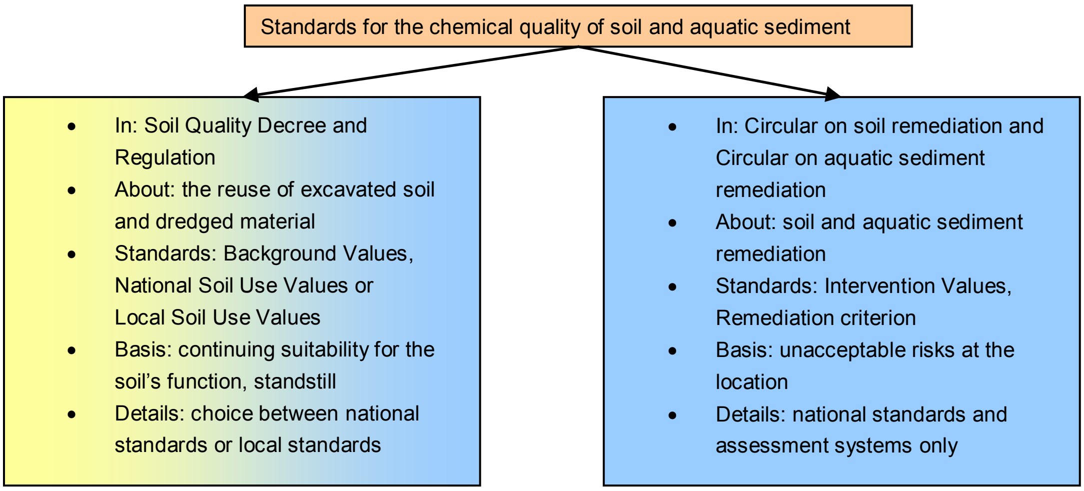
- A national framework with general standards that is straightforward to apply;
- A framework specific to an area with local standards which allows the decentral competent authority to make its own choices in determining the soil standards.

This is shown figure 1.1. These are standards for the reuse of excavated soil and aquatic sediment on soil/sediment or in large scale soil applications and for the spreading of dredged material on adjacent parcels of land or in surface waters. The standards are the Background Values, a number of different National Soil Use Values and the Local Soil Use Values. This report refers always to the nationally set Background Values (hence the use of the capital letters) and not to local background values.

The figures in this report use the color yellow for Background Values, blue for Intervention Values and the Remediation criterion and green for the National Soil Use Values in between these. The left section of the figure (from yellow via green to blue) shows that the standards for the reuse of excavated soil and dredged material may be between the Background Values and the Remediation criterion. There are options for the standards.

Figure 1.1 shows in broad outline what this report is about.

Figure 1.1: Broad outline of contents



1.3 What is the philosophy behind the standards system

The new standards system for the re-use of excavated soil and dredged material focuses on protecting human health and retaining the functional properties of the soil and aquatic sediment for humans, plants and animals. At the same time the system offers scope for the use of the soil for social developments in the context of specific areas. The challenge is to find a good balance between these. For this the right knowledge is needed.

With the new policy framework Central government (the Ministry of Housing, Spatial Planning and the Environment VROM; the Ministry of Agriculture, Nature and Food Quality LNV; the Ministry of Transport , Public Works and Water Management V&W) are aiming to achieve a proper balance between protecting soil quality on the one hand and offering adequate opportunities for disposing of excavated soil and dredged material on the other. Decisions on the soil quality must be based more on the environmental risks and on the use of the soil (referred to in the legislation as 'soil function'). The new standards system for the reuse of excavated soil and dredged material has been designed for this purpose, with National Soil Use Values for Housing and Industry depending on the function.
Central government makes it possible to take more account of the local situation on the basis of the Soil Quality Decree by setting Local Soil Use Values. Local authorities and water boards can thus respond to local problems and opportunities. In opting for Local Soil Use Values the soil manager can deal with the risks in a sensible way but he must ensure that humans and the environment are sufficiently protected. It is important to link local soil standards to local use of the soil. Central government has created an opportunity for devising a proper local soil policy on the basis of the environmental risks and the standstill principle. The information contained in this report helps you to use this opportunity.

The Soil Quality Decree is concerned with soil and aquatic sediment. In filling in the details of the hazard ranking systems for the re-use of excavated soil and dredged material different choices have been made in some cases for both soil and sediment because there are essential differences between them.
These differences are:

- In the case of aquatic sediment the water system has priority and the aquatic sediment is an integral part of this. Frequently, diverse functions exist in a water system which are interconnected. In the case of soil, generally speaking only a single soil use (or soil function) can be accorded to a certain area;

- In the case of aquatic sediment recontamination plays a major role in determining the objectives and thus in setting the standards. No recontamination occurs in the case of soil;
- Aquatic sediment has, as a rule, only one function: space intended for water. Soil may be accorded different functions (e.g. agriculture, nature, housing, business sites) in certain areas.

Central government has devised a national system for the spreading of dredged material on adjacent parcels and so-called large-scale soil applications. These specific applications must be possible irrespective of the soil function and the local soil quality, so that a national system is the obvious answer. There is also a national system for the reuse of dredged material in surface water but in this case the water quality managers can make their own choices within an area-specific system.

For aquatic sediment and soil remediation Central government still sets a limit. If the environmental risks are unacceptable then remediation must take place urgently. Below this limit the reuse of excavated soil and dredged material must in principle be possible.

Basing soil standards on environmental risks is not straightforward. Policy choices have to be made (how good must the protection be?), and choices have to be made about the methods of determining the risks, the results of an assessment method are not 100% reliable and usually more data are actually required than are available. New scientific knowledge sometimes means that standards have to be modified. However, it is otherwise the intention that the new system of standards should remain stable for some considerable time. The scientific developments referred to, but in particular the developments in the field of water and groundwater (European Water and Groundwater Framework Directive) may have consequences for soil standards.

1.4 Why is the knowledge in this report important?

The information presented in this report is important for allowing local authorities and water boards to choose properly between the national and the area-specific hazard ranking system for the reuse of excavated soil and dredged material. If a local authority opts for the national system for soil then the drawing up of a soil function map is mandatory. To draw up the map it is important to know what levels of protection go with what soil standards. If local authorities or water boards opt to develop their own local soil and aquatic sediment standards within the area-specific ranking system for the reuse of excavated soil and dredged material, knowledge of the underpinning of the system of standards is indispensable. Policy makers, advisors, enforcers and operations staff need to know the core of the new system of soil quality standards so that they can make responsible use of the opportunities that the standards system offers.

The report also shows the connection between the standards for the reuse of excavated soil and dredged material and the standards for the remediation of soil and aquatic sediment. As a result it becomes clear why in certain circumstances it is not necessary to carry out urgent remediation while the soil in question nevertheless cannot be used elsewhere in a comparable situation. The information in this report shows that there is logic behind the system.

1.5 Readers' Guide

Figure 1.2 helps readers find their way in the report

Figure 1.2: Readers' guide

The general base	Different types of risks (H2); Relationship between risks and soil function (H2); Standstill as basis for standards (H2)
The main thread	Relationship between the form of soil management (reuse of excavated soil/dredged material, remediation) and the underpinning of the soil standards (H3)
Soil and aquatic sediment remedation	Unacceptable risks, standards for soil and aquatic sediment remediation (H4)
Reuse of excavated soil and dredged material	Continuing suitability of soil, national soil standards (H5) Continuing suitability of soil, local soil standards (H6) Continuing suitability of aquatic sediment, national and local standards (H7)
Specific applications	Spreading of dredged material in surface water (H8) Spreading of dredged material on adjacent parcels (H9) Large scale soil applications (H10)

1.6 What is this report not about?

This report is not about the assessment of the physical or biological soil quality (target species, groundwater level, soil composition) and is not about nutrients in the soil. No hazard ranking systems have been included in the Soil Quality Decree and Regulation for this. However these aspects are important for assessing the soil quality. An important instrument in this respect has been developed in the Route planner Soil Ambitions project (see www.bodemambities.nl). Another project that is relevant in this context is BIELLS (Bodeminformatie, essentieel voor landelijke en local sturing, zie www.biells.nl), a project providing essential information for national and local authorities. Lastly the RBB project (Referenties voor de bodembiologische kwaliteit, zie www.bodemplus.nl) on references for biological soil quality should be mentioned and the accompanying RIVM report (Rutgers et al 2005). There are separate regulations for nutrients/eutrophication.

This report is not about the assessment of building materials either. Building materials involve preventive policy and the prevention of risks (and not dealing with risk bearing in mind the existing soil quality). The standards are concerned with the emission of substances in building materials into the soil and groundwater. For more information reference can be made to Verschoor et al 2006. The underpinning of the building materials standards incidentally does display many similarities with the underpinning of the standards for large-scale soil applications (see chapter 10).

The prior knowledge required to be able to read this report is the role of the various soil standards in the Soil Quality Decree and Regulation and the distinction between the national and area specific hazard ranking system. Readers must be familiar as well with the concept of the 'Risk toolbox'. More information on these subjects can be found in the Soil Quality Decree Manual and at www.risicotoolboxbodem.nl . In addition some knowledge of the role of the Intervention values and the Remediation criterion is needed. The report assumes that readers are familiar with the concept of 'case of serious soil contamination'. For this, reference should be made to 2006 Circular on soil remediation and the 2007 Circular on aquatic sediment remediation.

2 General basis for underpinning of the soil standards

2.1 The general basis

Most soil and aquatic sediment standards are based on risks. These are environmental risks, for example the risks to human health and the dispersion of contaminated substances in the environment. Details are given in sections 2.2 to 2.6. Whether risks are involved in a particular situation depends very much on the use of the soil (the soil function). Sections 2.3 to 2.6 deal with this by type of risk.

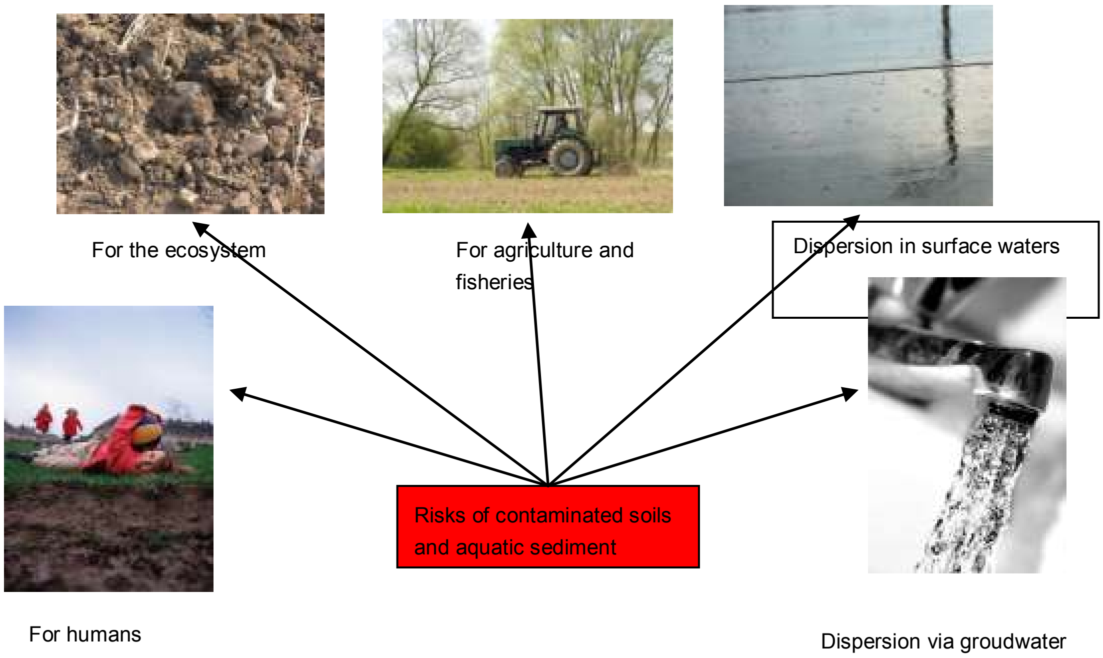
In addition there are also soil and aquatic sediment standards that are based on the standstill principle. Section 2.7 explains this.

2.2 Different types of risks

Soil and aquatic sediment standards are based on the following types of risks (see figure 2.1):

- the chance of an effect on human health;
- the chance of an effect on the soil and aquatic sediment ecosystem: effects on plants and animals and the disruption of the natural processes in the soil (for example the decomposition of leaves);
- the chance of effects on agricultural production, commercial fishing and shellfish farming: effects on the yield, on the health of livestock or the standards given in the Commodities Act or for animal feed being exceeded;
- the chance of dispersion into surface water. As a result water organisms can suffer effects;
- the chance of dispersion via groundwater, so that the contaminants may give rise to risks elsewhere (for example by ending up in drinking water).

Figure 2.1: Types of risks of contaminated soil and aquatic sediment



The types of risks are explained in more detail below.

2.3 Risks to humans

2.3.1 Exposure of humans can result in risks

To make sure that people do not become ill from the contaminants in the soil a limit has been set in the form of a maximum exposure dose: the MPR-human (the maximum permissible risk level for humans). Humans may not be exposed to more than this dose of a certain contaminant in mg per kg body weight per day. In deciding on the dose account has been taken of vulnerable groups, such as children, and sensitive individuals. The MPR-human has been derived by the RIVM on the basis of international literature (see Baars et al 2001).

There can only be risks to humans if people are actually exposed to the contaminants in the soil and these substances are also actually “ingested”. For soil there are three main exposure routes for human beings (see figure 2.2).

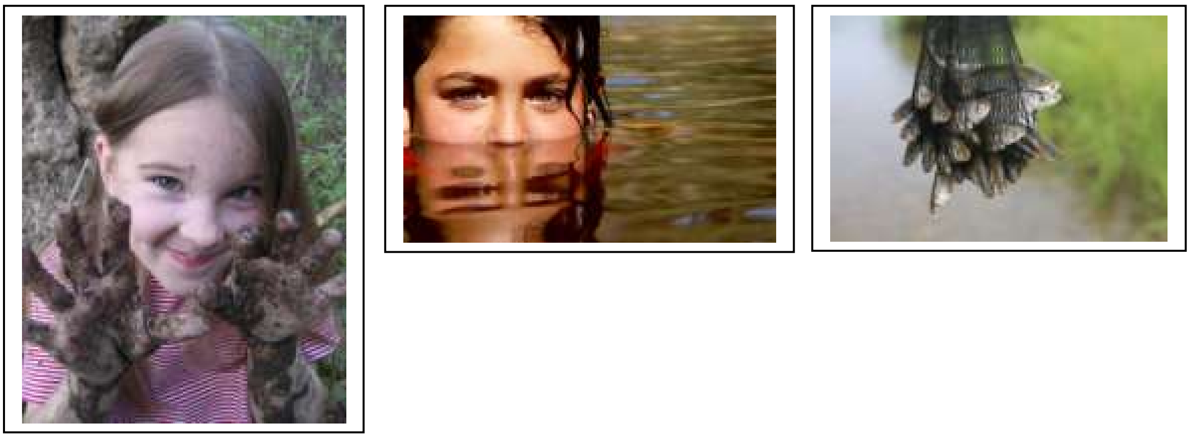
1. ‘Eating’ particles of earth, which have stuck to the hands as a result of direct contact with the soil and soil dust (in the home). This happens above all among small children who play on unpaved land, but it is also important for adults, for example when gardening, but also, to a lesser extent in the home.
2. The consumption of crops which have been cultivated on contaminated soil.
3. The evaporation of contaminants from the soil into the ambient air in dwellings.

Figure 2.2: Exposure routes that may pose risks to humans in the event of contaminated soil.

For aquatic sediment there are also three main exposure routes for humans (see figure 2.3):

1. ‘Eating’ sediment particles, in direct contact with the aquatic sediment. This occurs above all recreationally on the water’s edge.
2. Penetration through the skin as a result of direct contact with the aquatic sediment or surface water. This occurs equally during recreational activities at the water’s edge and swimming in surface water.
3. Consumption of self-caught fish which live in an area with contaminated aquatic sediment, for example eels that may contain dioxin-like compounds.

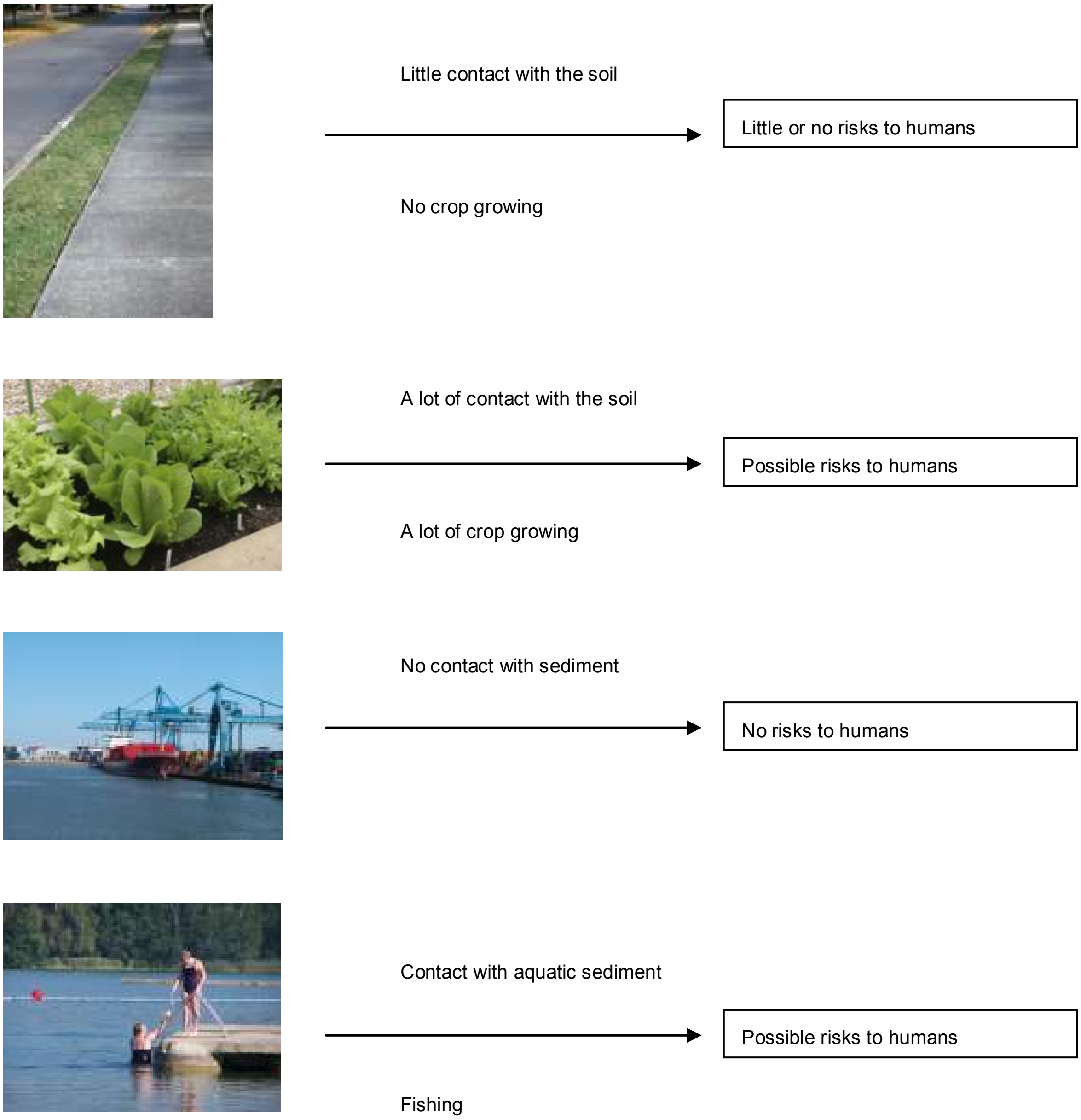
Figure 2.3: Exposure routes that may result in human risks from contaminated aquatic sediment.



2.3.2 Relationship between human risks and soil function

If there is little or no exposure there are few or no risks to humans. This applies for example if the soil is completely covered in a pavement or if surface water is not used for recreational purposes or fishing. If there is a great deal of exposure then there is a much bigger chance of soil contamination resulting in the maximum exposure dose for humans (MPR-human) being exceeded. This applies for example to a vegetable garden where there is a lot of direct contact with the soil and where crops for consumption are grown. In the case of aquatic sediment the biggest chance of exposure is in the case of water that is used for recreational purposes and fishing. From this it emerges that the soil function (the way in which the soil is used) determines whether the contaminants can be hazardous to humans. Figure 2.4 illustrates the relationship between the risks to humans and the soil function.

Figure 2.4: Relationship between human risks and soil function



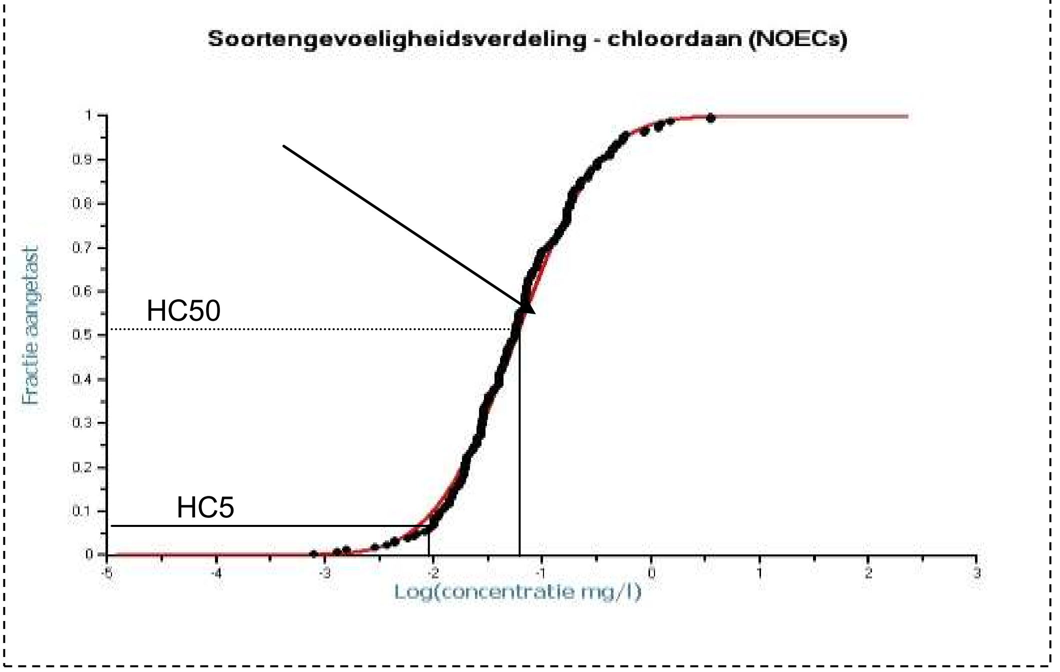
Computer models have been developed to be able to work out the exposure dose for humans depending on the soil function. The CSOIL model is used for the exposure of humans to contaminants in the soil and the SEDISOIL model is used for exposure to aquatic sediment.

2.4 Risks for the ecosystem

2.4.1 Assessment of ecological risks

A method has been developed to assess whether risks exist to the ecosystem. The method is the Species Sensitivity Distribution (SSD). Toxicity tests are carried out with all kinds of different test organisms. It is determined for each species at which concentration in the environment (soil or water) the No Observed Effect Concentration or NOEC applies. A figure is made of the results of all the tests together from which it can be seen which fraction of the species have been affected, i.e. the NOEC has been exceeded at which concentration in the environment.
Figure 2.5 gives an example of a Species Sensitivity Distribution of this kind. You can read in the figure which Potential Affected Fraction (PAF) belongs to which concentration in the environment (in this case water). The concentration that belongs to a PAF of 50% is the HC50 (Hazardous Concentration 50%); the concentration that belongs to a PAF of 5% is called HC5. The HC5 can be regarded as a relatively high level of protection and the HC50 as a relatively low level of protection for the ecosystem.

Figure 2.5: Example of a species sensitivity distribution curve (SSD curve)



To underpin the standards for soil the preference is for toxicity tests with soil organisms. Toxicity tests with water organisms however are easier to carry out so that there are far more results of toxicity tests with water organisms. If there are too few test data from soil organisms to underpin the standards for soil the test data for water organisms are used and these are converted from the concentration in water to the concentration in soil.

The above method is used for each substance to underpin the standards for each substance. To assess soil quality use is sometimes made of a method for assessing the toxicity of the mixture of substances present. This method is called the ms-PAF : the Potential Affected Fraction for multiple substances. The ms-PAF method is a way of calculating that works out the ecological risk level by substance in the form of a PAF and subsequently adds up together the risks of the different substances. Thus a value arises for the ecological risk level for the mixture of substances present. This is the value of the ms-PAF in %.

2.4.2 The value of the ecosystem determines the level of protection

The ecosystem is always in contact with the soil contamination so that there is always exposure. This is not the case with human beings, where exposure depends on the soil function. For humans the level of protection is set (for a particular standard). As a result of exposure differing depending on the soil function the risks to humans, in the case of a certain soil concentration, are also different depending on the soil function.

If a fixed level of protection were to be chosen for the ecosystem (for a particular standard) the ecological risks for each soil function would be the same. There are major differences in what the ecosystem represents, especially in the case of soil. Under pavement it is above all a question of micro-organisms and in a nature area there may be extremely rare plants and animal species. This is why it has been decided that no set level of protection will be assumed for the ecosystem of soils but that different levels of protection will be used depending on the soil function. In the case of the ecosystems of soils therefore it is a question of how important society considers the protection to be. In the legislation on soil, the level of protection for the ecosystem has been chosen policy-wise, depending on the value that is attached to it.

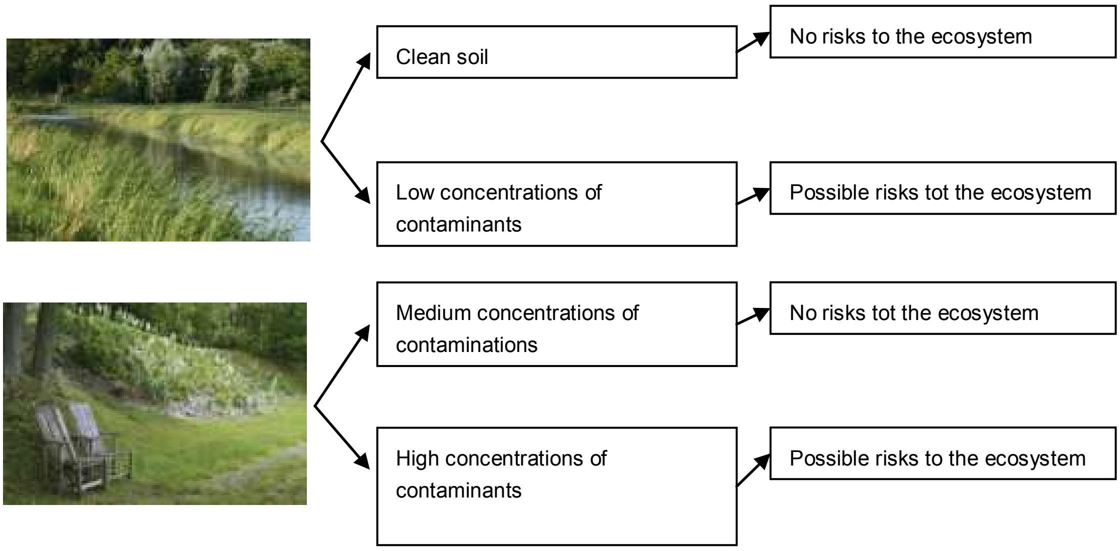
In the case of aquatic sediment there is a much less clear differentiation in function (see section 1.3). This is why a single set level of protection is adopted for aquatic sediment (for a particular standard) independent of the function.

2.4.3 Relationship between ecological level of protection and soil function

In the case of a nature area it would be obvious to opt for a high level of protection as a rule. Risks or too many risks are considered to exist here in the case of relatively low concentrations of contaminants. However, there are also beautiful nature areas in the Netherlands which have relatively high concentrations of contaminants (for example the Biesbosch). But the concern here is not with the actual level of protection in place but with the policy choice for a desired level of protection.

There are also straightforward ecosystems, such a field of grass or strips of green with a single species of shrub or the aquatic sediment below an industrial port. For this type of ecosystem it is logical to opt for a relatively low level of protection. It is only in the case of a relatively high concentration of contaminants that there are risks or too many risks for ecosystems of this type. Figure 2.6 illustrates this principle diagrammatically.

Figure 2.6: Relationship between ecological risks and the soil function



2.5 Risks for agricultural production, commercial fishing and shellfish farming

The risks at stake in the case of agricultural production, commercial fishing and shellfish farming are drops in yield, effects on the health of livestock or standards in the Commodities Act or for animal feed being exceeded. At the moment there are no aquatic sediment standards that are based on the risks for commercial fishing or shellfish farming, for example loss of production as a result of lower reproduction rates among fish. The aquatic sediment standards do take into account the quality of the fish to be consumed, but this comes under risks to humans (see section 2.3).

The question of what concentrations of contaminants pose risks to soil depends on the type of agricultural use. In setting standards a distinction has been made between arable farming, arable farming for animal feed, vegetables, grazing meadow, fruit and ornamental plant growing.

2.6 Risks of dispersion via the groundwater and into surface water

The groundwater and surface water have to be protected against an overly large pollution by contaminants. The stage at which the pollution is excessive is in fact a policy agreement. Agreements have been reached on this for the pollution of groundwater (see the 2006 Circular on soil remediation). In the case of surface water the goals are determined on the basis of the European Water Framework Directive. In this the sound ecological state of ecosystems has priority. Rules on the remediation of aquatic sediment have been geared to this (see the 2007 Circular on the remediation of aquatic sediment). For groundwater the goals are determined on the basis of the European Groundwater Directive. The review of the system of standards for groundwater is being worked on in 2007 and 2008.

2.7 Standstill as a basis for soil standards

There are limits to basing soil standards on environmental risks. No soil standards can be set which are lower than the quality of relatively clean soil in the Netherlands. This is why the quality of relatively clean Dutch soils, in the form of Background Values, are the basis for soil standards (see section 3.2).

In the case of aquatic sediment the so-called recontamination level is important. For certain goals there is no point in setting aquatic sediment standards which are stricter than the quality of newly-formed sediment. This has been taken into account in setting a number of standards for aquatic sediment (see chapters 7 and 8).

3 The main thread: the relationship between the kind of soil management and the underpinning of the soil standards

3.1 The main thread

Reference is frequently made to there being risks or no risks (as earlier on in this report), but unfortunately things are not so simple. Different forms of soil management set different limits when it comes to risks. This chapter deals with the main thread. What level of protection or level of quality belongs with which type of soil management and why is this?

The types of soil management in this chapter are:

1. Soil management below the 'always-limit': few rules are necessary. The reuse of excavated soil and dredged material is allowed.
2. The hazard ranking systems for the reuse of excavated soil and dredged material under conditions.
3. Dealing with the presence of 'serious' contamination in the soil and aquatic sediment (management measures and remediation).

Sections 3.2 to 3.5 focus above all on soil and are intended to present an overview of a number of important types of soil management. Section 3.6 does the same for aquatic sediment. Section 3.7 briefly looks at the relationship between soil standards (and assessment systems) and the concentrations of contaminants in the soil.

The report deals elsewhere with the forms of soil management which are not included in this chapter. A further detailing of the underpinning of the soil standards is also explained elsewhere in the report.

3.2 Re 1: protection level and soil standard for the always-limit

The level of protection for the always-limit is the highest (the standards are the strictest). The soil quality is 'continuing suitability for every soil function'. The reuse of excavated soil and dredged material is permitted. The soil standards that apply are the Background Values. The Background Values are based on measured concentrations of contaminants in the Dutch soil in non-suspect agricultural and nature areas. More information can be found about this in Lamé et al (2005) and Lamé and Nieuwenhuis (2006).

Scientifically speaking there are limited risks even at the level of the Background Values. The Dutch soil is not entirely unpolluted and some contaminants, even at very low concentrations, nevertheless present a (limited) risk. Policy-wise such risks are considered to be so small that areas that meet the Background Values are regarded as being relatively unpolluted. There are no restrictions on the use of the soil, the excavated soil or dredged material. Setting stricter standards for soil management than the Background Values has no point: cleaner soil will usually not be available.

The Background Values are based on the standstill principle (maintaining existing quality) and not directly on risks. Because the Background Values are the strictest standards, the policy statement is that there are no risks for any soil function at the level of the Background Values. Although the Background Values are based on measurements in soil they also apply to aquatic sediment. This is in connection with the consistency of the system of standards.

3.3 Re 3: the level of protection and soil standards for serious soil contamination and remediation

The level of protection that goes with 'serious soil contamination' (this is the term that is used in the Soil Protection Act) and remediation is lowest. Action is only necessary if there are clear risks. Above the level of risk of the Remediation criterion the soil is 'unsuitable for the relevant soil function' and the risks are referred to as being 'unacceptable'. Remediation is urgently needed. The step-by-step assessment system specific to the location, which is relevant here, is the Remediation criterion. The first step as part of the system is to check against the Intervention Values which are not linked to the soil function. The system ultimately checks whether the level of risk of the Remediation criterion is exceeded. Chapter 4 deals in greater detail with the level of risk that accompanies unacceptable risks for soil and aquatic sediment.

3.4 Re 2: level of protection and hazard ranking systems for the application of excavated soil and dredged material

The level of protection at which the reuse of excavated soil and dredged material is permitted under conditions lies between the always-limit (re 1) and the limit for urgent remediation (re 3). The conditions referred to mean that the reuse of excavated soil and dredged material must meet a certain quality level that depends on the soil function (because of risks) and on the in situ soil quality (because of the standstill principle). In developing the hazard ranking system for the reuse of excavated soil and dredged material it is a question of finding the balance: in the case of overly strict standards reuse and social developments are impeded while overly lenient standards provide insufficient protection for the environment. To enable that balance to be found at local level two systems have been developed for the reuse of excavated soil and dredged material and the following choices have been made for the level of protection that accompanies these:

- For the National hazard ranking system choices have been made for the level of protection in which the soil quality continues to be suitable for the function in question. The accompanying statement is: there are 'no risks' linked to the soil function. The accompanying level of protection is 'the level of protection of the National Soil Use Values'. There are National Soil Use Values for Housing and for Industry. The Background Values apply as National Soil Use Values for Agriculture and Nature. Chapter 5 explains the underpinning of the National Soil Use Values
- Within the hazard ranking system specific to an area the competent authority, within the terms of a democratic process, may opt for the level of protection in which they consider the soil to be locally suitable for the function in question. This level of protection may lie between the level of the Background Values and 'unacceptable risks' for the soil function in question. The use of the Risk toolbox for soil is compulsory to gain a clear picture of the level of risk. Chapter 6 deals with this in greater detail.

3.5 Relationships between the form of soil management, the level of protection and soil standard

Table 3.1 presents an overview of the contents of the previous sections. The last column indicates where more detailed information can be found.

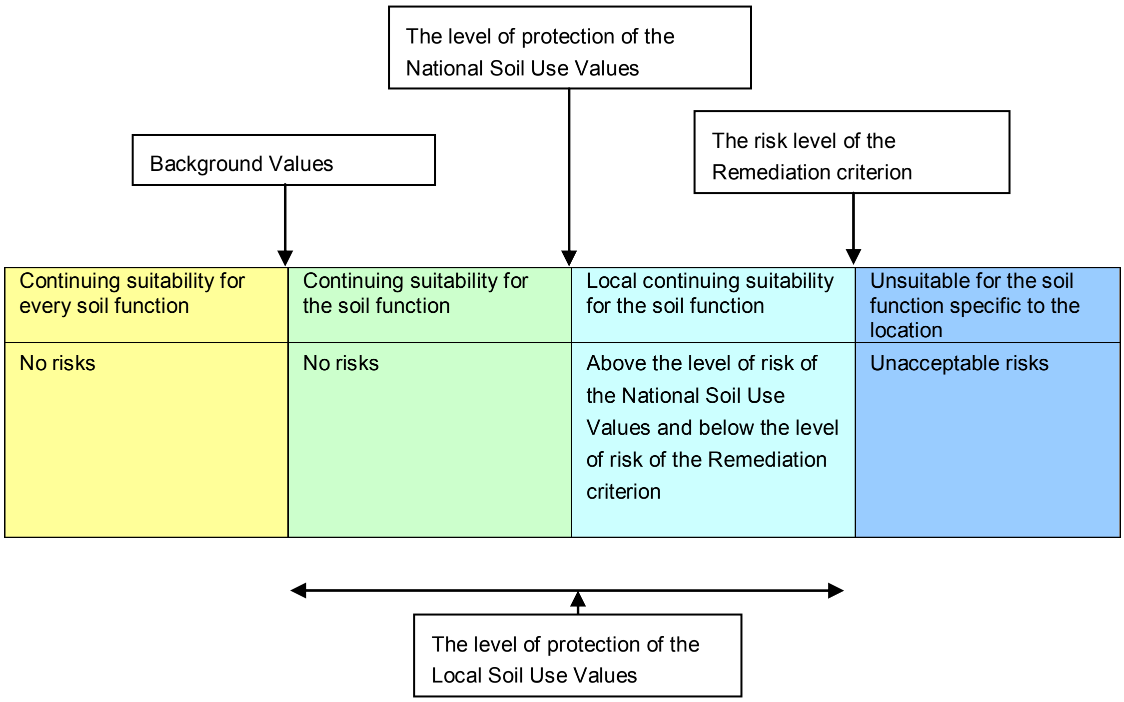
Table 3.1: Overview of the relationships between the form of soil management, the accompanying soil standards, the suitability of the soil for the function and the level of protection of the standards

	Standards	**Level of protection of the standards**	**Suitability of the soil for the soil function**	**More information**
Always-limit	Background values	No risks	Continuing suitability for every soil function	3.2
National ranking system for the reuse of excavated soil and dredged materials	Background Values, National Soil Use Value Housing, and National Soil Use Value Industry	No risks	Continuing suitability for the soil function category	H5
Area specific ranking system for the reuse of excavated soil and dredged material	Local Soil Use Values	Locally chosen	Locally suitable for the soil function	H6
Soil and aquatic sediment remediation	Intervention Values and Remediation criterion	Unacceptable risks	Unsuitable for the soil function	H4

Figure 3.1 shows the main thread described in this chapter up to now. From the free reuse of excavated soil and dredged material to the reuse of excavated soil and dredged material under conditions, to soil remediation:

- There is a rising level of risk and a diminishing level of protection;
- The link to the local situation becomes increasingly close.

Figure 3.1: Relationships between the suitability of the soil for the function, accompanying protection/risk levels and accompanying soil standards



3.6 The main thread for aquatic sediment

The main thread for aquatic sediment in the relationship between the form of soil management and the underpinning of the soil standards displays many similarities with the main thread for soil:

- the always-limit is filled in by the Background Values;
- there is a Remediation criterion which determines that a risk assessment specific to a location has to be carried out and remediation must urgently take place if there is a question of unacceptable risks;
- there is a national and an area-specific hazard ranking system for the reuse of excavated soil and dredged material, the limits for the area-specific hazard ranking system are the Background Values and the Remediation criterion for aquatic sediment.

The main difference between the systems of standards for soil and aquatic sediment is the filling in of the National hazard ranking system for the reuse of excavated soil and dredged material. In the case of soil there is a strong link to the soil function. Such a link is not an obvious step to take in the case of aquatic sediments because of the essential differences between these and soil (see section 1.3). The National hazard ranking system for aquatic sediment is therefore linked to the recontamination level, which is a much more obvious solution. A further explanation is given of this in Chapter 7.

3.7 The relationship between soil standards and soil concentrations

As explained in Chapter 2 the soil function determines the level of the risks to humans and the level of protection for the ecosystem.

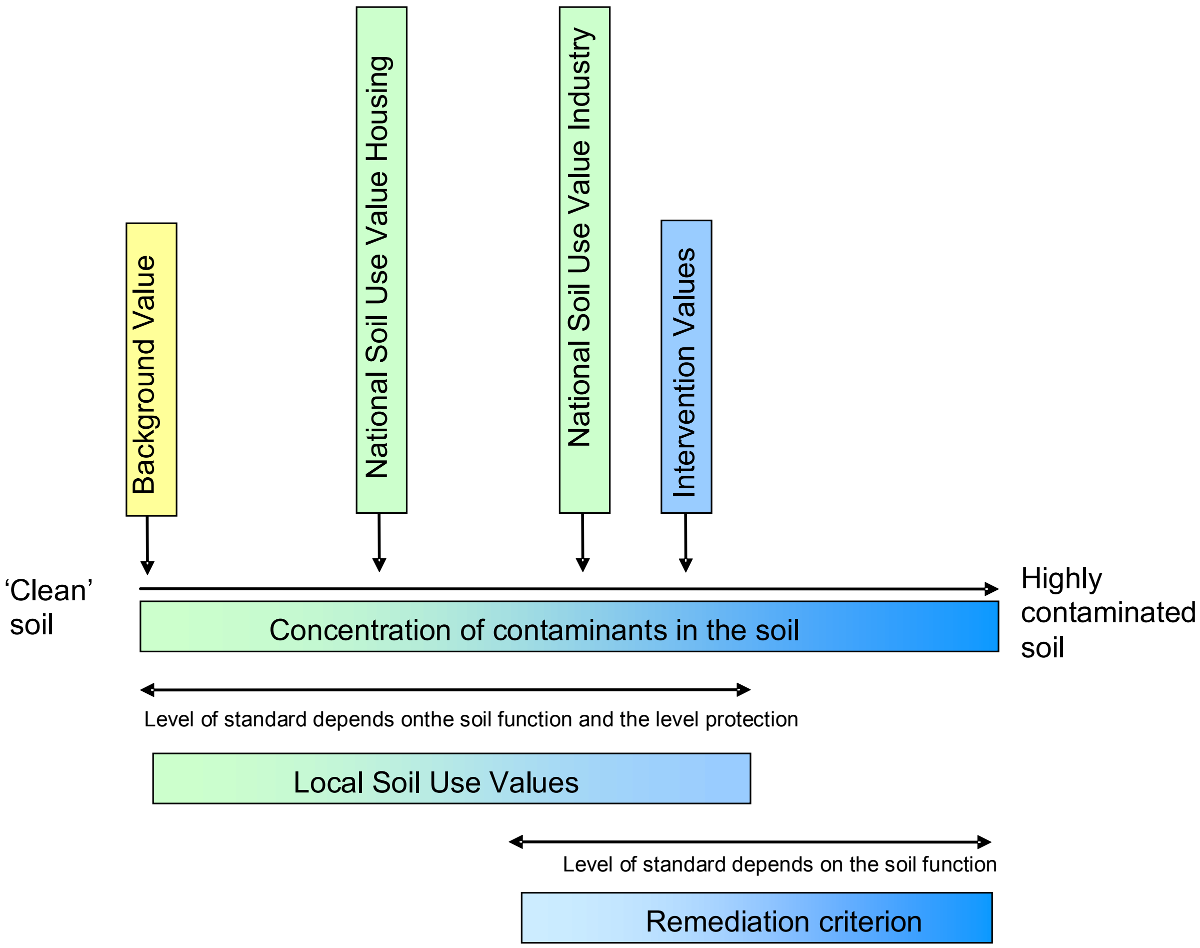
When an assessment is made of the soil quality using the Remediation criterion the soil function is very much taken into account. In the case of a certain soil concentration (concentration of contaminants in the soil), there may be unacceptable risks in the case of a particular (sensitive) soil function and no unacceptable risks in the case of another (less sensitive) soil function. In the case of a less sensitive soil function there will only be a question of unacceptable risks in the event of a much higher soil concentration.

Filling in the Intervention Values assumes a set level of protection for the ecosystem and a set exposure of humans (see section 4.2). A set soil concentration also applies. The Invention Values don't depend on the soil function.

For the National Soil Use Values the soil concentration depends on the soil function to which that Soil Use Value applies. If a single soil function is opted for, the set level of protection of the National Soil Use Values can be linked to a single soil concentration. This applies to the National Soil Use Value for Housing and the National Soil Use Value for Industry. The Local Soil Use Values do not have any level of protection set in advance and therefore nor do they have any set soil concentration in advance. Moreover the Local Soil Use Values depend on the soil function to which they apply. The Background Values have a set soil concentration but this is because they are based on soil quality measurements instead of risks (see section 3.2).

Figure 3.2 gives an overview of the relationship between soil standards and soil concentrations.

Figure 3.2: Relationship between soil concentrations and soil standards



In the figure it would appear as if the Local Soil Use Values could be higher than the Remediation criterion. This is not however the case. The overlap in the figure arises because a Local Soil Use Value for a relatively insensitive soil function may accompany a higher soil concentration than the Remediation criterion for a relatively sensitive soil function.

The figure shows that the Soil Use Value for Industry (which allows the reuse of excavated soil) may accompany a higher soil concentration than the Remediation criterion (implying that Remediation is urgent). This is a result of the linking both the Soil Use Value for Industry and the Remediation criterion to the soil function. It may happen that the soil quality is such that in the case of an extremely sensitive soil function (for example a vegetable garden) remediation is urgent. The same or even a poorer soil quality may be perfectly adequate for a business site where the excavated soil may then be used (provided the quality in situ comes under the heading of Category Industry). A further explanation of this can be found in Chapters 4 and 5, which deal with the underpinning of the different soil standards.

4 Unacceptable risks, standards for soil and aquatic sediment remediation

4.1 Step-by-step system for assessing unacceptable risks.

If there are unacceptable risks urgent remediation is needed (see section 3.3). This chapter is about the underpinning of the soil standards relating to unacceptable risks.

From the description of the different types of risk in Chapter 2 it is apparent that the soil function determines whether the environmental risks are unacceptable. The Remediation criterion for soil (see the 2006 Soil remediation circular) and the Remediation criterion for aquatic sediment (see the 2007 Circular on the remediation of aquatic sediment) provide a step-by-step assessment system, specific to a location, to judge whether there are unacceptable risks.

The application of the Remediation criterion requires specific information about the contamination situation and the soil function specific to the location. There was a need for a first straightforward step in the system in the form of checking the concentration in the soil and aquatic sediment against a concentration standard for soil, sediment and groundwater. This standard is the Intervention Value. For soil and aquatic sediment remediation the Intervention Value serves as a signaling value that there may be something the matter. If the Intervention Value is exceeded it has to be checked whether anything is wrong using the Remediation criterion. With the coming into force of the Soil Quality Decree there are separate Intervention Values for soil and for aquatic sediment.

The Intervention Values and the Remediation criterion bear in mind the risks to humans, to the ecosystem as well as the risk of dispersion into groundwater and surface water. Risks for agricultural production, commercial fishing and shellfish farming as a result of the existing quality of the soil and aquatic sediment are not taken into account in the Remediation criterion or in underpinning the Intervention Values. Producers themselves are responsible for ensuring that their product is of a good quality and they have to take into account any economic loss (fall in yields, effects on animal health) as a result of soil contamination. The quality of the product is protected by standards in the Commodities Act and the standards applying to animal feed.

If remediation of soil is urgently needed the remediation goal is the National Soil Use Value that applies to the soil function in question. This goal implies a continuing suitability of the soil for the function (see Chapter 5). Through this there is a consistent link between the rules for soil remediation and for the reuse of excavated soil and dredged material (see the 2006 Circular on soil remediation). The remediation goal for aquatic sediment is the removal of unacceptable risks.

The following sections first explain the underpinning of the Intervention Value for soil and then the underpinning of the Intervention Value for groundwater and the Intervention Value for aquatic sediment. The chapter then goes on to deal with the Remediation criterion for soil followed by the Remediation criterion for aquatic sediment.

4.2 Underpinning the Intervention Value for soil

4.2.1 The basis for the Intervention Value for soil

The Intervention Value for soil is based on the risks for humans and for the ecosystem.

4.2.2 Human risks as the basis for the Intervention Value

For humans the risks are unacceptable if the set maximum exposure dose for humans (the Maximum Permissible Risk level for humans, MPR-human) is exceeded as a result of the soil contamination. To link the Intervention Value for soil to possible unacceptable risks for humans, it has to be determined for each substance at which concentration in the soil the MPR-human is exactly reached. The exposure dose for humans is calculated using the exposure model CSOIL. CSOIL uses all kinds of input parameters such as the quantity of crops which are consumed from the contaminated soil and the degree to which particles of soil are 'eaten' (see section 2.3.1). To be able to use the CSOIL model for calculating the Intervention Value a choice of a representative soil use was required so that the input parameters could be filled in. The choice that was made was 'house with garden'. In the case of this type of soil use all kinds of ways of coming into contact with soil contaminants play a role (ingesting particles of earth, consuming 10% contaminated crops and evaporation into ambient air).

A possible choice for 'house with vegetable garden' for underpinning the Intervention Value for soil, would make this value stricter. Given an equal soil concentration, a higher exposure dose for humans would be calculated than in the case of 'house with garden' because more crops from one's own garden would be eaten. 'House with vegetable garden' however was found to be a much too exceptional soil function on which to base a National soil standard like the Intervention Value for soil. To prevent unacceptable risks below the Intervention Value being ignored, sensitive functions are defined in the Remediation criterion (see section 4.5).

4.2.3 Ecological risks as the basis for the Intervention Value

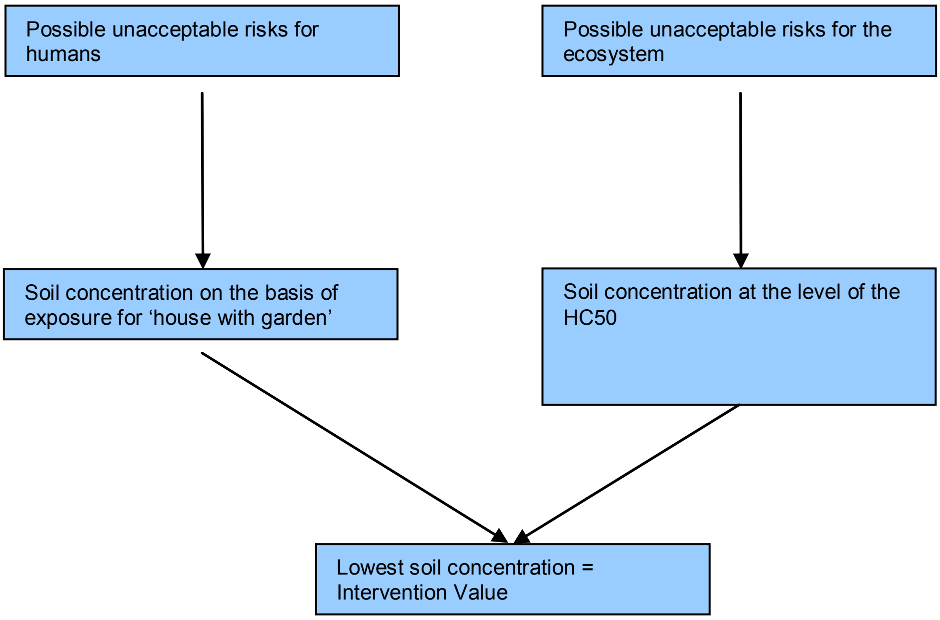
To set a limit for possible unacceptable risks to the ecosystem a more or less arbitrary choice had to be made. The limit for the Intervention Value for soil has been set policy-wise at a soil concentration in which 50% of the possibly present species of plants and soil organisms or natural processes in the soil have been 'impaired' by the soil contamination. This is the HC50 (see section 2.4). This is the National limit that has been chosen policy-wise to link possible unacceptable ecological risks to the Intervention Values. Effects which also occur at a concentration below the natural Background Value of substances are not counted here.

A possible choice for example for the HC5 as level of protection for the ecosystem for the underpinning of the Intervention Value would protect the ecosystem better but this would result in standards being exceeded in large parts of the Netherlands. This is unworkable in practical terms and there are no indications that the soil contamination has such repercussions that measures have to be taken in many places in the Netherlands. This is why this choice has not been made as a matter of policy. The HC50 provides a workable limit indicating that there "really is something the matter'.

4.2.4 Intervention Value for soil on the basis of human or ecological risks

It will be clear that the soil concentration that goes with possible unacceptable risks for humans is different than in the case of the ecosystem. The Intervention Values have been established on the basis of the lowest concentration of contaminants in the soil from the two derived soil concentrations for unacceptable risks. Usually this was the soil concentration that goes with possible unacceptable ecological risks. This means that if the Intervention Values are exceeded there is frequently no question of possible unacceptable risks for humans. Figure 4.1 shows the underpinning of the Intervention Values for soil.

Figure 4.1: Overview of the underpinning of Intervention Values for soil



With the coming into force of the Soil Quality Decree most of the Intervention Values for soil change. This is a result of an updating to bring these into line with the current state of the art. More information about this can be found in the Report on standards and soil quality assessment (VROM, 2008, in Dutch only).

4.3 Underpinning the Intervention Value for groundwater

The Intervention Value for groundwater has been derived from the Intervention Value for soil using a calculating method. As indicated in section 2.6 work is currently being done on reviewing the set of standards for groundwater. Hence no updating of the Intervention Values for groundwater has been introduced.

4.4 Underpinning the Intervention Value for aquatic sediment

Until the coming into force of the Soil Quality Decree there was always a single Intervention Value that applied to both soil and aquatic sediment. This rule was abandoned in the drafting of the Decree. At that stage a choice had to be made for aquatic sediment. Going along with the changes for soil didn't mean a better link with the risks for aquatic sediment. In updating the Intervention Values for soil it was possible to make greater use of toxicity data for soil organisms. The existing Intervention Values had largely been based on toxicity data for water organisms as a result of lack of data at the time. The RIVM put forward proposals in 2001 for specific Intervention Values for aquatic sediment (Lijzen et al, 2001). However, for this a fairly uncertain conversion had to be made from water to sediment. The proposed values for metals are high and are giving rise to a great deal of debate. In addition the drafting of the legislation on water is playing a role, as part of which the set of standards for aquatic sediment is being reviewed.

For practical reasons and reasons of policy it has been decided that at the moment for aquatic sediment the existing Intervention Values as used until 2007 will be retained as Intervention Values for aquatic sediment. One major advantage of this is that the limit set between serious aquatic sediment contamination or no serious aquatic sediment remains the same, so the 'working stock' need not be recharted. The real risk assessment is done using the Remediation criterion for aquatic sediment. For this the Intervention Value for aquatic sediment plays a subordinated role.

The Intervention Values for aquatic sediment must focus on contamination arising from point sources. For a number of metals the existing Intervention Values had already been exceeded in diffusely polluted areas. There is no point in resorting to the remediation of aquatic sediment in areas of this kind. The values in question therefore have been modified. For the metals in question the Intervention Value for aquatic sediment is based on the 95-percentile values of relatively contaminated sediment samples from the rivers area because this is regarded as a diffusely polluted area. A check has been carried out to see whether these new higher values for the Intervention Value for aquatic sediment are not leading to unacceptable ecological risks for soil and aquatic sediment organisms. This turned out not to be the case. For more information about this reference should be made to the Report on new standards for aquatic sediment (RWS-RIZA, 2007, in Dutch only).

4.5 The Remediation criterion for soil

4.5.1 The basis for the Remediation criterion for soil

The Remediation criterion for soil assesses the human and ecological risks and risks of diffusion into groundwater. For each type of risk a step-by-step system is used. The first step is an assessment to see whether the Intervention Value for soil is being exceeded and an assessment of whether there is a sensitive function.
The second step is a standard risk assessment and the third step is a risk assessment specific to the location.

4.5.2 Assessment of human risks with the Remediation criterion for soil

The choice of 'house with garden' for underpinning the Intervention Values means that for specific sensitive functions (for example vegetable gardens) account has to be taken of unacceptable risks for humans below the level of the Intervention Value for soil. This is why a number of sensitive functions have been defined in the Remediation criterion for soil for the first step of the Remediation criterion (see the 2006 Circular on soil remediation).

The second step of the Remediation criterion for soil provides a standard system which with the aid of the CSOIL model works out how great the exposure dose for humans is depending on the concentration of the contaminants in the soil and the soil function specific to the location. Next a check is made to see whether the MPR-human is exceeded. A possible third step in the Remediation criterion for soil could be additional measurements in contact media (crops for consumption, ambient air).

4.5.3 Assessment of ecological risks with the Remediation criterion for soil

To set a limit for unacceptable ecological risks in the second step of the Remediation criterion for soil an additional look was taken at the surface of the unpaved part of the contaminated area and the value of the ecosystem in situ. The risk level of the Remediation criterion for soil is a combination of the overstepping of the HC50 with a certain minimum unpaved surface depending on the soil function. A third step in the Remediation criterion for soil can be carried out in the form of a TRIADE-test. This comprises an assessment of the chemical quality, potential toxicity (using bioassays) and field inventories (see further the 2006 Circular on soil remediation).

4.5.4 Assessment of dispersion risks to groundwater with the Remediation criterion for soil

Policy agreements have been made for the Remediation criterion for soil as to which dispersion into groundwater creates unacceptable risks. The first step is a check against the Intervention Values for groundwater. The second step is a check to see whether there is an unmanageable situation (floating layer/sunken layer and/or large volume of groundwater with concentrations above the Intervention Values for groundwater (where dispersion is still taking place), or whether there is a question of a threat to so-called vulnerable objects. A possible third step may involve additional model calculations or measurements being carried out (see the 2006 Circular on soil remediation).

4.6 The Remediation criterion for aquatic sediment

4.6.1 The basis for the Remediation criterion for aquatic sediment

The Remediation criterion for aquatic sediment assesses the human and ecological risks and the risk of dispersion into groundwater and surface water. A step-by-step system is used for each type of risk. The first step is an assessment to check whether the Intervention Value for aquatic sediment is being exceeded; the second step is a step-by-step location-specific risk assessment by type of risk.

4.6.2 Assessment of human risks with the Remediation criterion for aquatic sediment

Step M1 of the Remediation criterion for aquatic sediment looks to see whether exposure of humans to the contaminated aquatic sediment is possible. If necessary step M2 follows with a calculation of the exposure of humans using the SEDISOIL model, depending on the concentration of contaminants in the aquatic sediment and the location-specific soil function. Next a check is made to see whether the MPR-human is being exceeded. A possible step M3 in the Remediation criterion for aquatic sediment can be carried out involving additional measurements in contact media (fish, suspended particles).

For aquatic sediment there are no specific sensitive functions where there can be unacceptable risks for humans below the Intervention Values for aquatic sediment.

4.6.3 Assessment of ecological risks with the Remediation criterion for aquatic sediment

To assess whether there are unacceptable ecological risks for aquatic sediment step E1 of the Remediation criterion for aquatic sediment looks at the toxicity for soil and aquatic sediment organisms using models, in this case the OMEGA model. To estimate the toxicity as accurately as possible measured available concentrations are used (thus no total concentrations in the sediment) as is the toxicity of the mix of substances present in their entirety. The direct effects on lower soil and aquatic sediment organisms are looked at as are the risks of birds and mammals being poisoned as a result. The OMEGA model uses the ms-PAF method. Policy-wise a limit has been chosen above which further tests are needed to see whether the risks are unacceptable. If the limit has been exceeded the measured effects on lower organisms can be looked at in step E2 of the Remediation criterion for aquatic sediment using a TRIADE test or measured concentrations in worms, fish or mussels (see the 2007 Circular on the remediation of aquatic sediment).

4.6.4 Assessment of dispersion risks to surface water with the Remediation criterion for aquatic sediment

The Remediation criterion for aquatic sediment provides a system for assessing whether contamination of aquatic sediment can result in the water quality standards not being achieved. The system makes a distinction between stagnant water and moving water (see the 2007 Circular on the remediation of aquatic sediment). If water quality standards which have been set on the basis of the European Water Framework Directive cannot be met, there are unacceptable risks.

4.6.5 Assessment of dispersion risks to groundwater with the Remediation criterion for aquatic sediment

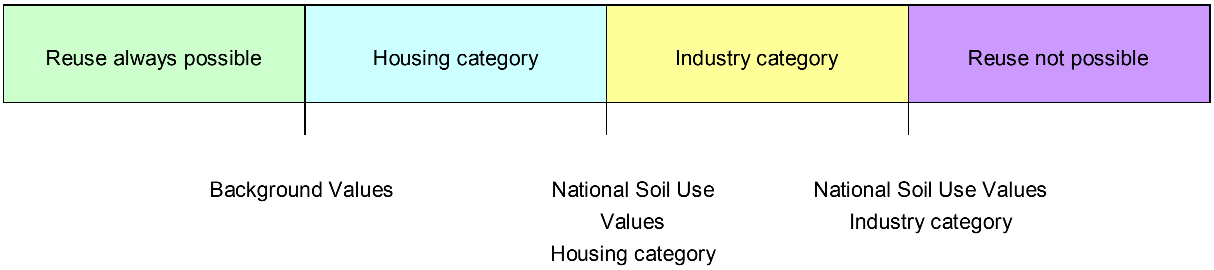
An assessment is made for aquatic sediment to see whether the geohydrological situation allows for dispersion into groundwater and if that is the case whether the contaminants are occurring in raised concentrations in the soil pore water. If that is the case it is ascertained whether vulnerable objects are threatened. For more information on this reference should be made to the 2007 Circular on the remediation of aquatic sediment.

5 National Soil Use Values

5.1 Continuing suitability, linked to the soil function

Figure 5.1 presents an overview of the national ranking system for the reuse of excavated soil and dredged material on or in the soil. For more information on the role of the standards reference should be made to the Soil Quality Decree Manual.

Figure 5.1: Overview of the national ranking system for the reuse of excavated soil and dredged material in soil (source: Soil Quality Decree Manual)



In reusing excavated soil and dredged material in soil the idea is that the soil quality should continued to be suitable for the soil function. There has to be sustainable soil management. For the hazard ranking system for the reuse of excavated soil and dredged material national choices have been made for the level of protection where this applies. Continuing suitability means that there are ‘no risks’. A certain quality level has to be met depending on the soil function. An indication is given below of when there is continuing suitability of the soil quality for humans, for the ecosystem and for agricultural production. The link to the soil function plays an important role here.

The Background Values constitute the limit for the continuing suitability of the soil quality for all soil functions (see also section 3.2). This is why below the Background Values the reuse of excavated soil and dredged material is freely allowed, irrespective of the soil function.
As is pointed out in section 2.6 the point of departure is that the new set of standards do not give rise to an overly high pollution of the groundwater.

5.2 Continuing suitability for humans

The aforementioned MPR-human, that is linked to unacceptable risks, in principle offers humans sufficient protection. However, as part of sustainable soil management, Central government wished to incorporate greater certainty for humans in the case of the reuse of excavated soil and dredged material. Hence the limit for continuing suitability is stricter than the limit for unacceptable risks. This has been filled in for carcinogenic substances by taking a factor that is 100 times stricter and for other substances by taking into account exposure from other sources besides soil (e.g. food and air). More information about this can be found in the Report on standards and soil quality assessment VROM, 2007, in Dutch)

As indicated in section 2.2 the soil function determines the degree of exposure and thus whether the contaminants can be hazardous to humans. The exposure in question here is through direct contact with the soil and exposure through the consumption of crops cultivated on contaminated soil.
To underpin the National Soil Use Values the following subdivision has been made:

- Degree of contact with the soil: high or low;
- Degree of consumption of crops: high, average, limited or none.

A ‘high’ degree of contact with the soil is the degree of contact with the soil that occurs in the standard situation of 'house with garden'. A ‘low' degree of contact with the soil is five times less than in the case of 'house with garden'. A high consumption of crops stands for the consumption of 100% leaf crops and 50% tuber crops from a person's own garden. An average consumption of crops would be 50% leaf crops and 25% tuber crops and a limited consumption of crops would be 10% leaf crops and 10% tuber crops.

It may occur to you that the exposure route of evaporation into ambient air (see chapter 2) has not been included. This is because the Soil Quality Decree only applies to diffusely contaminated excavated soil and dredged material and not to excavated soil and dredged material that has been contaminated by point sources. Diffusely contaminated soil contains non-volatile substances. Volatile substances only occur in the soil in the case of point sources. Moreover, dredged material on the whole is not contaminated by volatile substances either.

5.3 Continuing suitability for the ecosystem

The choice of the level of protection for the ecosystem depends on the value that people attach to this (see section 2.4). To protect the ecosystem it has been ascertained for a number of soil functions not only what the so-called general ecological risks are (as for the Intervention Values), but also specifically the risks of bioaccumulation. Risks of pollution being passed on means a chance of effects on higher organisms (e.g. birds and mammals), because they eat the lower organisms (e.g. worms), which are directly exposed to the soil contamination.

To underpin the National Soil Use Values a subdivision has been made into three levels:

- Great/high ecological value, high protection level, represented by the Background Values;
- Little/low ecological value, moderate protection, represented by the HC50 (ecological criterion Intervention Value);
- Average ecological value, average protection, represented by an average level (between HC5 (=Hazardous Concentration 5%) and the HC50).

5.4 Continuing suitability for agricultural production

The level of concentration of contaminants at which there is continuing suitability for agricultural production depends very much on the type of agricultural use. For the purpose of arable farming, arable farming for livestock, vegetables, grazing grassland, fruit and ornamental plant growing the so-called LAC2006-values have been derived, which means that the chance of risks to agricultural production are regarded as being small. For more information about this reference can be made to the Alterra Report (Römkens et al, 2007, in Dutch only)

For underpinning the National Soil Use Values the differentiation into six types of agricultural use was thought to be too many, partly because agricultural use may change from time to time. Hence Agriculture is regarded as a single soil function where the choice has been made for a high level of protection represented by the Background Values.

5.5 Linking choices for protection to soil functions

The soil functions for which national agreements have been reached on the level of protection that goes with continuing suitability for the soil function in question are:

a. House with garden
b. Places where children play
   i With an average ecological value
   ii With little ecological value
c. Vegetable gardens and allotments
   i With a high crop consumption (large vegetable gardens)
   ii With an average crop consumption (smaller vegetable gardens)
d. Agriculture
e. Nature
f. Greenery with nature value
g. Other greenery, urbanization, infrastructure and industry
   i Taking into account bioaccumulation (not almost entirely paved)
   ii Taking no account of bioaccumulation (almost entirely paved)

Table 5.1 shows how the soil functions referred to are linked to the levels of protection. The table indicates for the soil functions what type of risk applies, what degree of human exposure and the level of protection for the ecosystem. The table also shows that different forms of soil use (e.g. urbanization and infrastructure) come under a single soil function, because the 'risk scenario' for these uses is the same. Forms of soil use that are not included in the table belong to the risk scenario that fits best. For example for 'house with decorative garden' one can choose the soil function 'Places where children play'.

Figure 5.2 gives the same information, but now in the form of a choice diagram depending on what you as the local authority wish to protect. The soil function derives from the choices of what has to be protected within a certain area. As the local authority you opt for the degree of human exposure you wish to bear in mind as well as the ecological value. For garden and lawns in a residential area you would for example opt for the following route: no agricultural risks, a lot of contact with the soil, no consumption of crops and a low ecological value. That would bring you to the soil function 'Places where children play with low ecological value'.

For the national ranking system for soil a subdivision into seven functions of which three with sub functions was too many. This is why the soil functions have been clustered into soil function categories (see table 5.1). The most sensitive function within such a category determines the level of the standard. Soil that meets this standard 'continues to be suitable for the soil function category in question'. The soil quality continues to be suitable for the use of the soil for the group of soil functions within the soil function category. The soil standards that apply here are:

- The Background Values for the (most sensitive) soil functions Agriculture, Nature and Vegetable gardens/allotments;
- The National Soil Use Values for Housing with the soil functions 'House with garden', 'Places where children play' and 'Greenery with nature value';
- The National Soil Use Values for Industry for the (least sensitive) soil function 'Other greenery, urbanization, infrastructure and industry'.

Figure 5.2 shows the clustering of soil functions in categories with different colors. The green soil functions go with the Background Values, the red soil functions together constitute the soil function category Housing and the grey soil functions together constitute the soil function category Industry. The distinction between 'almost entirely paved' or 'not almost entirely paved' has to do with taking into account the ecological risks of bioaccumulation, or not taking them into account. For more information reference should be made to the Report on standards and soil quality assessment (VROM, 2007).

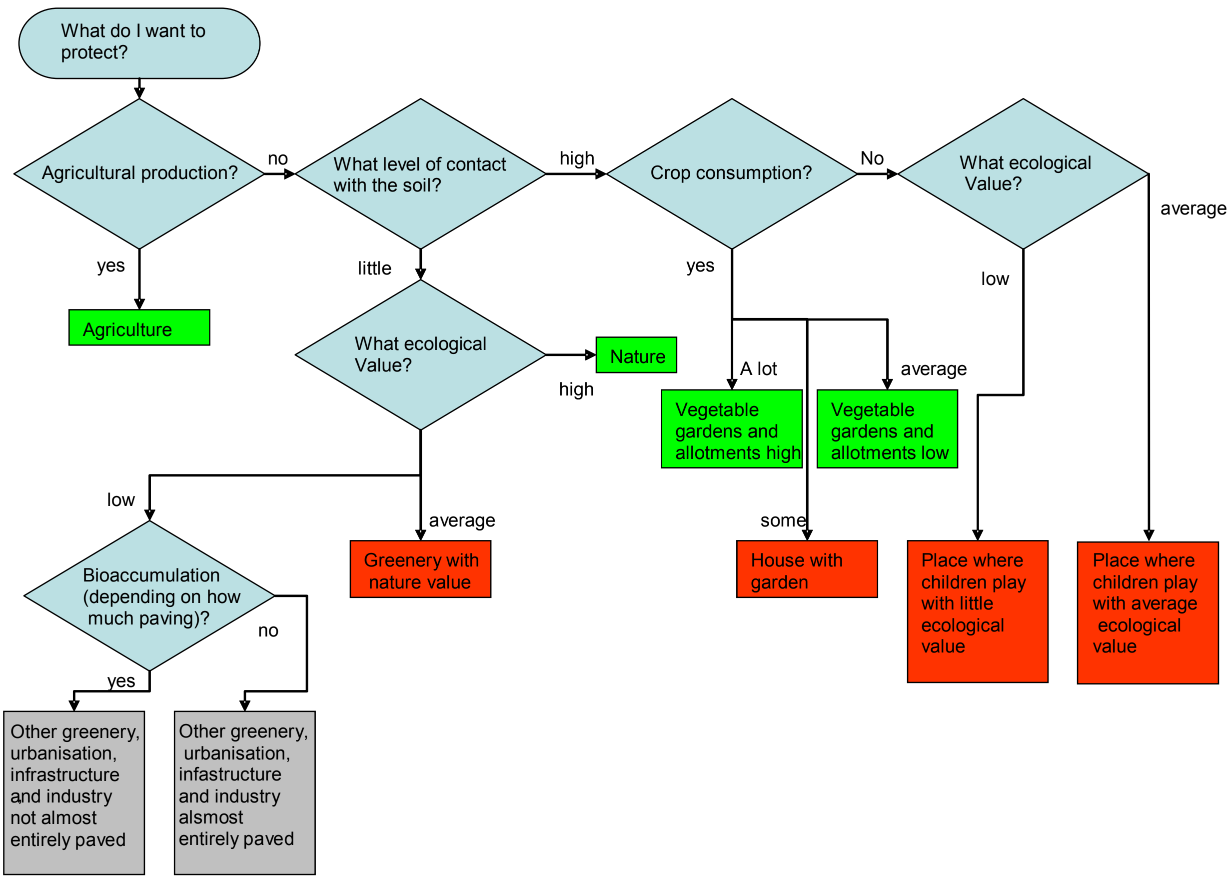
Table 5.1 shows that the soil function category Industry goes with a moderate level of protection for general ecological risks and for the risks of pollution being passed on. As indicated in section 5.3 this is represented by the HC50. The Intervention Value, too, is also represented on the basis of the HC50 (see section 4.2), but in this case it only involves the general ecological risks. For the substances for which the HC50 for general ecological risks is stricter than the HC50 for risks of bioaccumulation, the Soil Use Value for Industry is the same as the Intervention Value (if the ecological risks are the determining criterion). With some substances however the HC50 for the risk of bioaccumulation is stricter than the HC50 for general ecological risks. As a result for some substances there is a gap between the Intervention Value and the Soil Use Value for Industry. To find out to which substances this applies see the Report on standards and soil quality assessment (VROM, 2007).

Table 5.1: Subdivision into soil functions and the accompanying risk scenarios

Soil function category	**Housing**	**Housing**		**Background values**		**Background values**	**Background values**	**Housing**	**Industry**	
Soil function	**House with garden**	**Place where children play**		**Vegetable gardens and allotments**		**Agriculture**	**Nature**	**Greenery with nature value**	**Other greenery-urbanisation-infrastructure and industry**	
Sub-function		**Average ecological value**	Little ecological value	**High crop consumption**	Average crop consumption				**Bioaccumulation**	No bioaccumulation
Human Risks Degree of soil contact	high	high	high	high	high	high	low	low	low	low
Human risks Degree of crop consumption	limited	none	none	high	average	limited	none	none	none	none
Protection agricultural production	-	-	-	-	-	yes	-	-	-	-
Ecological risks national protection level	average	average	moderate	average	average	average	high	average	moderate	moderate
Ecological risks Protection level Bioaccumulation	-	-	-	-	-	average	high	average	moderate	-

The RIVM has derived National Reference values for the seven soil functions (in bold type) (Dirven-van Breemen et al, 2007). The details in the table are explained in section 5.2, 5.3 and 5.4..

Figure 5.2: Choices for protection levels according to soil functions

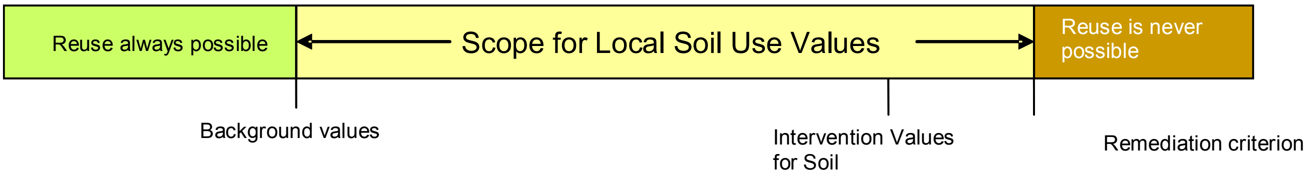


6 Local Soil Use

6.1 Freedom to choose local soil standards' level of protection

Figure 6.1 presents an overview of the area-specific ranking system for the reuse of excavated soil and dredged material on or in the soil

Figure 6.1 : Overview of area-specific ranking system for the reuse of excavated soil and dredged material on soil (source: Soil Quality Decree Manual)



Within the area-specific ranking system for the reuse of excavated soil and dredged material on land the competent authority, within the democratic process, can formulate the local soil standards itself: the Local Soil Use Values. Competent authorities have the freedom to fill in these values between the level of the Background Values (no risks for every soil function) and the risk level of the Remediation criterion (unacceptable risks for the soil function in question). In making the choice they must seek a balance between the level of protection of the standards, the complexity of the system of standards, any local restriction on the use of the soil and the possibilities of the reuse of excavated soil and dredged material. This is a complex process that is explained in detail in the Soil Quality Decree Manual.

The Risk Toolbox for soil is mandatory use for determining the level of protection of the Local Soil Use Values. This is done with the aid of the 'Repercussions of Local Soil Use Values' module. This module compares the level of protection of the Local Soil Use Values with the National Soil Use Values. If the level of protection of the Local Soil Use Values is lower than that of the National Soil Use Values and the risk level therefore higher, the so-called Risk Index is thus greater than 1. The Risk Toolbox for soil also has an 'Assessing current soil quality' module that competent authorities may use if necessary to take stock of the level of protection in terms of the current soil quality. This module can make use of data relating to the local bio-availability of contaminants.

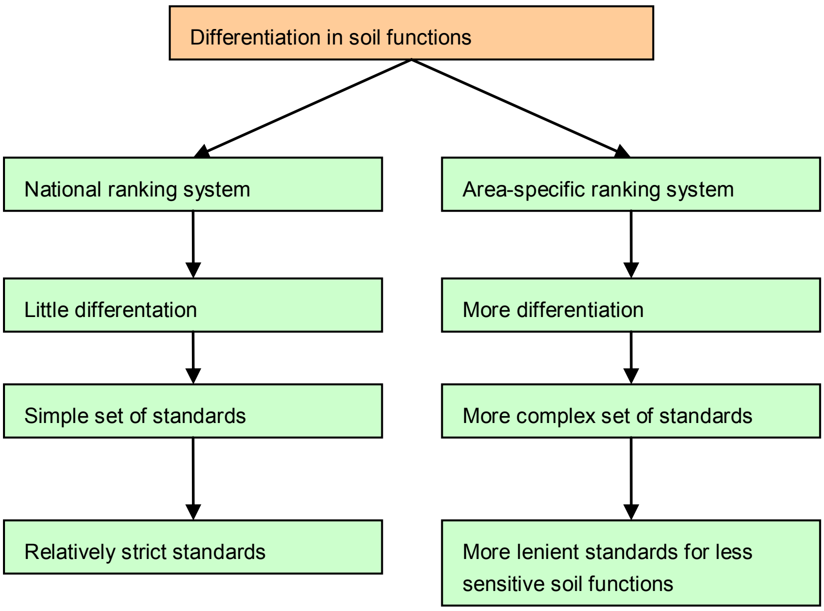
The Local Soil Use Values take the form of a soil concentration coupled to a soil function. Figure 3.2 in Chapter 3 shows that the level of the soil concentration depends on the soil function and on the level of protection. These are the choices for the competent authorities:
- differentiation by soil function (see section 6.2);
- differentiation by level of protection (see section 6.3).

6.2 Differentiation by soil function in determining Local Soil Use Values

Figure 6.2 shows the differences between the national and the area-specific ranking system geared to differentiation in the soil function. In the national ranking system differentiation is made in the soil function categories 'Background Values' (Agriculture and Nature), and Housing and Industry. Within the area-specific ranking system greater differentiation in the soil functions can be chosen. The choice is the ten soil functions indicated in section 5.5. For Agriculture moreover there are six sub-functions that can be used with the aid of the LAC2006-values (see section 5.4).

Within a soil function category in the national ranking system the most sensitive function determines the level of the soil concentration that belongs to that category. By according separate Local Soil Use Values to the different soil functions within the categories, higher soil concentrations than the Local Soil Use Value can be chosen for the less sensitive soil functions within the category. Here the level of protection is the same as that of the National Soil Use Values. Table 5.1 presents an overview of the possibilities available in terms of risk scenarios. The choice of a certain soil function is directly linked to a certain level of protection (see also figure 5.2). For example if a soil function is chosen for which there is no question of crop consumption, the competent authority has to see to it that no crops are grown in that area where this soil function applies. In other words if there are more differentiations in soil functions then there may be restrictions on use.

Figure 6.2 : Differentiations in soil functions within the national and the area- specific ranking system



The Risk Toolbox for soil uses the 'Repercussions of Local Soil Use Values' module to check against National Soil Use Values per soil function and the LAC2006 values to assess whether the level of protection complies with the National Soil Use Values. The accompanying soil concentrations per substance can be found in the Report on standards and soil quality assessment (VROM, 2007).

Taking more specific account of the soil function makes the system of standards and soil functions more complex, but it is a good way of dealing at decentral level in a responsible and sustainable way with higher concentrations of contaminants in the soil. The level of protection is the same as in the national ranking system, so in this no concessions are made. The local authority explains its choices in the Soil Management Memorandum. The Memorandum also indicates any restrictions on use. In the case of more differentiation in soil function there are 'no risks' and the soil quality continues to be suitable for the soil function in question.

6.3 Differentiation by level of protection in determining the Local Soil Use Values

6.3.1 Choices of level of protection

Figure 3.1 in chapter 3 presents an overview of the levels of protection. The level of protection for the Local Soil Use Values may lie below or above the level of the National Soil Use Values.

There are three options for dealing with the level of protection and the choice of soil concentrations in determining the Local Soil Use Values:

- Option 1: stricter than the national ranking system as regards the level of protection and soil concentrations;
- Option 2: complying with the national ranking system as regards the level of protection, but more scope when it comes to soil concentrations. This is possible by bearing in mind the local bio-availability;
- Option 3: responsibility is accepted for a lower level of protection than in the national ranking system. As regards soil concentrations more scope than in the case of the national ranking system.

The choice to determine the Local Soil Use Values will frequently be made on the basis of the existing soil quality. The sections below explain this.

6.3.2 Option 1: Stricter area-specific policy

In the national ranking system the reuse of excavated soil and dredged material is permitted if the quality of the material to be used meets the strictest requirements of:

- the category applying to the existing soil quality;
- the category applying to the soil function.

If for example the existing soil quality just fails to comply with the Background Values, this comes into the Housing category. If the case in point is a housing area, because of its function this can be classified in the Housing category. In a case of this kind it is possible that when applying the national ranking system the soil quality will deteriorate (to a limited extent). More information on this can be found in the Soil Quality Decree Manual.

The competent authority can prevent such a deterioration by setting Local Soil Use Values that are more strict that the National Soil Use Values. Local authorities explain in their Soil Management Memorandum why they have opted to do so. The Local Soil Use Values go with soil concentrations which are lower than the National Soil Use Value for Housing (for soil functions and areas with a soil quality that go with this) or lower than the National Soil Use Value for Industry (for the soil functions and areas with a soil quality that go with this). However the Local Soil Use Values cannot be below the Background Values. The Background Values are the national always-limit in the entire system of standards for soil management to which no exception can be made.

The level of protection of the Local Soil Use Values in the case of option 1 is higher than the level of the National Soil Use Values. There are no risks and the soil quality continues to be suitable for the soil functions in question.

6.3.3 Option 2: Taking into account a lower bio-availability

It may be the case that the existing soil quality in an area is poorer than the National Soil Use Value that goes with the soil function in question. The competent authority will then possibly set a Local Soil Use Value at the level of the existing soil quality in that area. This ensures that reuse of excavated soil can take place unimpeded in the area in question. The Risk Toolbox for soil in the 'Repercussions for Local Soil Use Values' module indicates that the level of protection for the Local Soil Use Values is lower than the level of protection for the National Soil Use Values (the Risk Index is higher than 1).

Using the 'Assessing current soil quality' module in the Risk toolbox for soil it can possibly be demonstrated that the current soil quality nevertheless complies with the level of protection of the National Soil Use Values. The module mentioned can use data on the bio-availability of the contaminated substances in the current situation, for example measured concentrations in crops for consumption. The National Maximum Soil Use Values use a concentration in crops for consumption that is predicted by a model. These can be replaced by measured concentrations in the 'Assessment of current soil quality' module. The measured concentrations in situ may be lower than the predicted concentrations because the bio-availability is lower than the bio-availability assumed in the model. Option 2 therefore means that by taking into account a lower bio-availability it can be demonstrated that the Local Soil Use Values comply with the level of protection of the National Soil Use Values.

In the Soil Management Memorandum competent authorities explain that the Local Soil Use Values are based on the current soil quality and that these comply with the risk level of the National Soil Use Values if the local bio-availability of the contaminated substances is taken into account. The competent authorities must also say how they prevent excavated soil or dredged material being reused in the area with concentrations of contaminants which are the same as the current soil quality but where there is a higher bio-availability of these substances. The soil quality in this case continues locally to be suitable for the soil function.

6.3.4 Option 3: Taking responsibility for a lower level of protection

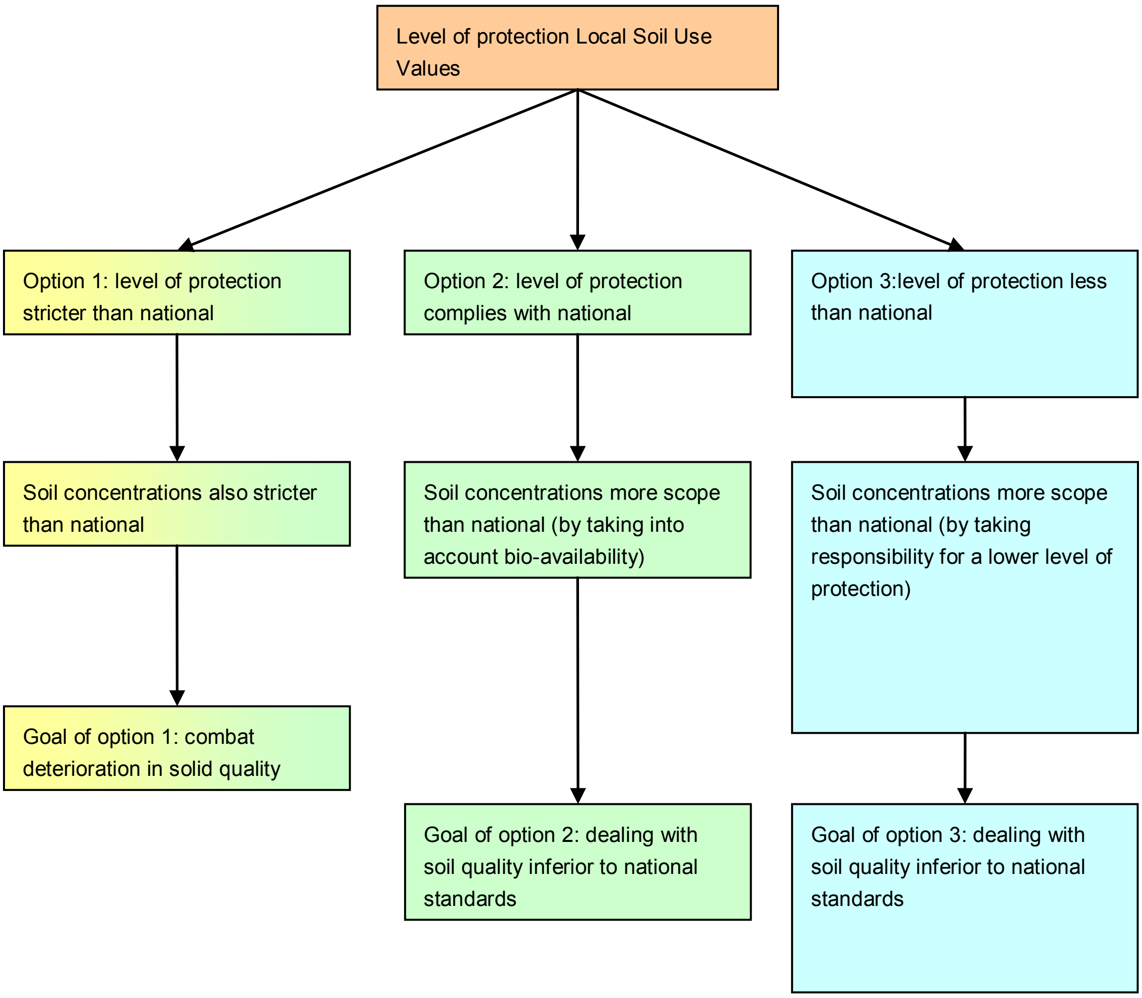
If the existing soil quality in an area is poorer than the National Soil Use Values for the soil function in question and the competent authority wishes to base the Local Soil Use Values on this, it may be that option 2 is not a solution. The level of protection of the Local Soil Use Values is lower than that of the National Soil Use Values even if account is taken of bio-availability. The area-specific ranking system allows this as long as the risk level remains below that of the Remediation criterion.

The competent authorities in such a situation take the responsibility for a lower level of protection than has been agreed nationally. This will primarily occur if there is a risk to the ecosystem which, in combination with the actual use of the area, is regarded as being a less relevant problem than for example social problems. In opting for a lower level of protection than that of the National Soil Use Values, in accordance with the 'Repercussions of National Soil Use Values' module, competent authorities must make a strong case in their Soil Management Memorandum for the problems they are preventing. Moreover, any restrictions on use and the way in which these are enforced must also be recorded in the Soil Management Memorandum.

These options within the system provide the decentralized competent authority with the ideal scope for coordinating soil standards to their own local soil contamination problems. In this case, too, the soil quality locally continues to be suitable for the soil function.

Figure 6.3 provides an overview of the options described above.

Figure 6.3: Options for the level of protection of the Local Soil Use Values

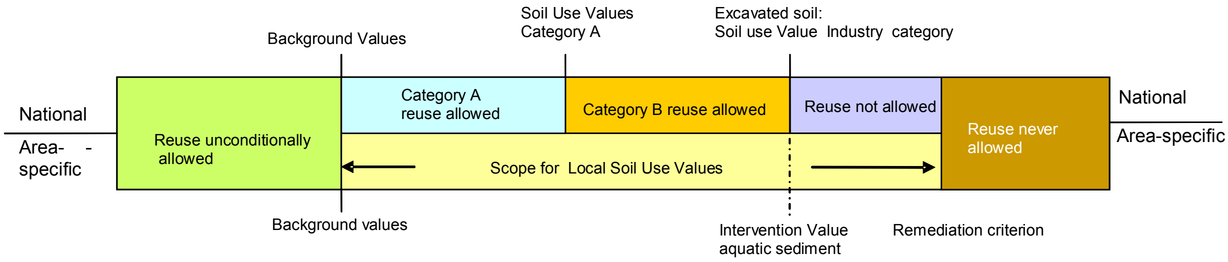


7 National and Local Soil Use Values for aquatic sediment

7.1 Continuing suitability for aquatic sediment

Figure 7.1 gives an overview of the national and the area-specific ranking system for the reuse of excavated soil and dredged material in aquatic sediment.

Figure 7.1: Overview of national and area-specific ranking system for the reuse of excavated soil and dredging material in aquatic sediment (source: Soil Quality Decree Manual).



Aquatic sediments are much more dynamic than soil. New sediment is constantly being formed and the so-called recontamination level is consequently a major basis for deciding on the standards for the reuse of excavated soil and dredged material in aquatic sediment. The standstill principle constitutes the point of departure for the aquatic sediment standards in question. This applies above all to the national ranking system for aquatic sediment.

Within the area-specific ranking system the competent authority can decide on local standards for aquatic sediment. The level of protection for Local Soil Use Values for the reuse of excavated soil and dredged material in aquatic sediment is set in relation to the level of protection of the national ranking system. The following sections explain the underpinning of the set of standards for the reuse of excavated soil and dredged material in aquatic sediment. For information on the role of the different standards and the choice between the national and the area-specific ranking system reference can be made to the Soil Quality Decree Manual.

7.2 The always-limit for aquatic sediment

The Background Values constitute the always-limit for the unconditional reuse of excavated soil and dredged material in aquatic sediment (see section 3.2). The other limits depend on the choice of the competent authority for the national ranking system or the area-specific ranking system.

7.3 The underpinning of the national ranking system for aquatic sediment

The Soil Use Value quality category B has been chosen as the upper limit for the reuse of dredged material in aquatic sediment in the national ranking system. Numerically this is the same as the Intervention Value for aquatic sediment. Section 4.4 explains the underpinning of the Intervention Value for aquatic sediment. Below this standard there are no unacceptable risks for aquatic sediment.

For the reuse of soil in aquatic sediment the Soil Use Value for Industry has been chosen as the upper limit. This ensures that excavated soil that cannot be reused on land cannot subsequently be reused in aquatic sediment.

For aquatic sediment there is no division into functions. This would mean that reuse of dredged material could occur without restriction for the entire quality range between the Background Value and the Intervention Value for aquatic sediment if no further limits were set. With a view to the Standstill principle Central government regarded this as undesirable. Hence an interim limit has been set: the Soil Use Value quality category A. This means a distinction can be made between category A (relatively clean dredged material) and category B (more contaminated dredged material). Because of the importance of recontamination for aquatic sediment the 95-percentile value of the recontamination level for the branches of the Rhine (HVN-Rijntakken) has been chosen. This value distinguishes between recently arising relatively clean dredged material/aquatic sediment and older, more contaminated material. The choice of this limit means that cleaner and more contaminated material is kept separate properly. The relationship of this value to an ecological risk level of the HC5 (Hazardous Concentration of 5%) has been ascertained (see section 2.4 for an explanation). It emerged that the value chosen is usually lower than the value that goes with the HC5 for sediment. The limit thus chosen offers a sound protection for the ecosystem. For more detailed information reference should be made to the Report on new standards for aquatic sediment (RWS-RIZA, 2007).

In the national ranking system the standard that is based on the HVN-Rijntakken is called the Soil Use Value quality category A.

7.4 The underpinning of the area-specific ranking system for aquatic sediment

Competent authorities can decide for themselves the level of the Local Soil Use Values. The level of protection may lie between 'no risks for every soil function' (Background Values) and 'unacceptable risks for the soil function in question' (the risk level of the Remediation criterion for aquatic sediment). Use of the Risk Toolbox for aquatic sediment is mandatory for setting the level of protection of the Local Soil Use Values.

The Risk Toolbox for aquatic sediment uses the SEDISOIL model for estimating risks to humans depending on the use of the water system (see section 2.3), and the OMEGA model (see section 4.6.3) for assessing the ecological risks for the water ecosystem. These models are used to judge whether there are unacceptable risks within the Remediation criterion for aquatic sediment. The Risk Toolbox for aquatic sediment compares the level of protection for the chosen Local Soil Use Values with that of the National Soil Use Values quality categories A and B.

The National Soil Use Value quality categories A and B are not underpinned by the calculating methods of the Risk Toolbox for aquatic sediment (see section 7.3). This means that the results of the Risk Toolbox for aquatic sediment may differ by substance. For the one substance the ecological risks for the aquatic sediment system at the level of the National Soil Use Value quality category A may be very low while for another substance they may be relatively high. The Risk Toolbox for aquatic sediment provides insight into the substances for which there is a relevant risk for the water ecosystem or for humans. For humans account is taken of the use of the water system which is a main determinant of the level of risk.

With the aid of the Risk Toolbox competent authorities can decide whether to establish the existing quality of the aquatic sediment within an area as the Local Soil Use Value. The same instrument can be used in the case of a sensitive use of the water system to judge whether there is any point in setting a stricter Local Soil Use Value than the Soil Use Value in the national ranking system or whether it is necessary to set restrictions on use.

Competent authorities explain their choices in a Soil Management Memorandum and give the reasons for them. If the Risk Toolbox for aquatic sediment indicates that there is a lower level of protection than in the case of the national ranking system, the competent authorities are required to justify their choice and explain the problems that they have thus avoided. Even if the competent authorities opt for stricter standards than in the national ranking system, they must indicate in the Soil Management Memorandum why they have done so.

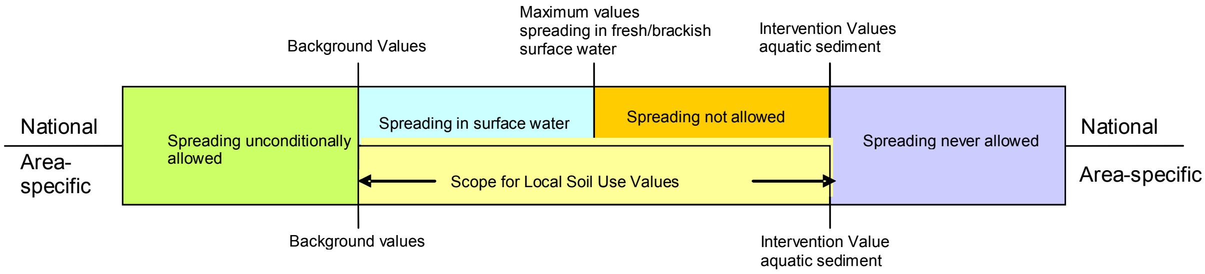
The area-specific ranking system offers local water quality managers the scope to adapt the aquatic sediment standards to local problems. By using the Risk Toolbox for aquatic sediment the balance can be found between the level of protection of the local standards, any restrictions on use of the aquatic sediment and the possibilities of reuse of excavated soil and dredged material.

8 Standards for the spreading of dredged material in surface water

8.1 System of standards for the spreading of dredged material in surface water

Figure 8.1 gives an overview of the national and area-specific ranking system for the spreading of dredged material in surface water.

Figure 8.1: Overview of the national and area-specific ranking system for the spreading of dredged material in surface water (source: Soil Quality Decree Manual).



The Intervention Value for aquatic sediment serves as the upper limit for the spreading of dredged material in surface water. Below this standard there are no unacceptable risks for aquatic sediment (see section 4.4). As the always-limit the Background Value also applies in this context (see section 3.2). For fresh and brackish surface water there are separate Soil Use Values set in the national ranking system for the spreading of dredged material in surface water. The underpinning of these limits are explained in sections 8.2 and 8.3. Section 8.4 briefly looks at the choice for Local Soil Use Values within the area-specific context.

8.2 Underpinning the National Soil Use Value for the spreading of dredged material in fresh surface water

The spreading of dredged material in fresh surface water involves moving sediment that is deposited in places where it is not intended to be because of shipping or better discharge.

Given the dynamics of the system the National Soil Use Value is based on the standstill principle. This means that the environmental quality should not deteriorate. It is logical to base the National Soil Use Value on the quality of the suspended particles in surface water which can be precipitating as the newly-formed sediment. The spreading of dredged material in fresh surface water mainly takes place at present in the Rhine area. This is why 95-percentile value of the recontaminant level of the branches of the Rhine (HVN-Rijntakken) has been chosen as the National Soil Use Value. This is the same limit that was adopted as part of the national ranking system for category A for the reuse of excavated soil and dredged material in aquatic sediment. This limit also offers a sound protection of the ecosystem (see section 7.3). The new National Soil Use Values for spreading dredged material in fresh surface water are almost all of them stricter than the present ones.

8.3 Underpinning the National Soil Use Value for the spreading of dredged material in brackish surface water

The spreading of dredged material in brackish surface water involves the dredged material that is produced in maintaining the depth of the Dutch seaport areas. Up to now the quality of the dredged material to be spread was assessed using the Chemical Toxicity Test (CTT), which is a combination of concentration standards for the chemical quality and the implementation of bio-assays (toxicity tests on water organisms). The latter is done to judge whether substances that have not been measured cause effects. The chemical concentration standards for the spreading of dredged material in brackish surface water date from the early eighties.
Step by step the following changes have been introduced:

- several parameters have been removed;
- standards for the sum PAH and the sum PCB instead of for the individual substances have been introduced;
- the soil type correction has been abolished.

Although the standards have a highly pragmatic origin, the values prove to correspond reasonably well with the level at which significant risks to water organisms are expected.

With the coming into force of the Soil Quality Decree and Regulation the CTT has been replaced by the brackish dredged material test (ZBT from the Dutch abbreviation=Zoute Bagger Toets). A major modification is that no bio-assays need to be carried out. Practical experience revealed that the results of bio-assays were insufficiently robust to be used as determining criteria. The check against the concentration standard has remained the same. Only for TBT (the main problem substance in spreading brackish dredged material) is the National Soil Use Value now dependent on the area where the dredged material is to be spread. The National Soil Use Value for TBT links up with the current quality of the brackish water areas in question.

8.4 Local Soil Use Values for spreading dredged material in surface water

Water quality managers can set Local Soil Use Values for spreading dredged material in surface water.

For fresh surface water the Intervention Value for aquatic sediment is the upper limit at which there are never any unacceptable risks. The Local Soil Use Values can be stricter or less strict than the National Soil Use Value for the spreading of dredged material in fresh surface water. Stricter values are self-evident if one wishes to protect certain vulnerable areas elsewhere from the deposition of dredged material of a poorer quality than the present one. Less strict values are self-evident if the spreading of dredged material for example is needed for shipping but the quality of this does not comply with the National Soil Use Value for the spreading of dredged material in fresh surface water. Water quality managers have to weigh the choice between the problem that the dredged material is causing in the place where it now is and in the place where it would end up if it were spread in surface water.

For brackish surface water the National Soil Use Value for the spreading of dredged material in brackish surface water is the upper limit for the Local Soil Use Values. Local Soil Use Values will therefore only be set with a view to additional protection for certain vulnerable areas.

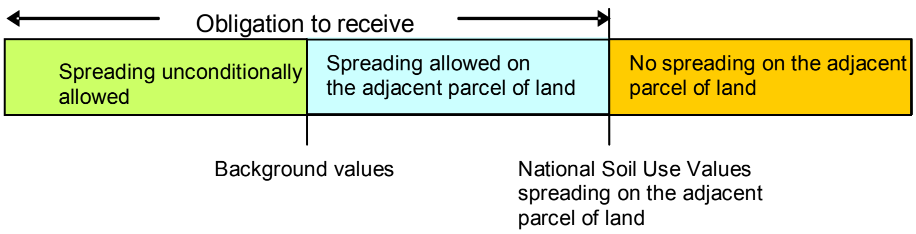
9 Standards for spreading dredged material on the adjacent parcel of land

9.1 System of standards and chosen assessment method

This chapter is about the spreading of dredged material on the adjacent parcel of land on the basis of the so-called 'obligation to receive'. Regular dredging is necessary to keep water courses clear so that they retain their function of discharging water. For the spreading of dredged material on the adjacent parcel of land there is only a national ranking system.

Figure 9.1 gives an overview of the ranking system for the spreading of dredged material on the adjacent parcel of land

Figure 9.1: Overview of the ranking system for the spreading of dredged material on the adjacent parcel of land (source: Soil Quality Decree Manual)



For the National Soil Use Value for the spreading of dredged material on the adjacent parcel of land ecological risks were first examined because on the whole these are the most critical risks. The ms-PAF method was chosen as the basis so as to link up optimally with the risks of the mixture of substances present (see the explanation of the method in section 2.4). The ms-PAF method makes a better distinction between the ecological risks that go with the quality of the dredged material than the standards by substance that have been used to date. As a result, as far as the risks are concerned, a better choice is made between the dredged material that can be deposited on the adjacent parcel of land and the dredged material that may not be deposited. The measured total concentrations are taken as the basis because the availability of substances may change if the dredged material on the adjacent parcel of land comes into contact with oxygen. So available concentrations, as in the case of the Remediation criterion for aquatic sediment, are not used.

So no standards by substance apply to the spreading or not of dredged material on the adjacent parcel of land but instead the method chosen is a value for the ms-PAF in %. An exception has been made for mineral oil because this cannot be calculated using the ms-PAF method. For a number of metals there are also still standards by substance. For more detailed information reference can be made to the Report on new standards for aquatic sediment (RWS-RIZA, 2007).

9.2 Underpinning the chosen National Soil Use Value

Up to which value of ms-PAF the dredged material can be spread on the adjacent parcel of land is a policy choice. The point of departure is that at least as much dredged material can be deposited on the adjacent parcel of land as with the division into categories which was used until 2007. This is necessary because regular dredging is needed for the water regime and shipping. There have been no indications to date that the system used in which category 1 and 2 dredged material could be deposited on the adjacent parcel of land has resulted in environmental problems (demonstrable ecological risks or risks to humans or agricultural production). The ms-PAF value that goes with the fixed minimum quantity of spreadable dredged material has been worked out. For metals this is 50% and for organic substances 20%. For more information reference can be made to the Report on new standards for aquatic sediment RWS-RIZA, 2007).

An assessment was then carried out to see whether the derived ecological risk limits offered sufficient protection to humans and agricultural production. The dredged material after all is spread on the land. For humans account has been taken of the most vulnerable situation ‘house with vegetable garden’. On the basis of this an extra limit has been set for cadmium in the form of a concentration standard. For the remaining substances it was not necessary to set an additional limit.

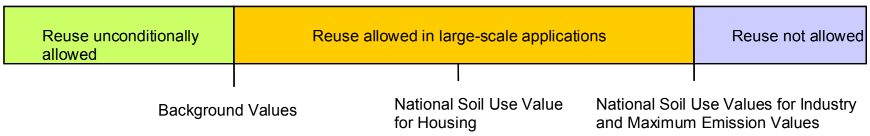
10 Standards for large-scale soil applications

10.1 Standards and relevant types of risks

The Soil Quality Decree Manual defines a so-called 'large-scale soil application' and explains why separate standards have been set for this. For large-scale soil applications there is only a national ranking system. For more information on the role of the standards for large-scale soil applications reference should be made to the Soil Quality Decree Manual.

Figure 10.1 presents an overview of the ranking system for large-scale soil applications

Figure 10.1: Overview of the ranking system for large-scale soil applications (source: Soil Quality Decree Manual)



Large-scale soil applications have a surface level, the quality of which must comply with the standards that are in force as part of the national or area-specific ranking system for the reuse of excavated soil and dredged material. As a result no risks occur for humans, for the ecosystem, for dispersion into surface water or for agricultural production as a result of contaminants in the excavated soil or dredged material which is part of the large-scale soil application. The only risk that cannot be prevented by the surface layer is the risk of diffusion into groundwater. That is why the setting of standards for large-scale soil applications focuses on the emission of substances from the large-scale soil application itself.

10.2 Underpinning of standards for large-scale soil applications

10.2.1 Standards for large-scale soil applications on land

For large-scale soil applications on land standards apply for the total concentrations in the material to be used and the maximum emission values for the leaching from the material.

Maximum emission values for metals are based on the same protection goals as for stony building materials. For soil, groundwater and surface water a limit has been set on the basis of ecological risks because this is usually the most sensitive criterion. The limit for soil and groundwater is HC5 (Hazardous Concentration 5%, see section 2.4 for an explanation). For surface water the point of departure for setting the standard is the HC5/10. For setting the emission standards for large-scale soil applications a layer thickness of 5 meters (instead of 0.5 meters for building materials) has been assumed. A correction factor has been applied for leaching from non-suspect soils. For detailed technical information reference can be made to the RIVM report (Verschoor et al, 2006) which elaborates on the underpinning of the standards for building materials. The setting of standards for large-scale soil applications links up with these.

Alongside the Maximum emission values for leaching Emission target values have been set in the form of soil concentrations. The Emission target values are based on existing values from the former Building Materials Decree.

The aforementioned approach can for the time being apply only to metals. For organic parameters there are still no suitable leaching tests available which is why no Maximum emission values could be set for these. Limits have been set for the total concentrations of metals, anorganic and organic substances in the soil material so as nevertheless to set a limit for organic compounds. This ensures that no highly contaminated excavated soil or dredged material is used in large-scale soil applications. The standards used are existing ones from the standards system so that this remains consistent and clear. For large-scale applications on land the limit that has been set is the National Soil Use Value for Industry.

10.2.2 Standards for large-scale soil applications in aquatic sediment

For large-scale soil applications in aquatic sediment the Maximum emission values and emission target values apply. But there is an exception. If dredged material is used below the water level and remains within the management remit of the water quality manager the Maximum emission values and the emission target values are not applicable. Here the standstill principle applies within the area. The large-scale soil application is used to rearrange dredged material within the area, for example in connection with drainage, water depth or water quality.

There is a great deal of knowledge available about the leaching and dispersion of substances from dredged material depots. Under water different geochemical circumstances prevail and different transport mechanisms occur than above water. The leaching of contaminants in permanently wet situations only takes place to a minor degree. Nevertheless for large-scale soil applications in wet situations (below the water level) standards for the total concentrations in the material to be used still apply. The limit for the total concentrations for dredged material is the National Soil Use Value quality category B (= the Intervention Value for aquatic sediment). This is commensurate with a consistent system of standards. The values for dredged material serve in this situation as emission target values to protect the groundwater. By using the Intervention Value for aquatic sediment as the national upper limit for dredged material in large-scale applications under water, the groundwater is offered protection comparable to such applications on land.

For large-scale soil applications in aquatic sediment, which do not come under the aforementioned exception, standards also apply for the total concentrations in the material to be used. The limit for the total concentrations for dredged material (as with the applications below water within the management area) is the National Soil Use Value quality category B (= the Intervention Value for aquatic sediment). For excavated soil this limit is set at the National Soil Use Value for Industry so as to prevent excavated soil which cannot be reused on land being reused in large-scale soil applications in aquatic sediment. This, too, is commensurate with a consistent system of standards.

11 Towards a clear and consistent system of standards

This report presents an overview of the filling in of the complete system of standards for the chemical quality of soils and aquatic sediment. The basis for the limits that have been set is thus clear:

- There is a limit under which 'everything can be done and is allowed' and there are no conditions set for the reuse of excavated soil and dredged material;
- There is a limit above which the soil quality is 'too bad' in relation to the soil function; then there is an urgent need for remediation;

In between these two limits the reuse of excavated soil and dredged material is permitted under conditions. Within this context competent authorities may, if they wish, use national standards or they may develop local standards.

For a number of specific applications individual limits have been chosen which best link up with the application in question. In the case of these applications an attempt has been made as much as possible to use the standards that have already been developed for the limits referred to above.

The limits set for soil are mainly based on environmental risks. For aquatic sediment the recontamination level is an important basis for filling in the standards.

Central government has taken a major step towards a clear and consistent system of standards with the renewed set of standards in the Soil Quality Decree and the latest updates of the Circulars for the remediation of soil and aquatic sediment. Limits have been set to protect humans and the environment, the use of the soil has been taken into account and scope has been created for choices at the local level to take account of special developments as well as the possibilities of reusing excavated soil and dredged material.

But the scientific train moves on. New insights will arise which will mean that the standards can be refined even more than they have been at the moment and there will be policy developments in Europe, for instance, which cannot be ignored. Practical operations benefit from stability in the setting of standards. Central government will consequently take due care in deciding whether future changes are really necessary.

12 Definitions

Background values	Standards based on measurement data from non-suspect areas in the Netherlands, below which there are no conditions for the reuse of excavated soil and dredged material.
Soil function	The purpose for which the soil is used. For example for agriculture, nature or housing.
Soil function category	Group of diverse soil functions for which a single Soil Use Value has been adopted in the national hazard ranking system of the Soil Quality Decree.
Cointinuing suitability for the soil function	Soil quality level that allows for the sustainable retention of the soil function. There are no environmental risks in relation to the function in question.
National Soil Use Valued	Standards that play a role in the reuse of excavated soil and dredged material subject to the conditions of the national hazard ranking system in the Soil Quality Decree. For soil these values are linked to the soil function and to the continuing suitability for this function. For aquatic sediment these values are linked to the recontamination level
Large-scale Soil applications	Applications defined in the Soil Quality Regulation in which larger quantities of excavated soil or dredged material are incorporated, for example in roads, dikes and noise barriers.
HC50: Hazardous Concentration 50%	A PAF of 50%
Recontamination level	The chemical quality level at which the aquatic sediment becomes contaminated by the supply of new sediment.
Intervention Values	Standards based on human and ecological risks, which are used as the first step in the Remediation criterion and above which the reuse of excavated soil and dredged material is subject to very strict conditions.
Local Soil Use Values	Standards that play a role in the reuse of excavated soil and dredged material subject to conditions of the area-specific hazard ranking system in the Soil Quality Decree. The level of these standards may be determined, within certain limits, by the decentralized competent authority.
MPR-human: Maximum Permissible Risk Level for humans	Maximum exposure dose of humans to a chemical substance, below which the effects are absent or permissible.
PAF: Potentially Affected Fraction	The percentage of potentially present species in an ecosystem for which the NOEC of a certain substance is exceeded.

Ms-PAF: Potentially Affected Fraction multiple substances	The same as the PAF, but in this case the PAFs of the combination of the substances in the soil or aquatic sediment are 'added up together'.
NOEC: No Observed Effect Concentration	The highest concentration of a substance in the soil or water in the range of tested concentrations in a chronic toxicity test, in which there is no question of an effect on a test organism.
Unacceptable risks	The limit set by the Remediation criterion above which the environmental risks are such that remediation must be carried out urgently.
Remediation criterion	Area-specific assessment system to determine whether there are unacceptable risks as a result of contamination of the soil or aquatic sediment. There are separate Remediation criteria for soil and aquatic sediment.

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