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Draft Memorandum on Scope and Level of Detail

National Programme on Radioactive Waste (NPRA)

25 August 2023

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1 Introduction

This is the Memorandum on Scope and Level of Detail (NRD) – the first step towards the Strategic Environmental Report[1] for the National Programme on Radioactive Waste (NPRA). This document describes the approach to the Strategic Environmental Assessment (SEA)[1] and in this way sets out the scope and level of detail of the analysis. The purpose of this Memorandum is to inform stakeholders and consult them about the scope and level of detail of the Strategic Environmental Assessment. The Netherlands Commission for Environmental Assessment (NCEA) and the legal advisers will also be consulted to obtain their advice on the approach. In accordance with the statutory provision on Environmental Impact Assessments, this document will be made available for public consultation at the same time as the Participation Plan of the Ministry of Infrastructure and Water Management (IenW) and the Ministry of Economic Affairs and Climate (EZK). This ensures that all interested parties will have the opportunity to submit their points of view on this NRD.

1.1 Why a National Programme on Radioactive Waste (NPRA)?

The European Directive 2011/70/EURATOM requires all Member States to adopt a national programme for the safe management of radioactive waste and spent fuel at least every ten years, and to subsequently maintain this programme. In 2016, the Netherlands published a national programme on the safe management of existing and future radioactive waste and spent fuel under said Directive. That NPRA now needs to be updated before August 2025.

1.2 Why a Strategic Environmental Report for the NPRA?

A plan or programme that is required by law or by administrative provisions may have certain effects on the environment, and these need to be investigated in advance. Because of this, it may be deemed necessary to carry out a Strategic Environmental Assessment for the plan or programme concerned. The regulations in this regard have been laid down in the Act of 23 March 2016 containing rules on the protection and utilisation of the physical living environment, i.e. the Environment and Planning Act (in Dutch: *Omgevingswet*). This Act will enter into force on 1 January 2024 and will therefore be applicable when the new NPRA is published.

Section 16.36 of the Environment and Planning Act provides that for a plan or programme required by law or by administrative provisions a Strategic Environmental Assessment must be carried out if this plan or programme forms a framework for projects subject to a compulsory Environmental Impact Assessment. It is realistic to assume that the NPRA will indeed contain statements that lay down a framework or provide guidance, which is why the decision was made to carry out a Strategic Environmental Assessment. In the Strategic Environmental Report to be drawn up, reasonable alternatives will be examined for their environmental effects and their feasibility. These alternatives can then be taken into consideration when strategic choices are made in the drafting of the NPRA.

[1] The term 'Strategic Environmental Report' (in Dutch: *plan-MER*) refers to the final report describing the assessment results. The term 'Strategic Environmental Assessment' (in Dutch: *plan-mer*) refers to the procedure that is followed to arrive at this report (the assessment itself).

1.3 How to use this document

This NRD describes the scope and level of detail of the approach to the Strategic Environmental Assessment for the National Programme for the Management of Radioactive Waste and Spent Fuel. It also establishes the assessment framework for the Strategic Environmental Assessment. Chapter 2 first offers a brief explanation on the NPRA and the goals to be included in it, and also explains the scope. Chapter 3 describes the current situation with regard to radioactivity and the environment. Based on this information, the trends, developments and risks are also identified. Chapter 4 describes the scenario for the intended activity, as well as the associated alternatives. The penultimate chapter explains the assessment framework and the methodology for the Strategic Environmental Assessment. Finally, Chapter 6 clarifies the follow-up process for the NPRA, the further steps in the Strategic Environmental Assessment procedure, and the way in which stakeholders will be involved in the NPRA (participation process).

2 National Programme on Radioactive Waste (NPRA)

The objective of the NPRA is to adopt a national policy to ensure responsible and safe management of spent fuel and radioactive waste, to avoid imposing an undue burden on future generations. For this the NPRA includes policy measures and strategies both at national and at international level, and addresses the entire life cycle of radioactive waste, from production to storage and disposal. At the time of writing this NRD, the new NPRA has not yet been drawn up. Therefore, scenarios with the designated activity and several alternatives will be used for the Strategic Environmental Assessment. For this, please refer to Chapter 4.

2.1 Description and goals of the NPRA

The NPRA 2025 will be based on the policy principles as used since 1984. This means that the four principles listed below will form the basis for the policy. Its final elaboration will be laid down in the NPRA 2025 based on the scenarios assessed in the Strategic Environmental Assessment.

- Minimisation of the generation of radioactive waste;
- Safe management of radioactive waste;
- No unreasonable burden imposed on later generations;
- Costs of management of radioactive waste borne by the producer.

2.1.1 Minimisation of the generation of radioactive waste

The policy principle for minimisation of the generation of radioactive waste primarily focuses on limiting the use of radioactivity as much as possible. This means that radioactivity can only be used if the economic, social and other benefits outweigh the damage it may cause in terms of health, safety and the environment. Additionally, the license holder is required, even in case of justified use, to reduce the generation of radioactive waste insofar as this is reasonably possible, in terms of both the activity and its volume.

In addition to minimisation, another aim is to close the raw material loops by making use of the waste hierarchy based on ‘Lansink’s Ladder’, as is also done for conventional waste. In concrete terms this means that from an environmental protection point of view, reuse is preferred to landfilling or disposal. Reuse of radioactive materials can occur immediately or after processing operations, like decontamination or immobilisation. For the reduction and processing of radioactive waste, the hierarchy of Lansink is proposed as well.

2.1.2 Safe management of radioactive waste

The next principle of the Dutch policy is that the safe management of radioactive waste must be continued as long as this waste involves risks for humans or the environment. As a result of this, we have opted for above-ground storage of radioactive waste for at least 100 years at the Central Organisation For Radioactive Waste (COVRA). The waste must be transported to this storage facility as soon as possible, so that it can be managed centrally. The main idea behind this long period of above-ground storage is to ensure that sufficient waste and resources are available to realise disposal. For this disposal, we are using a dual strategy, which means that for the choice of national and/or international geological disposal in 2130 all options are still open.

2.1.3 No unreasonable burden imposed on later generations

The third principle of the policy is that later generations cannot have an unreasonable burden placed upon them. In concrete terms, this means that generations which have reaped the benefits of the use of ionising radiation must themselves bear the costs of the management of the radioactive waste generated in this way. Because of this, a passive safe management method needs to be adopted once sufficient knowledge and resources are available for the realisation, operation and closure of the disposal facility. For this, a roadmap will be included in the NPRA 2025 to lay down the next steps towards disposal. This roadmap will be updated at the same time as the NPRA.

In line with this, very low-level waste (VLLW) of natural origin (NORM) will be added to the scope of this NPRA. This radioactive waste is currently dumped at the designated landfill sites, after which the provincial authorities will be perpetually responsible for the necessary follow-up care. An alternative could be to use specific release methods, for example, so that the waste can be released as conventional waste.

2.1.4 Costs of management borne by the producer

The fourth and final policy principle is that all costs associated with the management of radioactive waste must be borne by those who generated it. COVRA is responsible for charging all estimated costs of collection, processing, storage and disposal to the producer, based on the applicable guidelines. Following delivery of the radioactive waste, its legal ownership is transferred to COVRA, so that the uncertainty about the long-term existence of producers is mitigated. For the designated landfill sites, a similar arrangement applies.

2.2 Scope of the NPRA

The National Programme concerns the management of radioactive waste both now and in the future. It does not concern issues relating to justification of the use of radioactive substances and/or spent fuel. The scope of the National Programme for 2025 is based on the Joint Convention report of the IAEA[2], which sets out the guidelines for the safe management of radioactive waste and spent fuel. This includes spent fuel and radioactive waste subject to the Nuclear Energy Act (in Dutch: *Kernenergiewet*) where no reuse is expected. Compared to the NPRA from 2016, NORM waste subject to compulsory registration that is dumped at the designated landfill sites will also be included as part of the NPRA 2025. The following waste flows will therefore be included in the NPRA:

- Radioactive waste, including Naturally Occurring Radioactive Material (NORM) generated in the Netherlands as a consequence of licensed operations and activities involving radioactivity;
- Spent fuel from operations in the Netherlands;
- Radioactive reprocessing waste, including reprocessing waste still to be returned from abroad;
- Radioactive waste sources which cannot be linked to the rightful owner (orphan sources);
- Radioactive waste from the decommissioning of Dutch nuclear reactors, cyclotrons and particle accelerators;
- Radioactive waste from possible future remediation of sites with radioactive contamination or from companies using NORM.

[2] IAEA, Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management, December 1997

The NPRA does not relate to the following:

- Radioactive waste originating from abroad, as no radioactive waste is being imported at present;
- Depleted uranium and other residues from the enrichment of natural uranium, which are being further processed in the Netherlands, unless these are regarded as radioactive waste;
- The Dutch Caribbean territories, which are left out of consideration because the Nuclear Energy Act and the Euratom Treaty do not apply there.

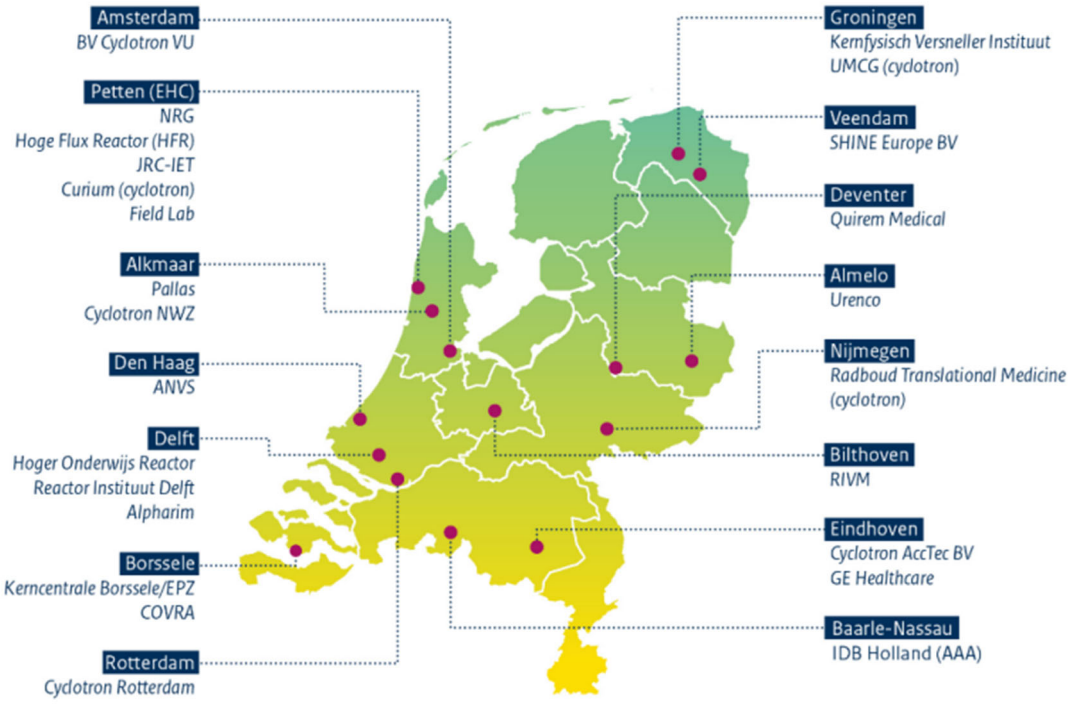
3 Current situation with regard to radioactivity and the environment

The current situation with regard to radioactivity and the environment is an important point of departure for the drafting of the Strategic Environmental Report. The overview below shows the current situation with regard to radioactivity and the environment. Trends, challenges and opportunities are mentioned there as well.

3.1 Radioactivity in the Netherlands

Radioactivity is a natural phenomenon and occurs everywhere around us. This natural radioactivity mainly originates from underground or is emitted by the sun. It was only when people started making use of the properties of radioactive materials that we started talking about the management of radioactive waste flows. In the Netherlands, these waste flows are generated, for example, by the production of nuclear energy and medical treatment of patients, but also by the production of steel from iron ore or the extraction of oil and gas.

Figure 3.1: Nuclear and medical isotope chain partners in the Netherlands



Source: NRG (2022), 'Background analysis for decision-making on the PALLAS reactor' (in Dutch: *Achtergrondanalyse ten behoeve van de besluitvorming over de PALLAS-reactor*)

3.2 Inventory of radioactive waste

At the request of the Ministry of Infrastructure and Water Management, both the National Institute for Public Health and the Environment (RIVM)[3] and COVRA[4] have conducted a study into the production and routes of radioactive residues and waste in the Netherlands. In these studies they also looked at the radioactive substances to be expected as a result of decommissioning and the possibilities for (further) minimisation of the production of this waste flow. In addition, the estimated production of radioactive waste from both old and new installations was charted.

The current storage capacity and a look ahead to 2030 and 2050 from the two studies are summarised in Annex C. For the look ahead, several scenarios have been drawn up where new installations will be added to the radioactive landscape in the Netherlands. This concerns the realisation of two new nuclear power plants, the PALLAS reactor and the isotope production facility Shine. The extension of the operating life of the Borssele nuclear power plant has also been included in the scenarios. A linear extrapolation of the available data from the past 20 years has been performed specifically for the NORM waste for which a license is required.

3.2.1 Trends, challenges and opportunities

In the Dutch landscape of radioactive waste management, continuous efforts are being made to keep the inventory of the different types and quantities of radioactive waste up to date, and to extend and refine it. These efforts are needed for both existing and future waste sources. In addition, the government has plans to build two new nuclear power plants which will produce radioactive waste. Plus, the operation of new installations for isotope production will add to the amount of radioactive waste as well. In the future, we will also need to take account of waste that is generated during the decommissioning of the nuclear power plants and other installations.

However, the extension, updating and refinement of this inventory will also pose a number of challenges, like the identification of new and future sources of radioactive waste. The anticipation of the future production of radioactive waste, in light of the planned new nuclear reactors and installations for isotope production, is also a great challenge because the techniques used are not yet fully known. Finally, only limited data are available for big decommissioning projects, such as for nuclear reactors or offshore gas and oil platforms. As a result, a fairly large margin of uncertainty applies to the estimation of the expected amount.

The updating of the inventory also offers several opportunities for continuous improvement of the management of radioactive waste in the Netherlands. By periodically updating the inventory of radioactive waste, we can identify any new sources of radioactive waste and improve the accuracy of the data. In addition, the reassessment of the radioactive risk of waste offers opportunities for circularity, such as specific release routes. Moreover, innovative processing technologies may be able to help reduce the volume of the waste that needs to be stored.

3.3 Physical living environment and socio-economic factors

The current physical living environment and the socio-economic situation in the Netherlands form an important basis for the assessment of environmental issues and/or opportunities in the

[3] RIVM, 'Radioactive residues and waste in the Netherlands - An inventory' (in Dutch: *Radioactieve rest- en afvalstromen in Nederland - Een inventarisatie*), 2022

[4] COVRA, 'National Inventory of Radioactive Waste' (in Dutch: *Nationale Radioactief Afval Inventarisatie*), October 2022

Strategic Environmental Assessment. In this context, an environmental baseline has been established, after which the trends, challenges and opportunities have been determined.

3.3.1 Environmental baseline

The environmental baseline was established using publicly available sources (see Annex C). The NPRA focuses on the whole of the Netherlands. Therefore, location-specific factors are not relevant or are relevant to a lesser degree. The elements of the environmental baseline are:

- Biodiversity, flora and fauna
- Water
- Soil
- Air quality
- Climate factors
- Population and public health
- Socio-economic factors
- Cultural heritage factors
- Landscape
- Infrastructure

3.3.2 Trends, challenges and opportunities

The environmental baseline was established to identify ecological and socio-economic trends, challenges and opportunities. This analysis was subsequently used to determine the relevant environmental aspects for the NPRA, taking into account the geographical locations and cross-border aspects, as well as the scope of the NPRA 2025. Because of the latter, all elements from the baseline will be included in the Strategic Environmental Assessment. The table below sets out the main challenges and opportunities.

Table 3.1: Main challenges and opportunities related to the environment

Item	Challenges and points for attention	Opportunities
Biodiversity, flora and fauna	● In the Netherlands there are many important plant and animal species and habitats. We have around 500 protected species, National Parks, Natura 2000 areas, and the National Ecological Network. The NPRA may impact biodiversity and nature conservation.	● Support for the measures to prevent the decline of species by protecting and improving habitats.
Water	● In the Netherlands there are eight types of surface water bodies and four international river basins. The National Water Plan 2022-2027 was developed with a focus on climate-related flooding, subsidence and a sustainable water transport system. ● The Netherlands is a low-lying country with flood plains where the water goes when rivers and streams burst their banks. ● The NPRA may have an effect on the water network if radioactive waste transport is to occur via this network. In addition, it may affect the water quality. ● The NPRA may have an effect on the quality and quantity of our drinking water.	● The NPRA can be used to explore sustainable transport options for the transport of radioactive waste. ● The NPRA and all associated buildings and structures can be developed to reduce flooding risks and improve the water environment.
Soil	● The majority of the Netherlands is used as agricultural land. In addition, there are several landfill sites, some of which are still operational.	● The soil is an important natural resource. When the NPRA is drawn up, account needs to be taken, therefore, of the minimisation of negative effects, the prevention of soil pollution or disturbance of the geological situation.
Air	● The Dutch government, the 12 provinces and various municipalities have concluded the non-binding Clean Air Agreement. In this Agreement they show that they are committed to the ambition to permanently improve air quality in the Netherlands. ● Our air quality is generally poor around industrial and urban areas, and around the road network. ● Nitrogen deposition has been identified as a major risk in the Netherlands. If too much nitrogen ends up in nature, the soil will be affected by eutrophication and acidification. Some plants cannot handle this and will die. This will negatively affect the quality of our nature, and therefore our biodiversity. The efforts to tackle nitrogen will help strengthen and restore nature. This has been laid down in the Nitrogen Reduction and Nature Improvement Act (in Dutch: *Wet Stikstofreductie en Natuurverbetering*), which entered into force on 1 July 2021. ● The NPRA may have an effect on air quality because choices made in the NPRA may influence the number of traffic movements between the installations and the storage facility. This may affect emissions into the air and therefore air quality.	● Limitation of a possible increase in emissions and other negative effects on air quality as a result of waste management, transport, storage and disposal.

Item	Challenges and points for attention	Opportunities
Climate factors	● In the Netherlands, the expectation is that in general temperatures will rise and there will be more periods of drought. Along the coast, more precipitation is expected, even though the net result will still be dryer weather conditions. The processing, transport, storage or disposal of radioactive waste may contribute to climate change.	● Minimisation of climate effects due to the processing, storage and disposal of radioactive waste in the Netherlands. ● Reduction of the contribution to climate change due to the management of radioactive waste and looking for ways to compensate for greenhouse gases. ● Ensuring that the management and the storage facilities are able to withstand the consequences of climate change.
Cultural heritage factors	● The Netherlands has various national heritage sites (in Dutch: *Rijksmonumenten*), 12 UNESCO World Heritage Sites, several archaeological sites and cultural landscapes. The NPRA may affect the conservation of the historic environment.	● Protection and conservation of cultural heritage in the Netherlands by thinking about the consequences of the NPRA in advance and assessing the effects. In addition, the general public needs to be made aware through promotion of heritage sites.
Landscape	● The Dutch landscape consists of a variety of plant and animal species, hills, agricultural areas and waterways. ● The NPRA may affect the road network, due to changing traffic for the transport of radioactive waste. There is also a possibility that extra space needs to be taken up around the storage facility if it turns out that insufficient space is available.	● We need to take the effects on the Dutch landscape into account. For instance, landscapes and the visual aspect need to be protected by improving the local environment, screening off radioactive waste facilities and opting for more sustainable means of transport.
Population and public health	● On the whole, the Netherlands is a densely populated country, although there are regional differences. For example, there are urbanised areas near the coast and highly rural areas in the east and north of the country. ● The NPRA may have an effect on risks relating to public health during transport, processing, storage or other activities involving radioactive waste. ● The Netherlands has different types of areas with increased noise levels. This mainly concerns urbanised and industrial areas and areas around the road network. The NPRA may affect the transport of radioactive waste, which in turn may influence the noise level.	● The policy must ensure that local communities are not inconvenienced/disturbed and that human health is further protected. ● The policy should create a safe environment for the management, processing and disposal of radioactive waste. ● Exploration of sustainable transport options to reduce or avoid noise nuisance.
Socio-economic factors	● The scenarios presented may have an effect on existing economic markets and tourism.	● There are possibilities for the creation of jobs and opportunities for improving local economies. ● The NPRA may further support the approach of ‘the polluter pays’ to secure enough funding for the management of the radioactive waste.

Item	Challenges and points for attention	Opportunities
Infrastructure	● The Netherlands has a variety of urbanised areas and an extensive road and railway network. ● There are several types of waste processing facilities in the Netherlands, like landfill sites, waste incinerators, anaerobic digestion and composting installations. ● COVRA is currently the only storage location for radioactive waste in the Netherlands. Therefore, it is important to chart medical and (nuclear) industrial trends in order to establish the possible impact on COVRA.	● Exploration of the possibilities to minimise the production of radioactive waste in the Netherlands, and maximise the availability of resources. ● The NPRA can aim to reduce the use of resources. ● The NPRA can affect the national transport network.

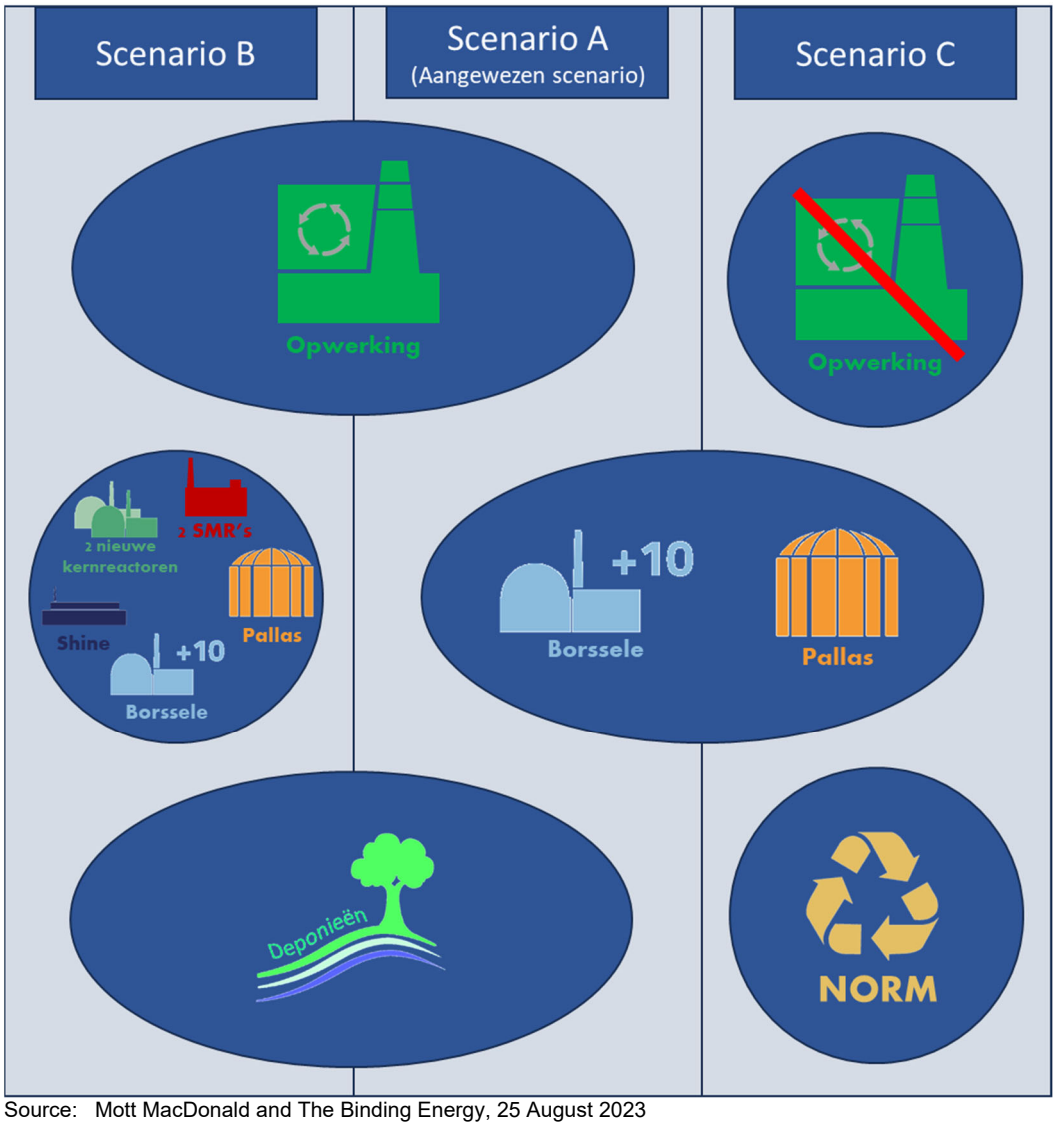
Source: Various. For references, see Annex D.

4 Designated scenario and alternatives

At the time of writing this NRD, the NPRA 2025 has not yet been drawn up. Therefore, we will work with scenarios; see Figure 4.1. The scenario that is closest to the current policy will be put forward as the designated activity (Scenario A). This will be compared to two alternative scenarios (B and C) with, on the one hand, the expected developments in the production of radioactive waste and, on the other hand, some other policy decisions. For the Strategic Environmental Assessment, these will be further elaborated and quantified to make it possible to carry out an objective assessment.

For the development and choices regarding the designated scenario and the examined alternatives, the reader is referred to Annex B.

Figure 4.1: High-level overview of scenarios



Source: Mott MacDonald and The Binding Energy, 25 August 2023

4.1 Description of scenario A

Scenario A for the safe management of radioactive waste, now and in the future, is largely based on the continuation of existing policy. This policy has been stable for several years and involves above-ground storage of radioactive waste for at least 100 years. This above-ground storage is to occur at COVRA only, so that there is a single central storage location for the whole of the Netherlands. In this scenario the radioactive waste must be moved to COVRA as soon as possible after being produced.

For short-lived waste and very low-level waste (VLLW) of natural origin, among other things, there are different processing routes. Short-lived waste with a half-life of less than 100 days can be stored in a suitable space at the producer's location for a period of up to 2 years. If the waste remains below the release thresholds, it can be subsequently disposed of as conventional waste. VLLW of natural origin (NORM waste) with an activity concentration of up to 10 times higher than the exemption thresholds can be dumped at landfill sites specially licensed for this purpose. The provinces will be perpetually responsible for the follow-up care for these landfill sites.

It is expected that all radioactive waste will be transferred to a geological disposal facility around the year 2130. Final decision-making on this will take place in 2100. This relatively long period for final decision-making gives the Netherlands the opportunity to learn from experience gained in other countries, to conduct research and to gather knowledge. This also means that the Netherlands is keeping its options open for collaboration with other Member States (among other things via ERDO[5]) besides final disposal in the Netherlands.

In this scenario, all existing installations as well as the extension of the operating life of Borssele, for which the first steps towards a legislative amendment have already been taken, and the PALLAS reactor, for which the construction phase is being prepared, will be taken into account. In this scenario, it will also be assumed that all spent fuel from the nuclear power plant in Borssele will be reprocessed in La Hague (France). All other initiatives are still at an earlier stage of the research and/or exploration phase and will be included in Scenario B.

This scenario will be regarded as the intended activity which the other two scenarios (alternatives) will be compared to, as is described in Section 7.7 of the Act of 13 June 1979 containing rules on a number of general topics relating to environmental protection, i.e. the Environmental Management Act (in Dutch: *Wet Milieubeheer*).

4.2 Description of the alternative scenarios

For the Strategic Environmental Assessment, two alternative scenarios have been drawn up which will be reasonably considered. Scenario B focuses on the potential extension of the number of license-holding establishments in the Netherlands with a few future projects. Scenario C focuses on a number of policy choices within the domain of radioactive waste management in the Netherlands. The development and substantiation of the scenarios can be found in Annex B.

4.2.1 Scenario B

Scenario B is largely the same as Scenario A as described above. Because Scenario A only takes account of projects for which the first steps have been taken before the legislative amendment or projects for which the licensing process is ongoing, Scenario B will include

[5] ERDO(2023), http://www.erdo-wg.com/

potential new installations. This way, we can assess the impact on the environment. All other aspects are the same as in Scenario A.

This scenario is based on the assumption of two new nuclear reactors being added, as these have been included in the Coalition Agreement of the Rutte IV government. In addition to these power plants, two Small Modular Reactors (SMRs) will also be included, because they are part of the climate plan[6] of Minister Rob Jetten[7]. Finally, the medical isotope production facility Shine will be part of the Strategic Environmental Assessment as well, because this project is at the stage of the preliminary consultations for the license application, and the notification of the Environmental Impact Assessment has been submitted.

4.2.2 Scenario C

Through Scenario C, some policy decisions will be assessed for their environmental impact within the scope of this NPRA. In this scenario, the policy will be changed in connection with the processing of spent fuel. Instead of reprocessing, we will opt for a policy without any reprocessing taking place. The storage at COVRA, as the central storage facility, will be maintained.

For some VLLW of natural origin, a policy change will also be included. For this radioactive waste it may be possible to develop specific release routes as a result of which these waste flows can be recycled or managed as ‘waste’ according to the requirements of the Environmental Management Act.

No policy changes are expected to be introduced for short-lived waste and for disposal. For this we will fall back on the reference scenario.

[6] https://open.overheid.nl/documenten/ronl-77b639d132c52e5e1d75a36381fb6e60748ed8bb/pdf (only in Dutch)

[7] The number of SMRs is not part of the climate plan. Therefore, we have randomly opted for the inclusion of two SMRs in the assessment.

5 Method and assessment framework for the Strategic Environmental Assessment

This chapter explains the method and the assessment framework for the Strategic Environmental Assessment. It makes a distinction between the NRD phase and the Strategic Environmental Assessment phase. This is followed by an overview of the main environmental aspects to be included in the analysis. These environmental aspects will be assessed based on the assessment framework and the criteria described in the next chapter. The final section includes the requirements for the contents of the Strategic Environmental Report.

5.1 Method

The method for the drafting of the Strategic Environmental Report has been subdivided into the various phases in which the full assessment is performed. In the NRD phase, the framework for the Environmental Impact Assessment is laid down. In this phase we also determine the relevant and specific objectives to enable a correct assessment of the scenarios. The Strategic Environmental Assessment phase then consists of the actual assessment process. The final phase consists of an assessment at programme level to determine the cumulative effects with other programmes and plans.

5.1.1 NRD phase

In the NRD phase, the most important aspects, such as the objectives and the main environmental parameters, have first been determined based on the relevant plans, policy lines and programmes (see Annex E). An environmental baseline has also been established for the Netherlands (see Annex D). This information has subsequently been used to identify the main trends, challenges and opportunities in order to determine the objectives of the Strategic Environmental Assessment. In turn, these objectives form the basis for the assessment framework and the criteria. This assessment framework consists of an assessment and evaluation system that makes use of a qualitative scale to assess the effects on the environmental aspects of each scenario.

5.1.2 Strategic Environmental Assessment phase

In the Strategic Environmental Assessment phase, the actual assessment of the various scenarios will be carried out. This assessment will consist of an iterative process to determine the impact of the scenarios, evaluate the effects and justify the findings. Use will be made of a consistent approach to assess the effects on the objectives (see Section 5.2) of the Strategic Environmental Assessment based on the predetermined assessment framework and criteria. The effects and assessments for the short and the long term of each scenario will be included in a matrix which will include all objectives. In addition, this matrix will show both the positive and the negative effects for the objectives. This way, combined effects can be identified. After the assessment and evaluation phase, mitigating measures and/or improvement measures will be defined, if necessary.

5.1.3 Assessment at programme level

Besides the assessment of the individual scenarios, the impact of the scenarios and the associated effects on other plans and programmes (see Annex E) will be determined. In this assessment at programme level, the interactions and combined positive and negative effects

with other important plans in the Netherlands and/or neighbouring countries will be analysed. For every combined effect, a suitable justification will be drawn up. If it turns out that these effects will have significant consequences for the objectives, additional mitigating measures or recommendations will be defined.

5.2 Objectives of the Strategic Environmental Assessment

The objectives of the Strategic Environmental Assessment (SEA) are based on the trends, challenges and opportunities of the predetermined baseline and form the basis for the elaboration of the assessment framework and the criteria (see Table 3.1). The overview below sets out the SEA objectives.

Table 5.1: SEA objectives

Item	SEA objectives
Biodiversity, flora and fauna	Protect, maintain and improve biodiversity, flora and fauna in the Netherlands.
Water	Minimise the deterioration of the water environment and reduce the risk of flooding.
	Maintain the quality and quantity of drinking water sources.
Soil	Avoid negative effects on the soil and geological characteristics.
Air	Minimise emissions of polluting gases and particles, and improve air quality.
Climate factors	Minimise greenhouse gas emissions and ensure sufficient resilience to the possible consequences of climate change.
Cultural heritage factors	Avoid effects on historic buildings and their surroundings.
Landscape	Protect and improve the quality of the landscape, townscapes and visual impact mitigation.
Population and public health	Minimise inconvenience/disturbance for local communities.
	Avoid damage to public health.
Socio-economic factors	Promote sustainable development and support local economies.
	Ensure properly funded management of radioactive waste.
Infrastructure	Minimise the effects on existing buildings and other infrastructure.
	Minimise the need for resources.
	Increase the amount of recycled or reused waste.

5.3 Assessment framework and criteria

As the final step in the NRD phase, the assessment framework and the associated criteria have been determined. For this the objectives were further refined into research criteria first, after which the scoring criteria were determined. These research criteria are characterised by their typical question form that allows an answer to be given on the feasibility of the objectives. In the table below this is shown for the item of 'Biodiversity, flora and fauna'.

Table 5.2: Research criteria for the item of 'Biodiversity, flora and fauna'

Item	SEA objective	Research criteria
Biodiversity, flora and fauna	Protect, maintain and improve biodiversity, flora and fauna in the Netherlands.	• Will the NPRA influence the conservation of Natura 2000 areas, National Parks and the National Ecological Network? • Will the NPRA protect and improve the ecology of the North Sea and the Wadden Sea? • Will the NPRA protect, conserve and improve ecosystems, habitats, flora and fauna in the Netherlands? • Will the NPRA improve our biodiversity? • Will the NPRA support the UN's sustainable development goal of 'life on land'?

The research criteria will be assessed in the Strategic Environmental Assessment phase based on the scoring criteria. The scoring criteria make use of a five-point scale ranging from 'Important positive' to 'Important negative'. There will also be the option of 'Uncertain' for situations where insufficient evidence can be gathered based on the available information. For each score, a clear explanation has also been given to ensure the objectivity of the study. An example has been elaborated in the table below.

Table 5.3: Scoring criteria for the item of 'Biodiversity, flora and fauna'

Item	Main elements	Effect	Description	
Biodiversity, flora and fauna • Protect, maintain and improve biodiversity, flora and fauna in the Netherlands.	• National Parks • Natura 2000 areas • National Ecological Network • Protected animal and plant species	++	Important positive	The NPRA will significantly improve our biodiversity and the protection of certain species. The NPRA will significantly improve certain areas.
		+	Limited positive	The NPRA will result in limited improvements in habitats and the number of species.
		0	Neutral	The NPRA will not have any effect on our biodiversity, flora and fauna.

	-	Limited negative	The NPRA will result in limited deteriorations in habitats and the number of species.
	--	Important negative	The NPRA will significantly deteriorate biodiversity and the protection of certain species. The implementation of the NPRA will cause significant deterioration of certain areas.
	U	Uncertain	Based on the available information, no conclusive evidence can be gathered.

The elaborated research and scoring criteria for the other items can be found in Annex F.

5.4 Contents of an Environmental Impact Report

The contents of an Environmental Impact Report have been laid down in the Environment and Planning Act and the Environment Decree (in Dutch: *Omgevingsbesluit*). The Environmental Impact Report must at least contain the following information, taking into account the current knowledge and contents of the plan or programme:

a. A description of the contents of the plan or programme and the reasonable alternatives, the main objectives of the plan or programme and the connection with other relevant plans and programmes;
b. The relevant aspects of the existing state or quality of the environment and the possible development thereof if the plan or programme will not be executed;
c. The environmental characteristics of areas for which the effects of the plan or programme may be significant;
d. All existing environmental problems which are relevant to the plan or programme, particularly the problems in areas where the interest of environmental protection plays an important role;
e. A description of the way in which the objectives for environmental protection as determined at international, community or national level and other environmental considerations have been involved in the plan or programme, insofar as they are relevant to the plan or programme;
f. A description of the possible significant environmental effects of the implementation of the plan or programme and of the reasonable alternatives, including an assessment of those environmental effects;
g. The intended measures to prevent, limit or compensate for the significant negative environmental effects of the implementation of the plan or programme;
h. A substantiation of the selection of the investigated alternatives and a description of the way in which the environmental effects have been determined and assessed, including the challenges encountered when gathering the necessary information, such as technical shortcomings or knowledge gaps;
i. A description of the intended monitoring measures; and
j. A non-technical summary of the information provided under items a to i.

6 Further process and procedure

6.1 Preparation process for the National Programme on Radioactive Waste

The Strategic Environmental Assessment is part of the update of the National Programme on Radioactive Waste. The list below sets out the main steps to be taken to arrive at the final updated NPRA.

1. For the development of the NPRA 2025, the Ministry of Infrastructure and Water Management has decided not to draw up a preliminary draft NPRA. In addition, the decision has been made to set out general policy lines including a few alternatives. These policy lines and alternatives will then be assessed in the Strategic Environmental Assessment so that the draft NPRA can be subsequently drawn up.
2. Based on these policy lines and alternatives, a draft NRD has been drawn up which has been discussed with several internal and external stakeholders during two workshops in June 2023. Once the draft NRD has been completed, it will be available for consultation during a six-week period from October 2023, to give all stakeholders the opportunity to provide their points of view. After this period, all points of view will be combined into a response memorandum. This response memorandum will in turn be used to draw up the final NRD in late 2023.
3. After the NRD has been completed, and consequently also the scope of the Strategic Environmental Assessment, a draft Strategic Environmental Report will be drawn up by the end of November 2023. After this, two workshops will also be organised so that a number of internal and external stakeholders can share their vision during the development of this Strategic Environmental Report. In addition, the intention is to make the draft Strategic Environmental Report available for consultation during a six-week period starting in February 2024. After the points of view have been responded to and processed, the Strategic Environmental Report will be finalised in early May 2024.
4. After this study phase, the draft NPRA will be drawn up and an early participation opportunity will be planned. This will be followed by an official consultation round for the draft NPRA in late 2024. The aim is to deliver the final NPRA by March 2025. This way, there will still be sufficient time to meet the deadline of August 2025 for the final presentation of the NPRA to the European Parliament as provided for in the European Directive 2011/70/Euratom.

6.2 Initiator and Competent Authority

The responsibilities and parties involved in the process of the Strategic Environmental Assessment are as follows:

- Ministry of Infrastructure and Water Management: responsible for coordination and direction of the Strategic Environmental Assessment process;
- COVRA: responsible for the management of radioactive waste and involved in the development of the Strategic Environmental Report;
- Provinces: responsible for the management of radioactive waste stored at the landfill sites;
- Co-determination bodies: responsible for organising participation and consultation rounds and for processing points of view received;
- Other parties involved: other relevant public authorities, interest groups and the general public.

6.3 Participation

Consultation and participation are important parts of the Strategic Environmental Assessment process. By involving stakeholders and the public in the decision-making, we can increase support for the final decisions, and people will have a better understanding of the interests and concerns of all parties involved. This chapter describes the consultation procedure and participation options.

6.3.1 Consultation procedure

The consultation procedure for the Strategic Environmental Report consists of several different steps where stakeholders and the public will have the opportunity to provide their points of view on the proposed policy, the alternatives and the environmental effects analysed. The procedure consists of the following steps:

- Making the Memorandum on Scope and Detail Level available for consultation: The NRD will be disclosed publicly and made available for consultation for a period of six weeks starting from 3 October 2023, with the option of an eight-week extension. During this time, stakeholders and the public can submit their points of view either verbally or in writing.
- Response memorandum: After the period for consultation, the points of view received will be collected and processed into a response memorandum. This response memorandum will give an overview of the points of view submitted, the initiator's response, and the way in which the points of view will be taken into account in the preparation of the final Strategic Environmental Report.
- Making the Strategic Environmental Report available for consultation (February 2024): Once the Strategic Environmental Report has been drawn up, it will be disclosed publicly and made available for consultation for a period of six weeks. Here, too, stakeholders and the public can submit their points of view either verbally or in writing.
- Decision-making process: Based on the Strategic Environmental Report and the points of view received, the responsible authority will make a decision on the proposed policy and the associated environmental effects. The decision will then be published and made available for consultation by the end of 2024.

6.3.2 Other participation steps

Prior to the formal consultation procedure, the Ministry of Infrastructure and Water Management organised workshops with various stakeholders to promote the involvement of these parties during the development of the NRD. For this the Ministry invited relevant public authorities, but also businesses and industry associations for the relevant sectors and civil society organisations, such as environmental organisations. During these workshops, these parties were informed about the procedure regarding the NPRA and were able to provide input for the NRD. The results of these workshops have been incorporated into the draft NRD insofar as possible.

Following these workshops, the draft NRD was presented to and discussed with the parties listed below, which were given the opportunity to respond to the draft NRD. The results of this have also been incorporated into the draft NRD insofar as possible.

- Ministry of Economic Affairs and Climate;
- Ministry of Health, Welfare and Sport;
- Ministry of Social Affairs and Employment;

- Nuclear Safety and Radiation Protection Authority (ANVS) in its capacity as supervisory authority;
- COVRA, the Central Organisation For Radioactive Waste.

During the consultation procedure, you can find additional information on these two websites:

- www.overkernenergie.nl/english. On this website you will find general information on nuclear energy, developments in the sector and the participation process.
- www.platformparticipatie.nl. This website provides information (in Dutch) about the procedure and the decision-making process. You can also find the draft NRD and the participation and communication plans here. At a later stage, the final NRD and the (draft) Strategic Environmental Report will be uploaded here as well.

Finally, during the consultation procedure a digital information event will be held where the draft NRD and the procedures around the NPRA will be explained. During the digital event people will also have the opportunity to ask questions and talk to representatives of the Ministry of Infrastructure and Water Management and the Ministry of Economic Affairs and Climate.

For more information on the participation options, please refer to the attached participation and communication plan.

Annexes

A. List of acronyms

COVRA	Central Organisation For Radioactive Waste
ERDO	European Repository Development Organisation
EZK	Ministry of Economic Affairs and Climate
IAEA	International Atomic Energy Agency
IenW	Ministry of Infrastructure and Water Management
WFD	European Water Framework Directive
NOVI	National Strategy on Spatial Planning and the Environment
NORM	Naturally Occurring Radioactive Materials
NPRA	National Programme for the Management of Radioactive Waste and Spent Fuel
NRD	Memorandum on Scope and Level of Detail
Strategic Environmental Assessment	This concerns the assessment procedure (in Dutch: *plan-mer*)
Strategic Environmental Report	This concerns the actual report to be drawn up based on the assessment (in Dutch: *plan-MER*)
RIVM	National Institute for Public Health and the Environment
SLA	Clean Air Agreement
SMRs	Small Modular Reactors
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN	United Nations
VLLW	Very low-level waste

B. Explanation on structural choices

B.1 Alternatives with regard to radioactive applications

The Dutch landscape relating to radioactive applications consists of multiple nuclear and research reactors, an enrichment plant and several installations for medical or industrial applications. This landscape may change considerably in the period up to 2035, with the realisation of new initiatives and the decommissioning of various installations. Therefore, an alternative scenario has been developed to incorporate these aspects. For this scenario it should be noted that there are no direct policy choices linked to this scenario in the NPRA. However, the impact of these initiatives should be identified. Initiatives with a limited contribution to the amount of radioactive waste have not been included in the scenarios.

The decision has been made to assign the initiatives to the scenarios based on their project phase. Initiatives which are at an advanced stage or for which the government is taking important steps will be assigned to Scenario A. All other initiatives will be included in Scenario B. The table below gives an overview of the initiatives included, the project situation and the chosen scenario.

Table B.1: Overview of the considered initiatives, the project situation and the chosen scenario

Initiative	Project situation	Chosen scenario
Extended operating life of Borssele	Motion for the required amendment to the Nuclear Energy Act submitted to the House of Representatives [14/Sep/2020]	Scenario A
Two new nuclear reactors	Included in the Coalition Agreement of the Rutte IV government	Scenario B
PALLAS reactor	Preparations for the construction phase	Scenario A
Isotope production plant - Shine	Preliminary consultations for the license application, and notification of the Environmental Impact Assessment submitted	Scenario B
Small Modular Reactors (SMRs)	Part of the climate plan of Minister Rob Jetten	Scenario B

B.2 Alternatives with regard to radioactive waste and spent fuel

Below we will present the policy alternatives considered when drawing up the reference scenario and the alternative scenarios. For this we looked at a number of structural choices made in the past as well as the recommendations defined in the RIVM report. It appears from this that an alternative policy will mainly focus on the processing and storage of spent fuel and additionally on very low-level waste (VLLW).

At the moment, the spent fuel is reprocessed by a French business, and the reprocessing residues are transported to COVRA. However, the reprocessing is the operator’s choice, and therefore there is always a chance of them deciding to no longer reprocess the spent fuel.

As a result, there are four options for the policy relating to spent fuel:

- Option 1 (current situation): Reprocessing and storage at COVRA
- Option 2: On-site reprocessing and storage
- Option 3: No reprocessing and storage at COVRA
- Option 4: No on-site reprocessing and storage

For Scenario A, use will be made of option 1, because this describes the current situation and it is in line with the objective of continuing the current policy as much as possible. For the alternative scenario (Scenario C), we will look at option 3. The on-site storage is contrary to one of the focal points of the policy, which is that all waste must be removed as soon as possible and transported to a single central storage location. As a result, options 2 and 4 are not possible within the current policy.

According to RIVM, there are possibilities for improving the current policy for very low-level waste (VLLW). The policy is currently based on the fact that all radioactive residues and waste must be removed to COVRA. For NORM waste that is subject to compulsory registration, an exception applies so that it can be removed to the designated landfill sites. According to RIVM, there are possibilities for these waste flows to create other specific release routes, so that some of these products can be recycled or managed as ‘waste’ according to the requirements of the Environmental Management Act. As a result there are two possible options:

- Option A (current situation): Removing VLLW of natural origin to the designated landfill sites
- Option B: Creating alternative specific release routes for VLLW as described in the RIVM report

Option A will be used in Scenario A with a view to the objective of continuing the current policy as much as possible. Option B will be included in Scenario C for which the environmental impact will be determined.

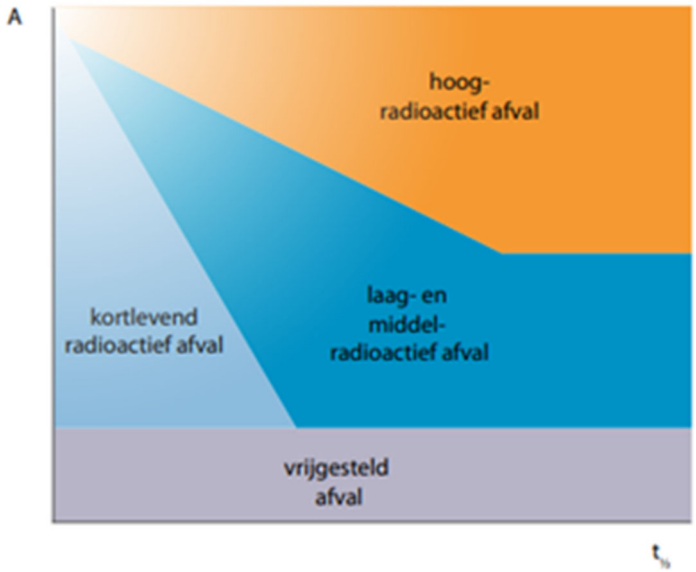
C. Baseline of radioactivity

In the Netherlands, there are about 800 businesses with a license under the Nuclear Energy Act for the possession and use of radioactive substances and/or sources of radiation. In addition, there are a number of businesses which have a registration for the use of radioactive raw materials, mainly NORM materials. Sooner or later, all these businesses will generate radioactive residual materials or waste. These residual materials or waste products of the types of high-level waste (HLW) and low-level and intermediate-level waste (LLW/ILW) must be removed to COVRA as soon as possible after production. In practice, this usually means within the maximum permissible storage period of two years. This way, waste with a half-life of less than 100 days can drop below the release thresholds. After this period it can be removed as conventional waste. Other residual materials and waste products are less radioactive, for example, so that they can also be processed and removed in another way. For NORM waste, for example, it is possible to transport it to the designated landfill sites.

C.1 Waste classification

In 2009, the IAEA (International Atomic Energy Agency) developed a radioactive waste classification consisting of six waste classes. This classification is non-binding, so that every Member State can use it in its own way. The Dutch legislation deviates from the IAEA classification, where a distinction is only made between radioactive waste subject to compulsory registration and radioactive waste for which a license is required, and between waste that contains spent fuel and waste that does not contain spent fuel. At COVRA, on the other hand, use is made of a classification based on the IAEA guideline that consists of four classes: high-level waste (HRW), low-level and intermediate-level waste (LLW/ILW), short-lived waste and exempt waste.

Figure C.1: The COVRA classification for radioactive waste



Source: COVRA, 'National Inventory of Radioactive Waste' (in Dutch: *Nationale Radioactief Afval Inventarisatie*), October 2022

High-level waste (HLW) is characterised by a high radiation level and sometimes also the production of heat. This waste originates from the generation of spent fuel elements from nuclear power plants and the spent fuel elements from the research reactors. In addition, it is also generated during the production of medical radio-isotopes and the decommissioning of nuclear installations.

Low-level and intermediate-level waste (LLW/ILW) consists of several waste flows of various origins (consumables, calibration and radiation therapy sources, replacement components of nuclear installations, etc.). This can be either short-lived or long-lived waste. Within the class of low-level and intermediate-level waste, COVRA makes a further distinction between four types of LLW/ILW:

- A waste: Radioactive waste emitting alpha radiation (often long-lived).
- B waste: Radioactive waste originating from the nuclear power plants with a relatively short lifespan.
- C waste: Radioactive waste with a half-life of more than 15 years.
- D waste: Radioactive waste with a half-life of less than 15 years.

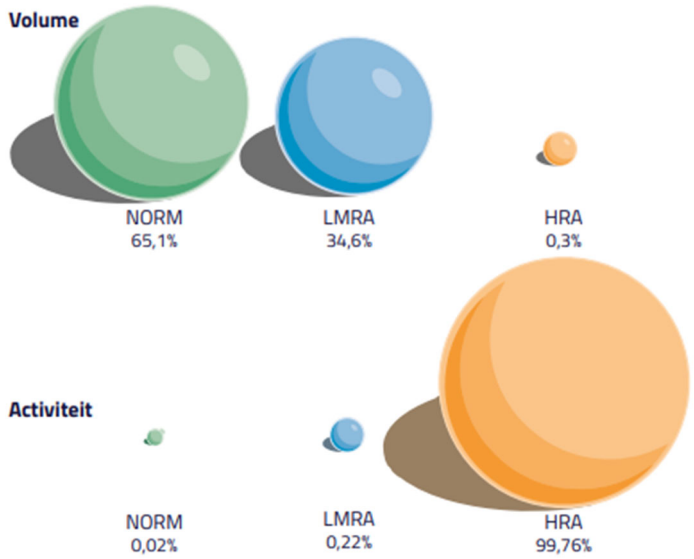
A separate category within the LLW/ILW is NORM waste. This waste with an elevated level of radioactivity is generated when natural, radioactive products are concentrated during processing (metal processing, pigment industry, zirconium industry, geothermal industry, etc.). This waste often has a longer lifespan so that it needs to be managed and stored in a safe way.

C.2 Waste quantities

C.2.1 Current situation

The current quantity of radioactive waste in the Netherlands amounts to more than a hundred thousand cubic metres. The majority of this is radioactive waste of natural origin and has been dumped at the designated landfill sites. The other waste is stored at COVRA and this amounted to about 35,000 m³ in late 2020. About two thirds of this is NORM waste and one third is LLW/ILW. High-level waste only amounts to 110 m³ and therefore represents just 0.3% of the total quantity.

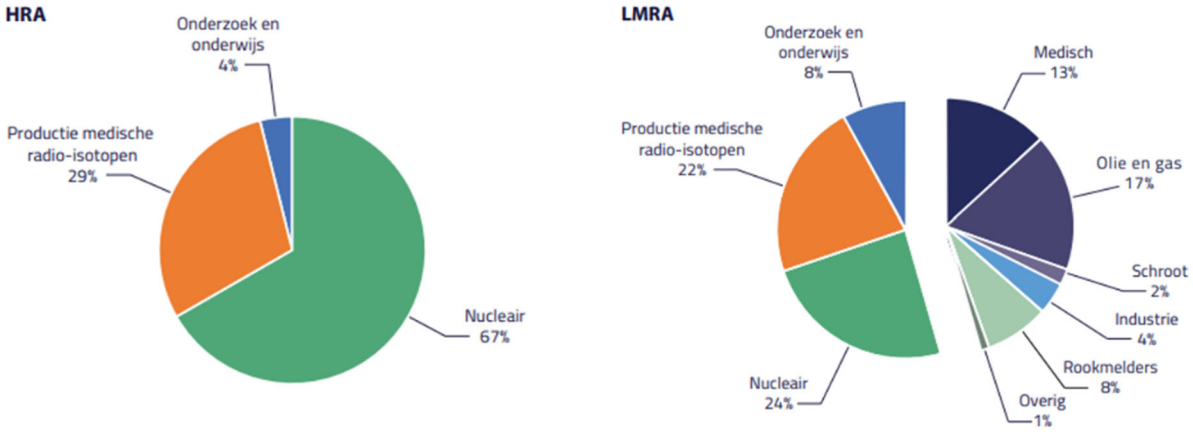
Figure C.2: Activity and volume of radioactive waste stored at COVRA (December 2020)



Source: COVRA, National Inventory of Radioactive Waste, October 2022

Over the years, this quantity of radioactive waste has been generated by the various industries. At the moment, about 114,000 m³ of radioactive waste is produced per year, of which about 1,000 m³ is transported to COVRA. The figure below gives an overview of the production ratios for the various sectors of the waste transported to COVRA for the period 2018-2020. This overview does not include the NORM waste intended to be removed to the landfill sites. For more concrete figures, the reader is referred to the study by RIVM[8].

Figure C.3: Origin of radioactive waste stored at COVRA for the period 2018-2020



Source: COVRA, National Inventory of Radioactive Waste, October 2022

[8] RIVM (2022), 'Radioactive residual materials and waste in the Netherlands - An inventory'

C.2.2 Expected quantities

For the inventory for 2021 onwards, the current policy as described in the NPRA 2016 is taken into account. Moreover, different scenarios have been included where new installations form part of the nuclear landscape in the Netherlands. The different scenarios are shown below:

Operational extension for the Borssele nuclear power plant until 2034

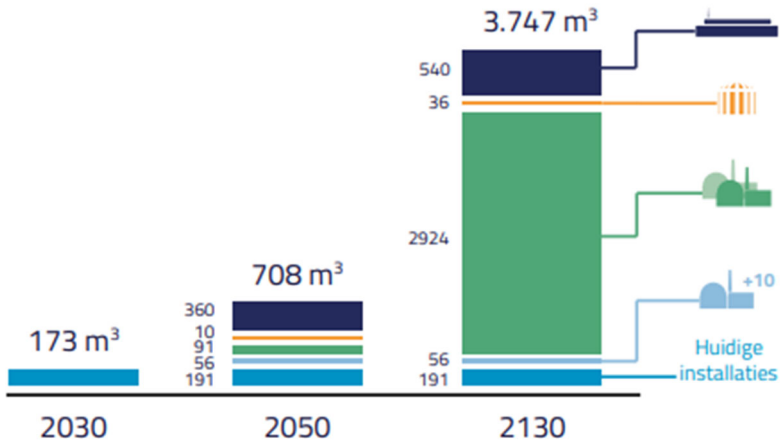
Two new nuclear reactors

PALLAS reactor

Shine

The figure below gives an overview of the quantities of HLW to be expected in 2030, 2050 and 2130.

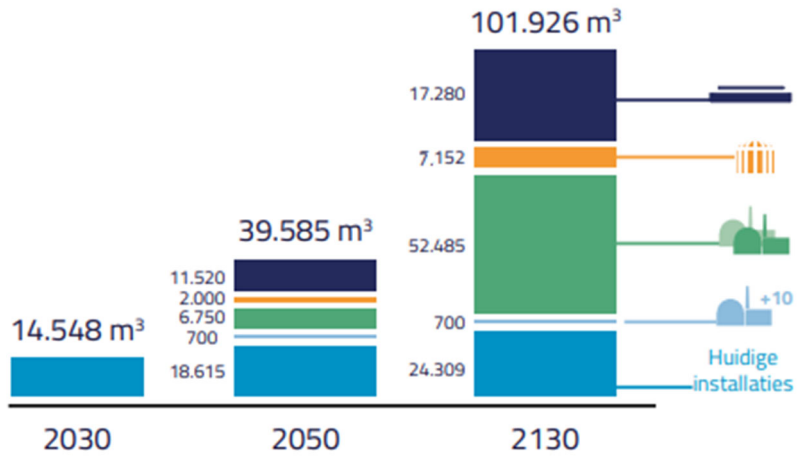
Figure C.4: Expected quantities of HLW for the different scenarios (in m³)



Source: COVRA, National Inventory of Radioactive Waste, October 2022

The prognoses for the quantities of LLW/ILW in 2030, 2050 and 2130 are shown in the next figure.

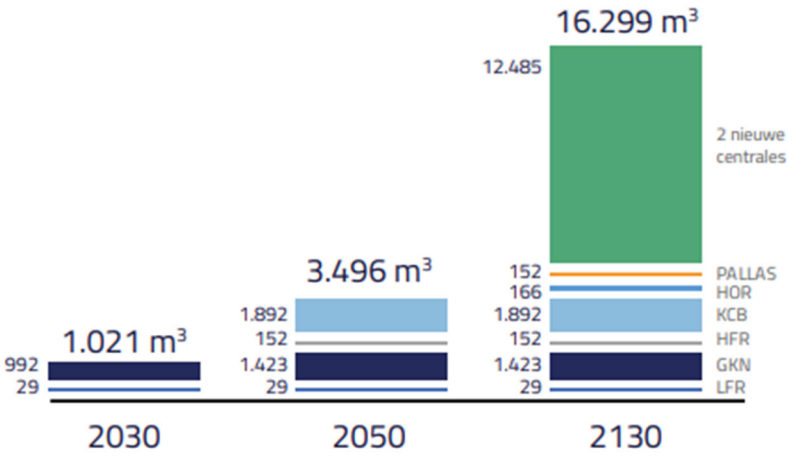
Figure C.5: Expected quantities of LLW/ILW for the different scenarios (in m³)



Source: COVRA, National Inventory of Radioactive Waste, October 2022

At the end of the operating life of the various installations, these will in turn all be decommissioned as well. This is also associated with certain quantities of radioactive waste. The overview below shows the expected quantities of radioactive waste for the decommissioning of the various nuclear reactors.

Figure C.6: Expected quantities of decommissioning waste for the different scenarios (in m³)



Source: COVRA, National Inventory of Radioactive Waste, October 2022

For the expected amount of NORM waste, we have only looked at the amount to be stored at COVRA. Almost 7,000 m³ of this originates from the decommissioned phosphorous production plants. The remaining amount originates from the uranium enrichment industry. This is based on a linear extrapolation of the available data from the past 20 years. It has also been assumed that this industry will have stable production until up to 2050. Finally, it has been assumed that no NORM waste from other industries will be stored at COVRA.

Table C.2: Quantities of NORM waste to be expected for storage at COVRA (in m³)

Type of NORM waste	2030	2050	2130
NORM waste originating from uranium enrichment	28,172	49,360	49,360
Calcinate (phosphorous industry)	6,710	6,710	6,710
Total	**34,882**	**56,070**	**56,070**

Source: COVRA, National Inventory of Radioactive Waste, October 2022

D. Environmental baseline

D.1 Introduction

This environmental baseline has been collected and assessed for the NRD. It has been compiled with the help of published sources which are publicly available, and is described in the present section. The information presented in this Annex forms an evidence base against which important environmental issues and/or opportunities as a consequence of the NRD can be assessed. It concerns the environment in the broadest sense, and includes elements of the physical living environment, as described in Section 1.2 of the Environment and Planning Act, but also a number of socio-economic aspects.

- Biodiversity and flora and fauna
- Water
- Soil
- Air
- Climate factors
- Landscapes
- Culture
- Infrastructure
- Socio-economic aspects
- Population and public health

The NRD focuses on the Netherlands as a whole, and therefore this baseline offers a general overview of the circumstances in the Netherlands, instead of location-specific factors.

In this baseline, we sometimes refer to legislation which over time will be replaced with the Environment and Planning Act. The entry into force of the Environment and Planning Act is currently planned for January 2024. We have opted to refer to the existing legislation, because it still applies at the time of writing this NRD. In addition, we are not expecting the Environment and Planning Act to have a major impact on the baseline, since the baseline only provides an outline.

D.2 Biodiversity and flora and fauna

D.2.1 Protected animal species

In the wild, the Netherlands has about 36,000 animal species, and about 500 of those are protected[9]. The regulations regarding the protection of plants and animals are described in the Flora and Fauna Act (in Dutch: *Flora- en faunawet*). Animal species which no longer occur in the Netherlands or are in danger of becoming extinct are placed on the Red List[10]. This list is used by the government to identify the priorities in the protection of animal species. Red lists have an alert function and not a legal status. Placement on the list therefore does not automatically mean that the species is protected. For this, the species needs to be listed under the Nature Conservation Act (in Dutch: *Wet natuurbescherming*).

The government implements measures to combat the decline in animal species. One of the main causes of this decline is the fact that animal habitats are decreasing. Therefore, many measures focus on the protection and strengthening of nature.

Extra measures have been taken to protect the following animal species[10]: porpoises, large cetaceans, seals, wolves, migratory birds, farmland birds, and bees.

D.2.2 Protected natural areas

The Netherlands has several types of protected areas, including:

- National Parks;
- Natura 2000 areas;
- Ramsar sites; and
- the National Ecological Network.

The management and protection of these areas has been laid down in various acts.

D.2.2.1 National Parks

The Netherlands has 21 National Parks, which have been designated under the Nature Conservation Act. These parks each cover at least 1,000 hectares and are open to visitors. The Ministry of Agriculture, Nature and Food Quality has set up the National Parks Agency (in Dutch: *Nationale Parkenbureau*) to help improve the quality of these parks. The Agency's aim is to preserve and strengthen the natural values and landscape values of the National Parks, to promote sustainable tourism, and to improve the general public's knowledge about and awareness of these areas.

[9] Protection of Endangered Animal Species | Nature and Biodiversity | Rijksoverheid.nl (only in Dutch)

[10] Red Lists | Protected Nature in the Netherlands (nederlandsesoorten.nl) (only in Dutch)

Figure D.7: : National Parks

Source: Ministry of Economic Affairs (2017) via Maps | Environmental Health Atlas (only in Dutch)

D.2.2.2 Natura 2000 areas

The Natura 2000 network is a collection of strictly protected natural areas in Europe, where vulnerable animal and plant species and their habitats are protected. The Natura 2000 areas have been specifically selected for their unique and endangered flora and fauna, and have been listed in the European Birds and Habitats Directives. In 2023, the Netherlands has 162 Natura 2000 areas[11]. By protecting these areas, Europe is trying to combat the decline of species and preserve their habitats.

[11] Natura 2000 areas | Natura 2000 (only in Dutch)

Figure D.8: Natura 2000 areas

Source: Ministry of Economic Affairs (2018), via Maps | Environmental Health Atlas (only in Dutch)

D.2.2.3 Ramsar sites

The Netherlands has over 1 million hectares of wetlands, such as areas of marsh, fen, peatland or water. Examples of this are: the Wadden Sea, the IJsselmeer area and De Biesbosch National Park. In 2023, the Netherlands has 44 Dutch wetlands which have been defined as Wetland of International Importance. These sites are protected by the international Ramsar Convention. Bar one, these sites have all been designated as Natura 2000 areas as well[12]. This means that they are subject to protection under the Nature Conservation Act. The purpose of this protection is to preserve and reinforce the unique natural values and landscape values of these areas, so that they can be maintained for future generations and can continue to add to our biodiversity.

[12] Wetlands of the Ramsar Convention, as at 2022 | Environmental Data Compendium (clo.nl) (only in Dutch)

Figure D.9: Ramsar sites

Source: Ministry of Economic Affairs (2018) via Maps | Atlas of Natural Capital (only in Dutch)

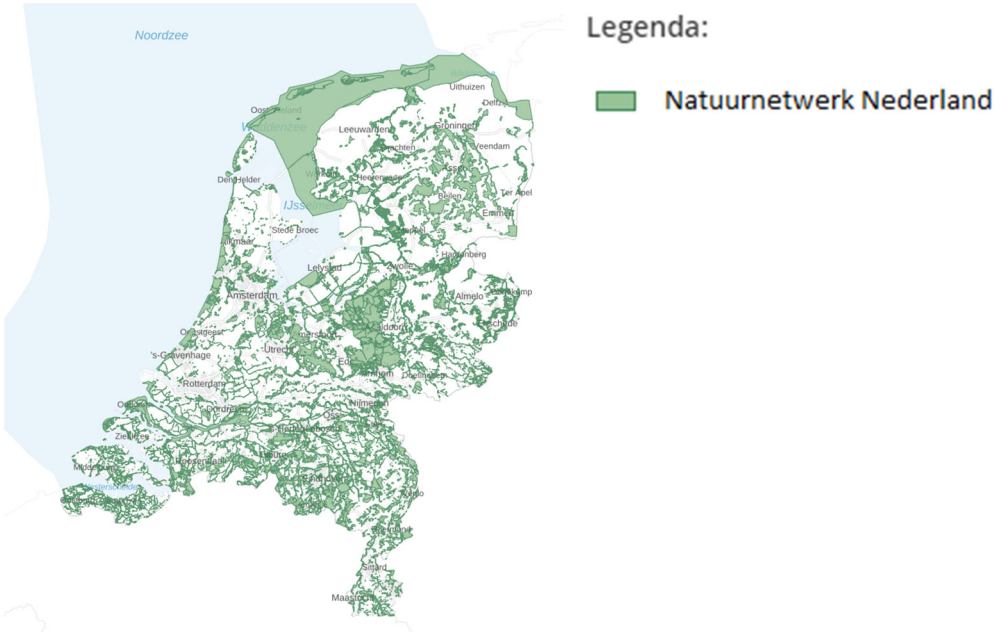
D.2.2.4 National Ecological Network

The National Ecological Network (NEN) is a network of both existing and new natural areas in the Netherlands[13]. This network ensures that these areas are better connected to each other and to the surrounding agricultural areas. The provinces are responsible for managing the National Ecological Network on land. The network not only includes all major bodies of water like the major rivers, the Delta Waters, the IJsselmeer area and the Wadden Sea, but also the entire North Sea. The management of these water areas is the responsibility of the central government. The aim of the National Ecological Network is to preserve and strengthen our biodiversity and ensure that our natural resources are used in a sustainable manner.

The NEN is protected via the Spatial Planning Act (in Dutch: *Wet ruimtelijke ordening* or Wro), which ensures that plans made by a higher level of government have the intended effect at lower levels of government as well. The limits and goals, as well as the target species of the National Ecological Network, vary between provinces and have been laid down in provincial physical environmental plans (in Dutch: *omgevingsplannen*) and environmental regulations (in Dutch: *omgevingsverordeningen*), i.e. statutory regulations that govern spatial planning in the province. Municipal authorities are responsible for the protection of the NEN in their municipality.

[13] Natural Ecological Network | Nature and Biodiversity | Government.nl

Figure D.10: National Ecological Network



Source: Association of the Dutch Provinces (2022) via Maps | Environmental Health Atlas (only in Dutch)

D.2.2.5 Protection of the North Sea and Wadden Sea

The North Sea is home to a wide variety of species, including seabed life, fish, sea mammals and sea birds, which together form the North Sea's ecosystem. It is important to protect this ecosystem, as space in the North Sea is limited, and human activities may threaten it. The North Sea is protected by European and international laws and regulations, like the Birds and Habitats Directives, the Marine Strategy Framework Directive, and the OSPAR Convention[14].

The Wadden Sea is an important natural area that is not only significant for the Netherlands, Germany and Denmark, but also for Arctic and African regions. Every year, millions of migratory birds stop over in the Wadden Sea to rest and regain their strength[14]. It is the largest natural Wetland in Europe and is protected by several European Directives, like the Birds Directive, the Habitats Directive and the Water Framework Directive, as well as the international Ramsar Convention. In addition, the Wadden Sea is part of the National Ecological Network, and the German, Dutch and Danish sections are jointly included on the World Heritage List.

[14] Protected Nature Areas | Nature and Biodiversity | Government.nl

D.3 Water

The Netherlands is a country of water. Rijkswaterstaat and the water authorities are the water management bodies in the Netherlands. In addition, provinces and municipalities are involved in water management as well. An important policy document for surface water is the Water Framework Directive (WFD)[15].

D.3.1 Bodies of water

The WFD has designated a large share of our surface water as water bodies. Many large lakes have been designated as Birds Directive areas.

Table D.3: Surface area and length of water bodies

	Surface area in km^2	Length in km
Salt water bodies	62,000	
Brackish and transitional waters	800	
Major rivers	330	650
Canals and channels		6,500
Lakes >50 ha	2,500	
Smaller moving waters (e.g. brooks)		6,200
Ditches		330,000
Fens	2.4	

Source: Surface Water in the Netherlands | Environmental Data Compendium (clo.nl) (only in Dutch)

The Netherlands is part of four international river basins: Ems, Scheldt, Rhine and Meuse.

[15] Surface Water in the Netherlands | Environmental Data Compendium (clo.nl) (only in Dutch)

Figure D.11: Major rivers in the Netherlands

Source: Rivers | Rijkswaterstaat

D.3.2 Drinking water

Drinking water in the Netherlands is generally of good quality[16]. Measurements conducted by the drinking water companies show that it is safe to drink. Drinking water companies regularly check the quality of the drinking water they supply. The number of checks they perform depends on the amount of water they produce and distribute across their distribution area.

Drinking water companies extract water from the ground in special areas referred to as water catchment areas. Via a purification process, this water is rendered suitable for consumption. These water catchment areas are indicated in Figure D.12 with a dark blue colour. Around the water catchment areas there are groundwater protection areas (light blue) and 100-year zones (orange), where certain rules apply to prevent pollution of groundwater. Drilling-free zones (white with red stripes) are even further away from the water catchment areas and are intended

[16] Drinking water | RIVM

to protect the groundwater supply against activities like drilling through clay layers for specific applications[17].

Figure D.12: Groundwater protection map of areas around drinking water sources

Source: RIVM (2022) via Maps | Environmental Health Atlas (only in Dutch)

Drinking water in the Netherlands is generally of good quality. Still, there are some concerns about the sources from which this water is extracted[18]. About 60% of our drinking water is produced from groundwater and 40% from surface water, and there are about 200 locations across the country where these sources are used.

To adhere to national and international policy, like the European Water Framework Directive, the quality of the drinking water sources must be such that drinking water can be easily purified. Unfortunately, this is only the case for about half of the groundwater extraction points in the Netherlands at present. The other half are negatively affected by human activities like agriculture, sewage systems, industry, and lingering soil contamination.

What's more, the quality of our surface water is not yet optimal. Even though some improvement has occurred over the past few decades thanks to the reduction in emissions from industry and agriculture, these emissions still pose a problem. At present there are particular concerns about the presence of substances used by consumers, like drugs, insecticides, biocides, cosmetics, flame retardants and nanoparticles.

Wastewater treatment plants are not yet able to fully remove these substances, so that they end up in the environment and ultimately in our drinking water sources as well. Drinking water companies are working on advanced purification techniques to effectively remove these

[17] Drilling in Protected Areas - Kenniscentrum InfoMil (only in Dutch)

[18] Quality of drinking water | RIVM

substances. Although very low concentrations of these substances can remain, they do not pose a risk to public health at the moment.

However, it is important to emphasise that the use of these substances is expected to increase in the future, among other things due to population ageing and changes in the composition of our population. Therefore, assuring the quality of our drinking water sources remains an important challenge for the coming years.

D.3.3 Risk of flooding

Primary flood defence systems are built to protect the land behind the defence systems against flooding from major rivers, the sea or large lakes. The standards which these defence systems must meet have been laid down in law and may differ between areas, depending on the severity of the consequences that flooding would have[19]. The flood defence systems are checked regularly and reinforced where necessary so that the standard continues to be met. In addition to the primary defence systems there is a finely meshed system of regional defence systems, like dikes along smaller rivers or secondary dikes around polder areas. These defence systems must also meet the standards adopted by provinces.

There are low-lying areas which are not protected by flood defence systems, like floodplains along rivers, where flooding therefore occurs on a regular basis. Especially in the 'High Netherlands', flooding can occur due to small rivers or streams bursting their banks, as a consequence of heavy rain further upstream. In large parts of the Netherlands, local water problems can occur due to extreme levels of precipitation, leading to overburdening of sewage systems or to groundwater discharge.

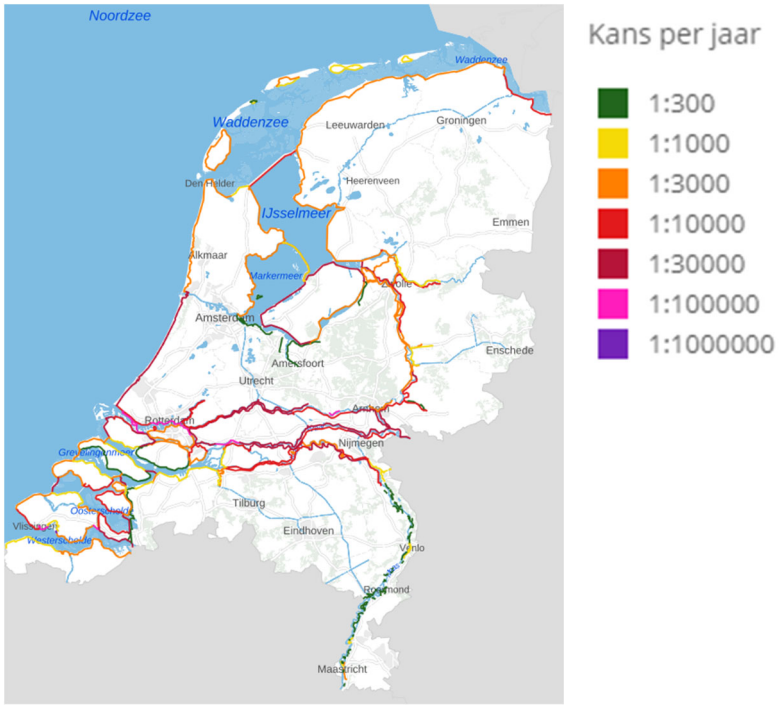
Figure D.14 to Figure D.17 show what the maximum water depth will be after the occurrence of floods with various likelihoods. Floods with a high likelihood can occur more than once in a lifetime. Floods with a medium likelihood can probably occur only once in a lifetime. Floods with a low likelihood are very unlikely to occur in a lifetime.

From 2017, the primary flood defence systems have been subdivided into dike sections. In Dutch legislation, a signalling value has been included for every dike section, which forms the standard together with the lower limit. This value indicates the likelihood of flooding. For all primary flood defence systems in the Netherlands, a signalling standard of between 1 in 300 and 1 in 1,000,000 has been established. The aim of the Delta Programme is to have all dike sections meet the safety standard by 2050[20].

[19] Water safety portal

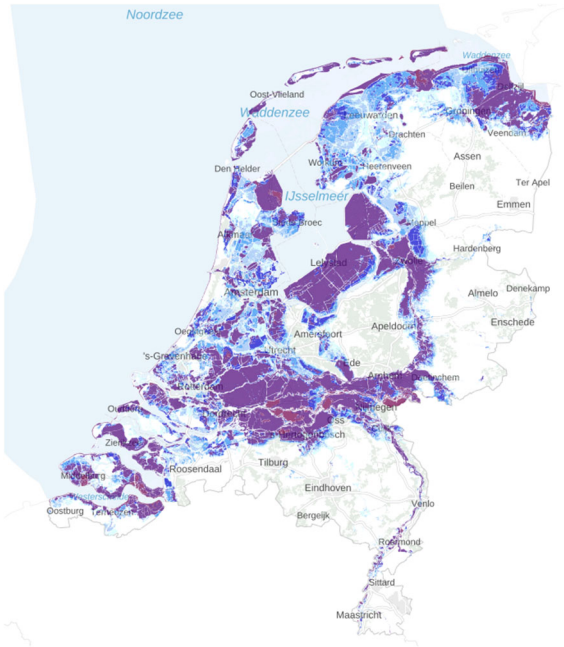
[20] Water safety portal

Figure D.13: Classification of dike sections



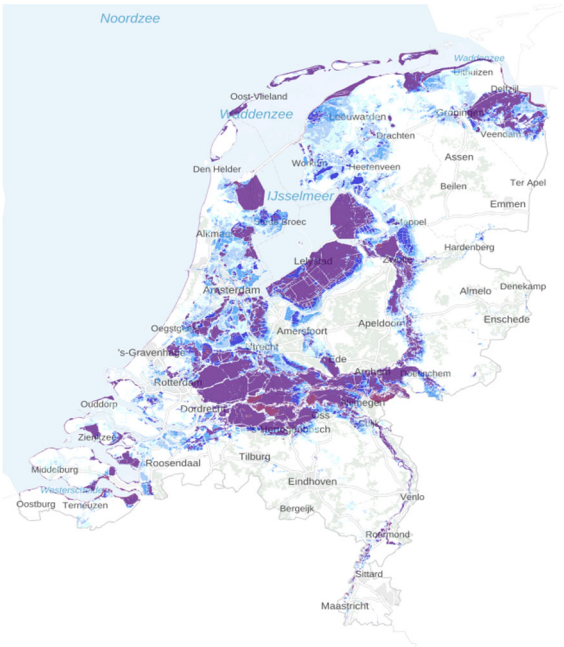
Source: Water safety portal

Figure D.14: Very low likelihood – maximum water depth



Source: Association of the Dutch Provinces (IPO) (2021), via Maps | Environmental Health Atlas (only in Dutch)

Figure D.15: Low likelihood – maximum water depth



Source: Association of the Dutch Provinces (IPO) (2021), via Maps | Environmental Health Atlas (only in Dutch)

Figure D.16: Medium likelihood – maximum water depth

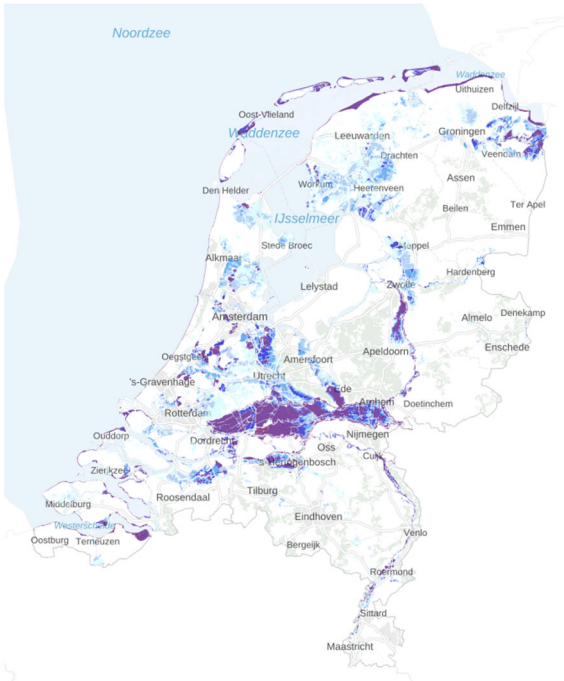


Figure D.17: High likelihood – maximum water depth

Source: Association of the Dutch Provinces (IPO) (2021), via Maps | Environmental Health Atlas (only in Dutch)

Source: Association of the Dutch Provinces (IPO) (2021), via Maps | Environmental Health Atlas (only in Dutch)

Source: Association of the Dutch Provinces (IPO) (2021), via Maps | Environmental Health Atlas (only in Dutch)

D.3.4 National Water Plan 2022-2027

To ensure that the Netherlands remains safe, attractive and liveable for future generations as well, the National Water Plan 2022-2027 (NWP) has been developed. The NWP describes a number of major challenges for the water domain, which may become greater and more complex in the future[21].

- We need to prepare for the consequences of climate change in the Netherlands, by means of adequate protection against floods, water-resistant spatial planning, and a freshwater supply that will still be adequate in case of increasing drought.
- Another challenge is that we need to combat subsidence.
- The Netherlands needs to keep working on the quality and quantity of our groundwater and surface water, the restoration of biodiversity, and the realisation of a sustainable drinking water supply.
- There are many functions in the North Sea that need to be balanced, like wind energy, nature development, fishing, shipping and sand extraction.
- The infrastructure, like flood defence systems, bridges, locks and sluices, will need to be maintained, and replaced or renovated where necessary.
- Finally, we need to tackle the challenge of ensuring an efficient, safe, robust and sustainable system for transport by water.

The consequences of climate change will increase the current challenges in the areas of water safety, problems due to excess water, freshwater and drinking water supplies, water quality, nature, landscape, cultural heritage, and shipping. Climate adaptation is unavoidable for the Netherlands.

[21] National Water Plan 2022-2027 - Water Helpdesk (only in Dutch)

D.4 Soil

D.4.1 Agriculture in the Netherlands

Agriculture takes up the majority of the surface area in rural parts of the country, as is shown in Figure D.19, and therefore strongly influences the Dutch landscape. Dutch agriculture is generally of an intensive nature and based on knowledge and expertise. A significant share of the production is intended for the global market, making the Netherlands the second-biggest exporter of agricultural products in the world[22].

The efficiency of Dutch farming operations makes this enormous export possible even though the amount of land used is relatively limited. On 15 May 2021, agricultural land use covered 1,812,000 hectares in total. This surface area can be subdivided as follows: 1,181,000 ha (65.17%) for grassland and feed crops, 526,000 ha (44.52%) for arable farming for human consumption, 95,000 ha (5.23%) for horticulture on open land, and 11,000 ha (0.59%) for horticulture under glass[23].

Although the intensive agricultural operations have certain advantages, they also have negative effects[22]. For example, the Netherlands has the highest surpluses of ammonia and phosphates of all European countries. Lowering the groundwater levels under agricultural land may result in desiccation, while the excessive use of pesticides forms a threat to biodiversity and public health.

The consequences of these substance surpluses have been the subject of national political debate for many years. In November 2022, the Dutch government presented a new action plan, as part of which the most polluting livestock farms will get the chance to sell their land or will be forced to make their operations more sustainable.

Figure D.18: Map of soil types in the Netherlands

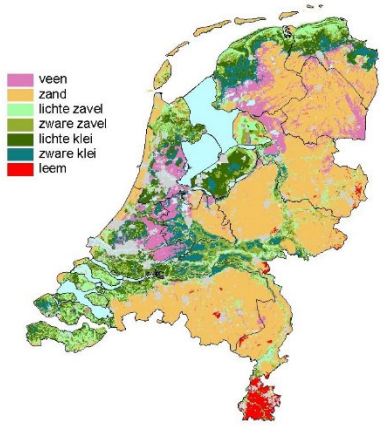
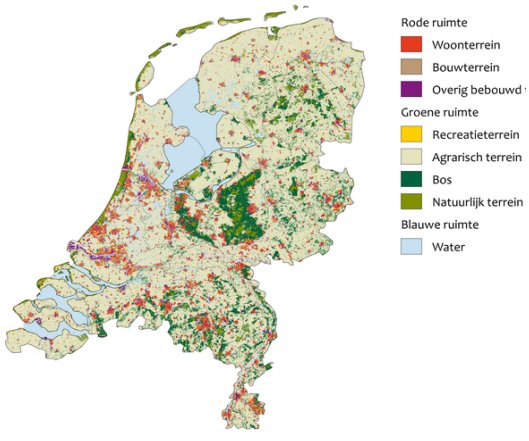


Figure D.19: Map of land use in the Netherlands



[22] Agriculture and Food | PBL Netherlands Environmental Assessment Agency (only in Dutch)

[23] https://www.agrimatie.nl/ThemaResultaat.aspx?subpubID=2232&themaID=2286&indicatorID=2911 (only in Dutch)

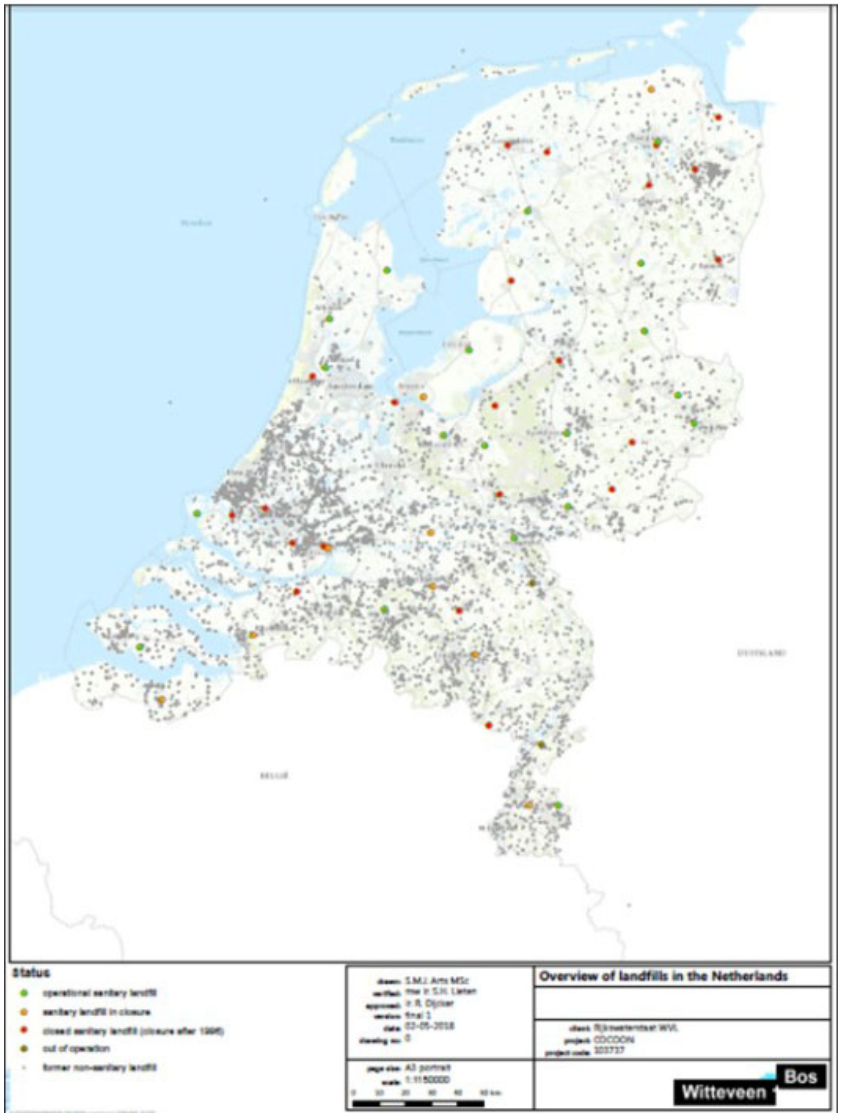
Source: Map of soil types - WUR (only in Dutch)

Source: Land use in the Netherlands, 2012 | Environmental Data Compendium (clo.nl)

D.4.2 Landfill sites

The Netherlands has many former landfill sites. Nineteen landfill sites are still operational, and these are spread across the Netherlands. Figure D.20 gives a complete overview.

Figure D.20: Former and current landfill sites



Source: EU (2018), Landfill Management in the Netherlands

Radioactive waste of natural origin that is subject to compulsory registration (also referred to as very low-level waste or 'VLLW') can be dumped at a landfill site designated under Article 10.6, paragraph 7, of the Decree on Basic Safety Standards for Radiation Protection (in Dutch: *Besluit basisveiligheidsnormen stralingsbescherming* or Bbs) as an 'establishment that can

receive radioactive waste of natural origin for which an official notification is required'. In 2005, a regulation was adopted in which all landfill sites for hazardous substances were designated as such. Pursuant to the transitional law of Article 12.5 of the Decree, this designation has also applied to the receipt of VLLW since 6 February 2018. It is important to note that of the total of 11 designated landfill sites in the Netherlands, only 4 were actually prepared to receive VLLW in 2022. The landfill sites are operated by private companies. The four designated landfill sites prepared to receive VLLW are located in Assendelft, Lelystad, Wieringermeer and the Maasvlakte industrial area (Rotterdam).

D.5 Air quality

In the Netherlands, health improvement via air quality measures is the key topic of the Clean Air Agreement (Dutch acronym: SLA). The aim of the Clean Air Agreement is to permanently improve air quality in the Netherlands. It is an agreement concluded between the central government, the provinces and a large number of municipalities. Together, the participating parties are aiming for a health benefit of at least 50% by 2030 compared to 2016 (based on Dutch sources)[24]. Values for PM_{10}, $PM_{2.5}$ and NO_2 can be translated into health effects to be expected (for both premature death and burden of disease) in the exposed population. All 12 provinces and 94 of the Dutch municipalities have signed this agreement. The Living Environment department of Rijkswaterstaat reports that 27% of the permanent measures from this Agreement are being implemented. These measures and the associated progress can be monitored in a dashboard developed to make the process more insightful[25].

For the first time since 2005, the WHO has adjusted the recommended guideline levels for nitrogen dioxide, PM_{10} and $PM_{2.5}$* to 10, 15 and 5 micrograms per cubic metre, respectively[26]. As is shown in Figure D.21 to Figure D.24, these guidelines are not being achieved in the majority of the Netherlands.

The high levels of harmful substances mainly seem to be concentrated near industrial areas, like the Maasvlakte or Hoogovenhaven, and around roads. It is only in the north of the country that this air seems to remain clean, partly due to the limited presence of industry and roads and the generally low population density there. Most cities, especially in the Randstad conurbation, suffer from high concentrations of particulate matter, soot (elemental carbon or EC) and nitrogen dioxide.

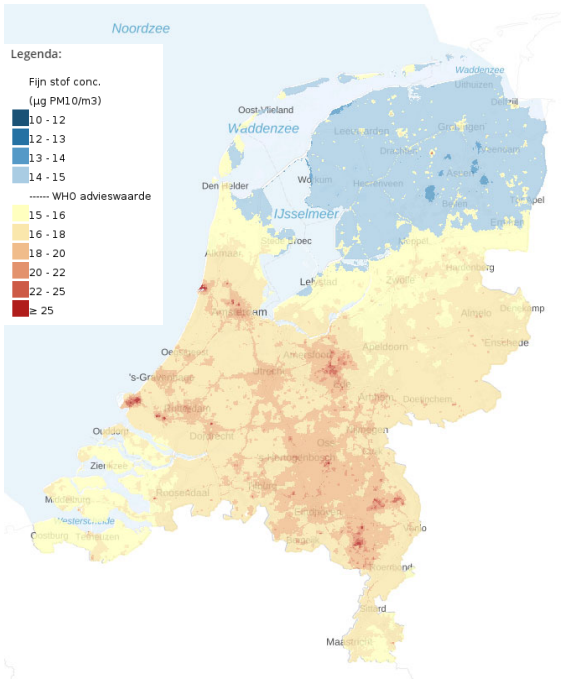
Recently, more and more has become clear about the negative consequences of these substances for human health. The best-known areas to be affected by these consequences are IJmuiden due to emissions from Tata Steel, Badhoevedorp due to Schiphol Airport, and Rotterdam due to its Port.

[24] Home - Clean Air Agreement (only in Dutch)

[25] Microsoft Power BI (only in Dutch)

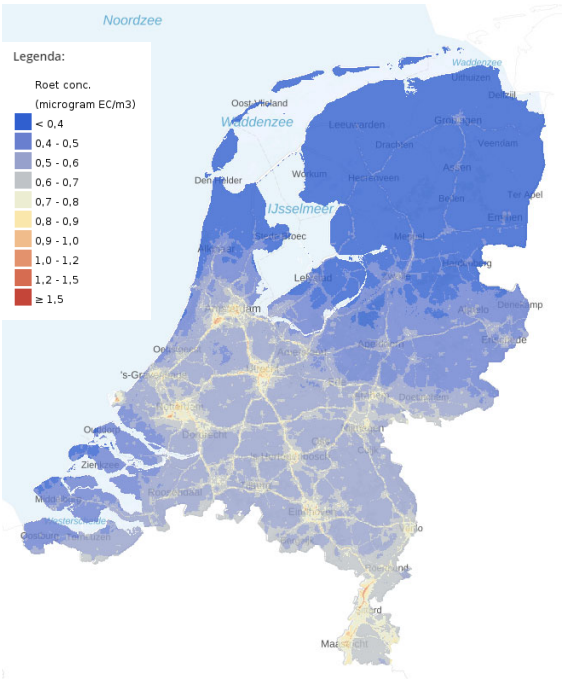
[26] New WHO Air Quality Guidelines - Clean Air Agreement (only in Dutch)

Figure D.21: Particulate matter (PM_{10}) in the Netherlands 2020



Source: RIVM (2020) via Maps | Environmental Health Atlas (only in Dutch)

Figure D.22: Soot (EC) in the Netherlands 2019



Source: RIVM (2020) via Maps | Environmental Health Atlas (only in Dutch)

Figure D.23: Particulate matter ($PM_{2.5}$) in the Netherlands 2020

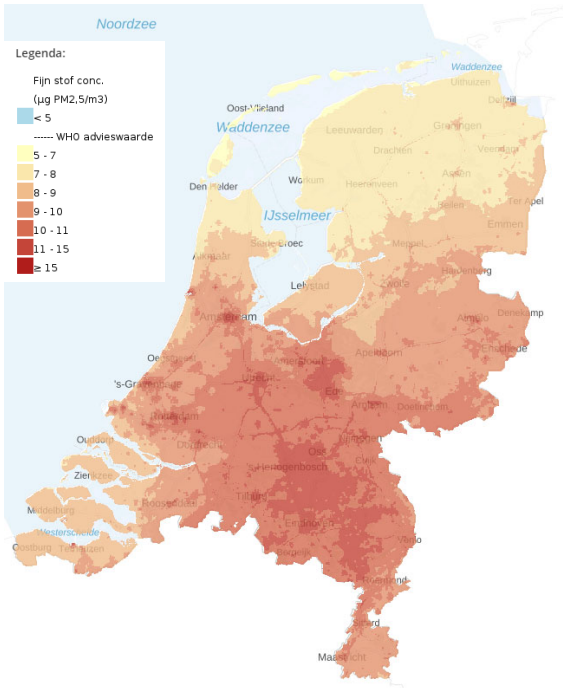
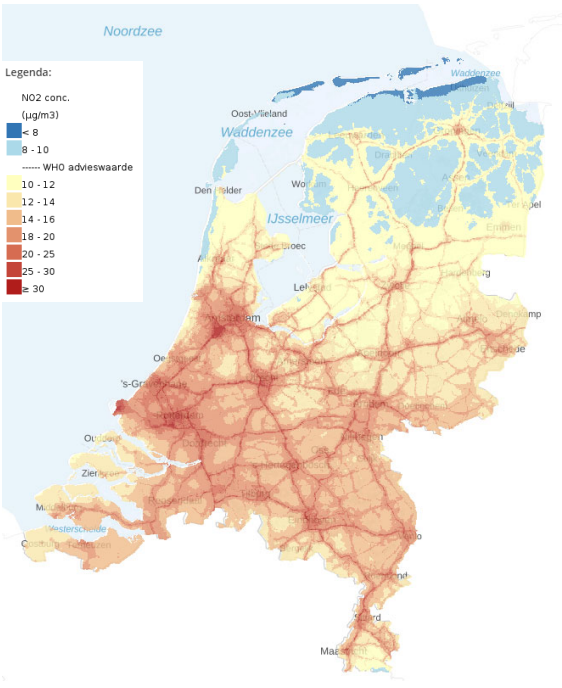


Figure D.24: Nitrogen dioxide in the Netherlands 2019



Source: RIVM (2020) via Maps | Environmental Health Atlas (only in Dutch)

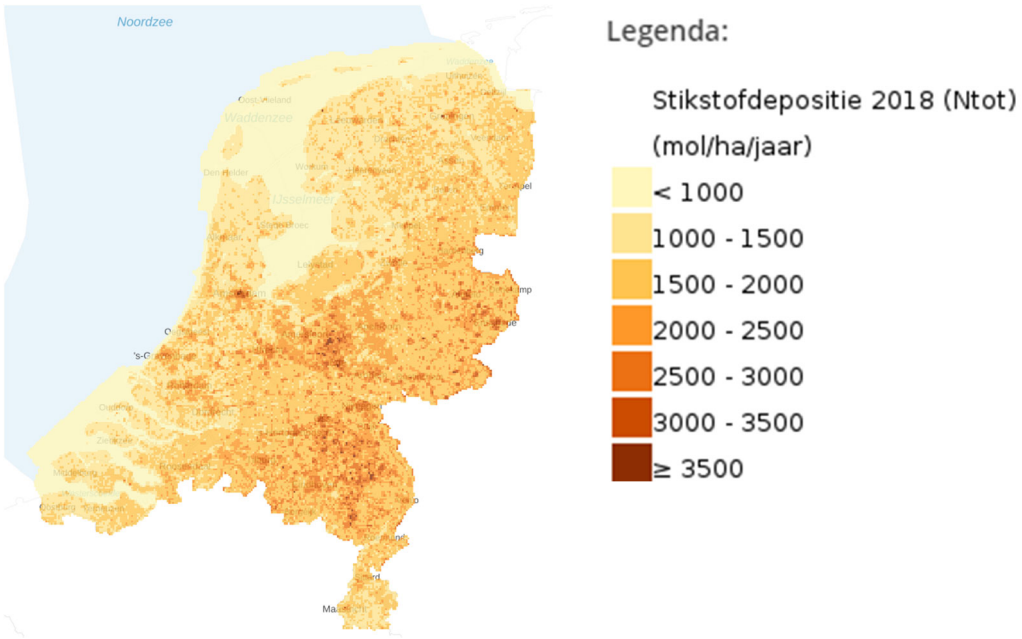
Source: RIVM (2020) via Maps | Environmental Health Atlas (only in Dutch)

D.5.1 Nitrogen deposition

Nitrogen deposition is the deposition of nitrogen compounds from the air into soil and water. This does not concern the nitrogen gas (N_2) that naturally occurs in the air, because this is not deposited. Reactive nitrogen compounds end up in the air as a result of emissions. The main forms of these are ammonia (NH_3) and nitrogen oxides (NO_x). All emissions of ammonia and nitrogen oxides from various sectors (like agriculture, transport and industry) ultimately end up on land or in water again. Figure D.26 presents the origin of the nitrogen deposition in 2020. Part of the nitrogen is deposited in rain, which is referred to as 'wet deposition'. The rest is deposited by gravity, which is referred to as 'dry deposition'. Ammonia can react in air or in water and convert to ammonium (NH_{4+}). To predict the dispersion and deposition of nitrogen, RIVM makes use of the Operational Priority Substances (OPS) model.

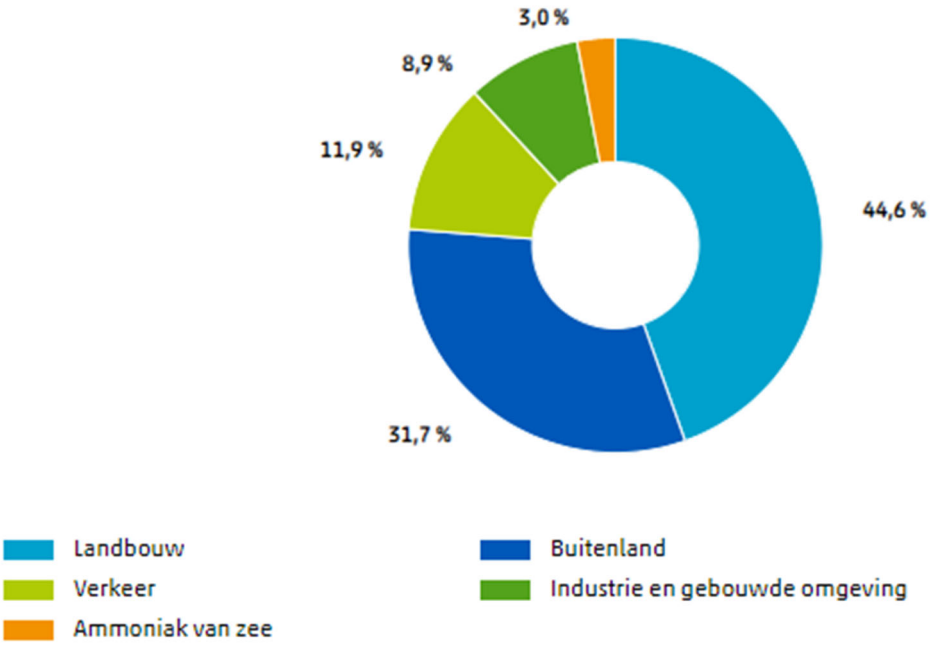
Figure D.25 presents the deposition of nitrogen compounds in the Netherlands in 2018. It is important to note that the government is trying to reduce nitrogen deposition. The efforts to tackle nitrogen will help strengthen and restore nature. This has been laid down in the Nitrogen Reduction and Nature Improvement Act, which entered into force on 1 July 2021. To realise the desired improvements, national targets have been established for nitrogen reduction. The achievement of these targets will help realise the aim of restoring the condition that our nature is in. The Nitrogen Reduction and Nature Improvement Programme (in Dutch: *Programma Stikstofreductie en Natuurverbetering*) and the National Programme for Rural Areas (in Dutch: *Nationaal Programma Landelijk Gebied*) are initiatives aimed at achieving these goals. To take steps to significantly reduce nitrogen deposition in the short term, the government is working on measures to reduce peak loads.

Figure D.25: Nitrogen deposition 2018



Source: RIVM (2018) via Maps | Atlas of Natural Capital
(only in Dutch)

Figure D.26: Nitrogen deposition according to origin 2020



Source: Statistics Netherlands (CBS, 2020), Nitrogen deposition (cbs.nl) (only in Dutch)

D.6 Climate factors

Climate change results in torrential rain, heavier storms and a rising sea level, among other things. Heat waves and periods of drought may become more frequent as well. These changes have an impact on nature, agriculture, infrastructure and public health. Measures will need to be taken to adapt the country to these changes and to limit the negative consequences[27].

Climate change is a global problem that demands close collaboration between countries. The problem, which is mainly caused by gases that increase the greenhouse effect, like carbon dioxide, methane, etc., also has consequences for the temperatures in the Netherlands. Between 1906 and 2015, the rise of the average temperature in degrees Celsius was[28]:

- 1.8°C for spring
- 2.1°C for summer
- 1.5°C for autumn
- 1.3°C for winter

The influence of the maritime climate is stronger in the west of the Netherlands, where there are fewer days with extreme temperatures than in the east of the country. Temperature fluctuations are therefore greater in the south-east.

According to various calculation models of the Royal Netherlands Meteorological Institute (KNMI), historically measured temperatures and the predicted temperatures are set out in several different scenarios, as shown in Figure D.27. The greenhouse effect could increase an average temperature of 11.2°C (2022) to 12.4°C by 2050.

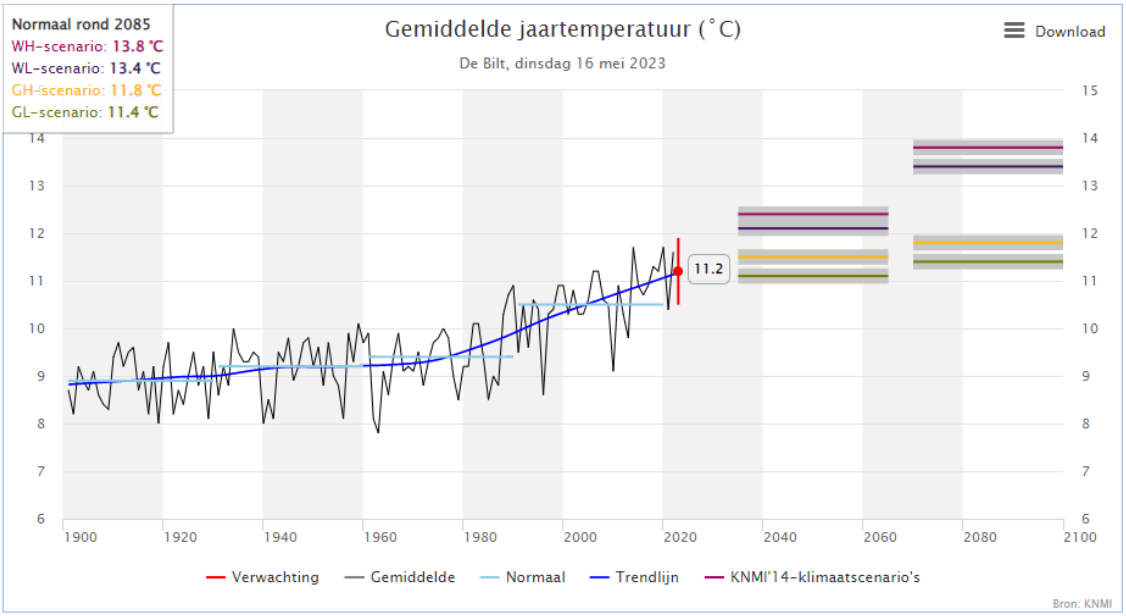
Besides higher temperatures, drought is another consequence of climate change[29]. It has been demonstrated that drought caused by climate change is on the increase, except on the coast (where it has not yet been demonstrated). This is due to the fact that we are seeing increasing amounts of rain but more rapid vaporisation of water, which has a net effect of greater drought in the Netherlands. In addition to drought, subsidence due to the lowering of the groundwater level will also play a role in the climate problems in the long term.

[27] Climate Change and Consequences | Climate Change | Rijksoverheid.nl (only in Dutch)

[28] Temperature trends: the Netherlands and worldwide, 1906-2015 | Environmental Data Compendium (clo.nl)

[29] https://www.knmi.nl/kennis-en-datacentrum/uitleg/droogte (only in Dutch)

Figure D.27: Annual average temperature in the Netherlands (1906-2022)



Source: https://www.knmi.nl/klimaatdashboard (only in Dutch)

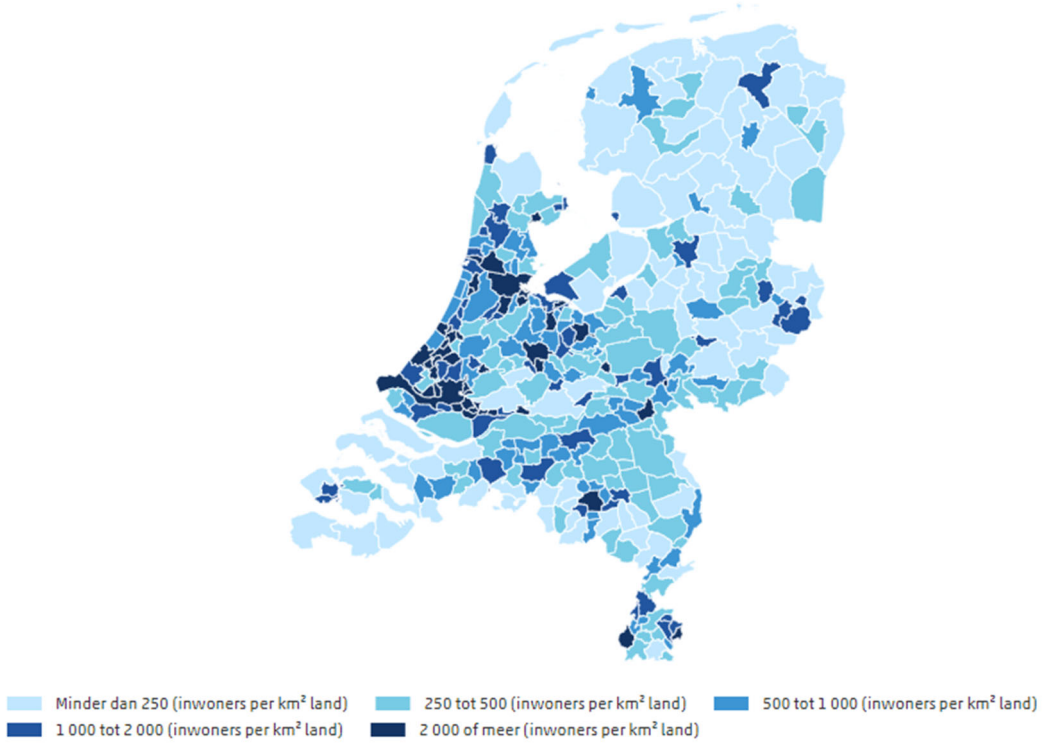
D.7 Population and public health

D.7.1 Population

The Netherlands is considered to be a densely populated country. With its population density of more than 500 people per square kilometre, the Netherlands is one of the most densely populated countries of the European Union[30]. There are regional variations, however, with urban areas in the Randstad conurbation generally being more densely populated than rural areas in the east and north of the country, for example. Figure D.28 charts the regional differences. The high population density affects various aspects of daily life, like housing, traffic and spatial planning. At the end of March 2023, the Netherlands had 17,842,933 residents. As is shown in Figure D.29, the population has grown from 5 million to nearly 18 million between 1900 and 2023. Figure D.30 gives a prognosis for the population growth per region up to 2035.

A problem that is related to population growth in the Netherlands is the current shortage of homes. To accommodate the increase in the number of households and replace the number of homes removed from the housing supply due to demolition or for other reasons, as well as to ensure a healthy balance between the number of people looking for homes and the housing supply, we need about 900,000 extra homes in the period up to 2030[31].

Figure D.28: Population density in the Netherlands (2022)

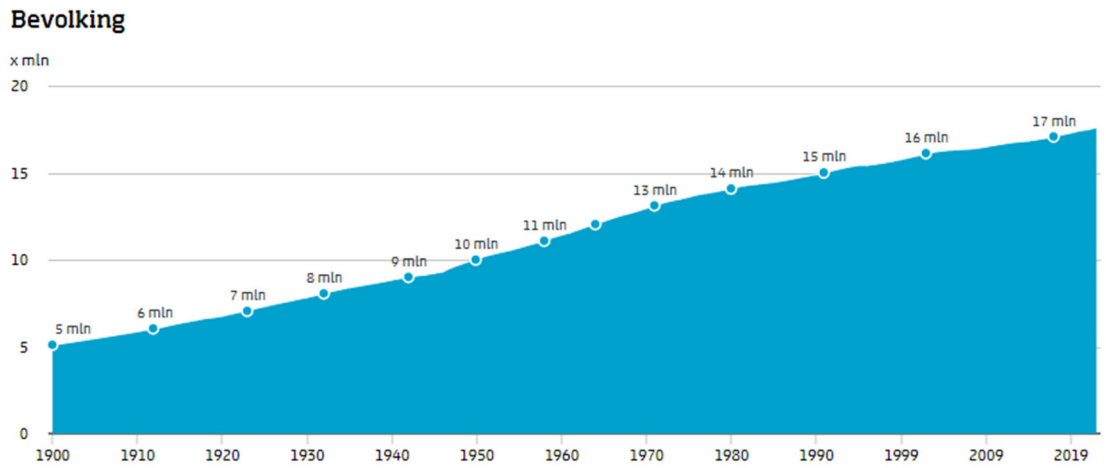


Source: Statistics Netherlands (CBS, 2022), Residents per municipality (cbs.nl) (only in Dutch)

[30] Population | Regional | Public Health and Healthcare (vzinfo.nl) (only in Dutch)

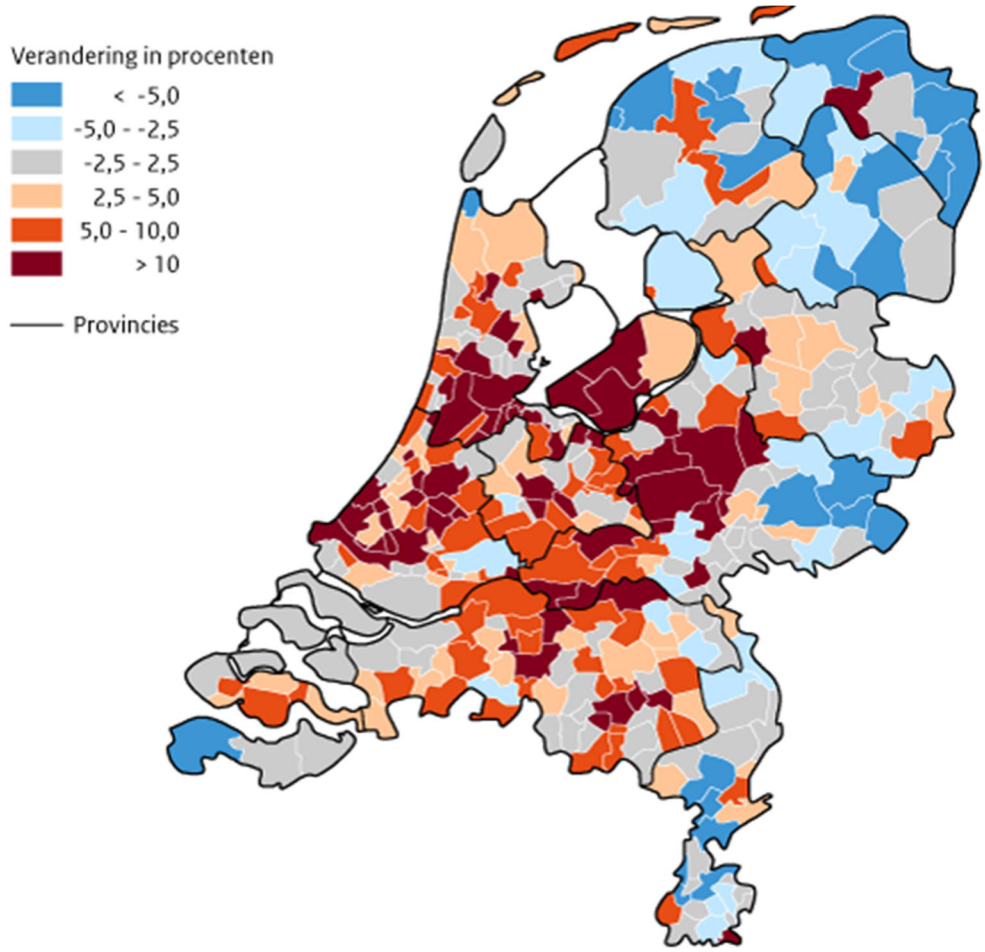
[31] Housing and Spatial Planning Programme (overheid.nl) (only in Dutch)

Figure D.29: Population growth in the Netherlands (1900-2023)



Source: Statistics Netherlands (CBS, 2023), Population counter (cbs.nl)

Figure D.30: Prognosis of population development from 2021 to 2035



Source: PBL/Statistics Netherlands (2021), via Population | Regional | Public Health and Healthcare (vzinfo.nl) (only in Dutch)

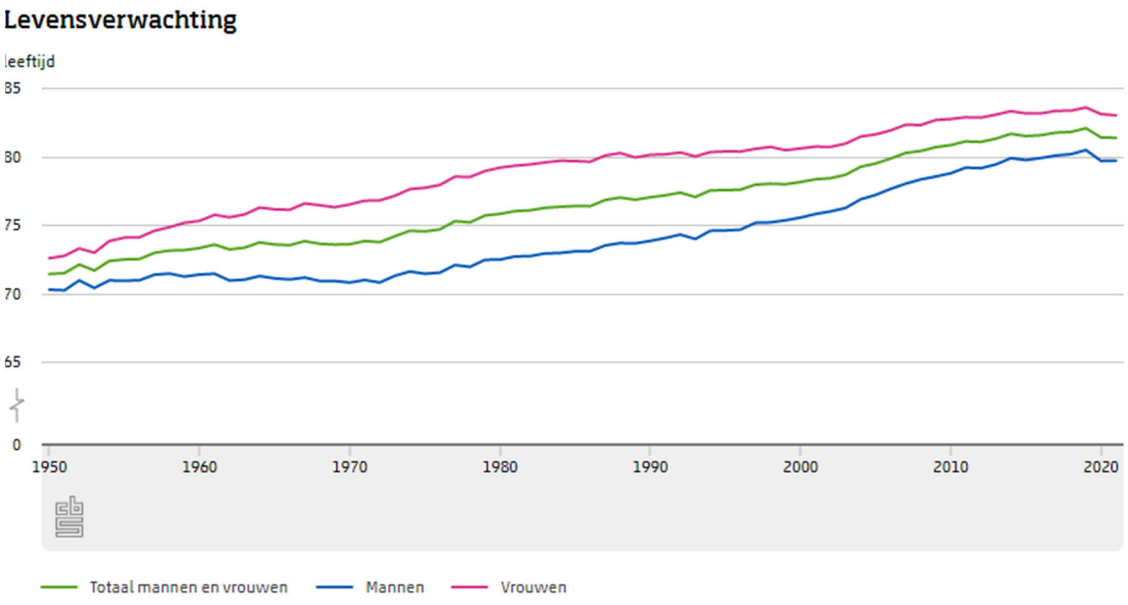
D.7.2 Public health

The Netherlands generally has a well-developed healthcare system[32]. This is one of the causes of the country's relatively high life expectancy. In 2021, the average life expectancy in the Netherlands was about one year higher than the EU average[33]. Although the life expectancy in the Netherlands kept growing in the 2010s, this growth has decreased. An important factor contributing to this was the impact of COVID-19. Between 2019 and 2020, the life expectancy in the Netherlands dropped by 0.7 years, similar to the EU average.

Among the main causes of death in the Netherlands in 2019, lung cancer, strokes and ischemic heart disease featured prominently[34]. However, in the year 2020, a considerable share of the deaths that occurred (1 in 15) was attributed to COVID-19, as a result of the global pandemic.

Public health in the Netherlands is monitored and promoted by several bodies, like RIVM and the municipal public health services (GGDs). RIVM is responsible for monitoring the state of our public health in the Netherlands, for performing research, and for providing reliable health information to the general public[35]. The GGDs implement local health-promoting programmes and provide preventive care and health services[36].

Figure D.31: Average life expectancy in the Netherlands



Source: Statistics Netherlands (CBS, 2023), Deaths (cbs.nl)

[32] The Commonwealth Fund (2021), Mirror, Mirror 2021: Reflecting Poorly | Commonwealth Fund

[33] EC (2021), State of Health in the EU The Netherlands Country Health Profile 2021, 2021_chp_nl_english.pdf (europa.eu)

[34] EC (2021), State of Health in the EU The Netherlands Country Health Profile 2021, 2021_chp_nl_english.pdf (europa.eu)

[35] National Institute for Public Health and the Environment | RIVM

[36] Home - GGD (only in Dutch)

D.7.3 Noise

The Netherlands has areas with high levels of cumulative noise, particularly around cities, industrial sites, roads and airports. Areas with low levels of cumulative noise can mainly be found in the countryside or in natural areas[37]. Most of these natural areas are also quiet zones, designated to leave nature unharmed. The boundaries of the quiet zones have been set to ensure that the noise levels in these areas do not surpass 40 dB most of the time. This is not a hard requirement. It is comparable to the sound of birds singing. The above is shown in Figure D.32 and Figure D.33.

Local noise generators are mainly motorways, railways and airports. The airports in particular, especially Schiphol, burden local residents with enormous transgressions of the noise standards. The nuisance there is so great that national action plans have been drawn up to tackle this[38]. Roads and railways in built-up areas are usually screened off using sound absorbers to reduce the numbers of decibels.

In a general sense, the Activities Decree (in Dutch: *Activiteitenbesluit*) offers protection against the noise produced by[39]:

- Installations and systems which are present in a facility, and
- Operations and activities performed in a facility, and
- Loading and unloading activities for, and in close proximity to, the facility.

The Activities Decree indicates that the maximum noise level varies between areas and possibly between different types of licenses that apply.

Figure D.32: Noise in the Netherlands (2020)

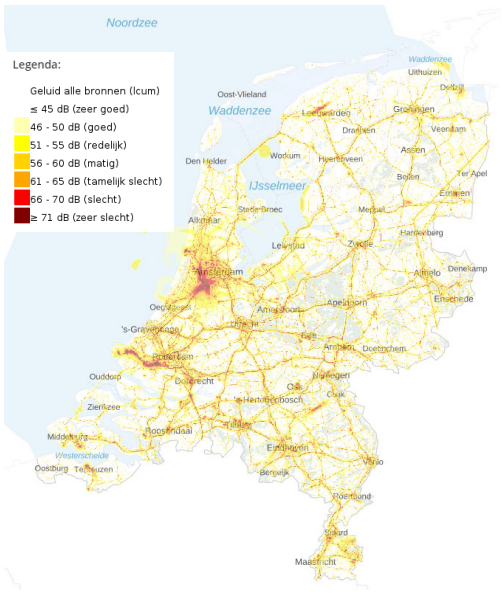


Figure D.33: Quiet zones in the Netherlands (2022)

[37] Quiet Zones - Province of Zuid-Holland (only in Dutch)

[38] Ministry of Infrastructure and the Environment (2018), Microsoft Word - 2018-07-03_Actieplan Schiphol_2018-2023 (overheid.nl) (only in Dutch)

[39] Activities to be assessed - Kenniscentrum InfoMil (only in Dutch)

Source: RIVM (2020) via Maps | Environmental Health Atlas (only in Dutch)

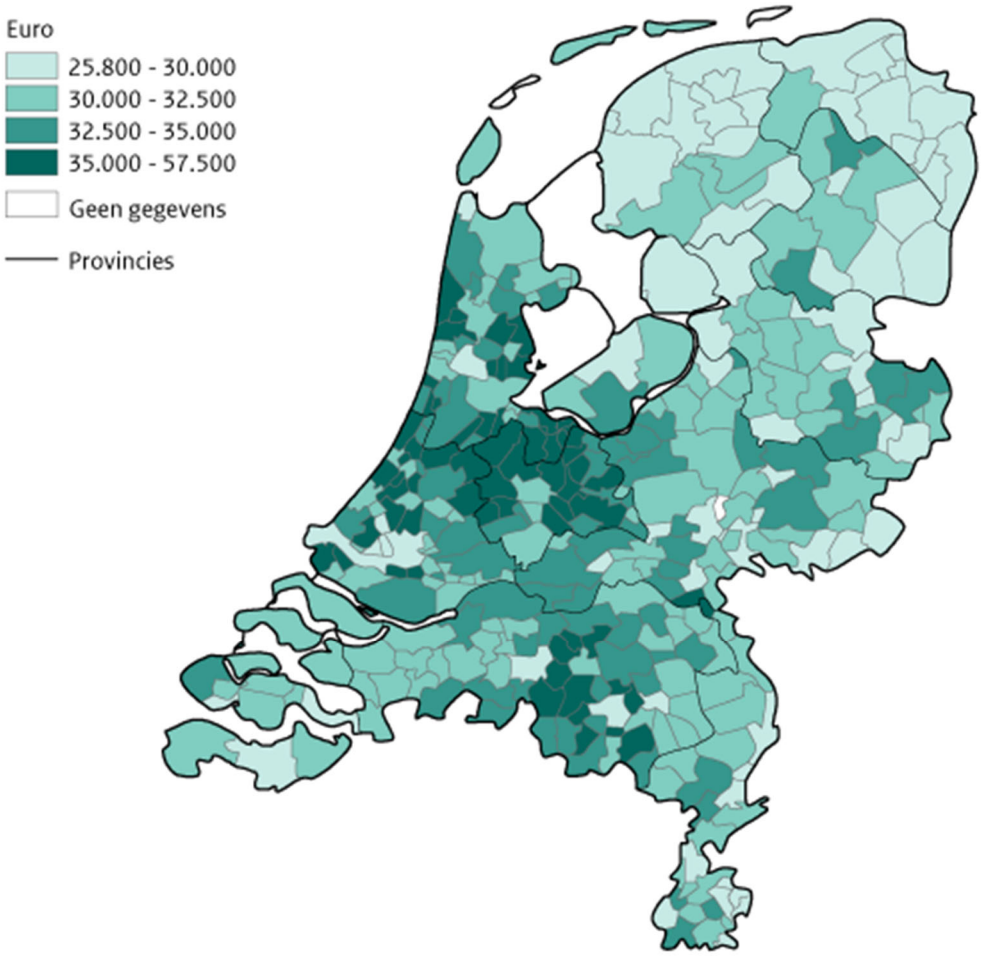
RIVM (2020) via Maps | Environmental Health Atlas (only in Dutch)

D.8 Socio-economic aspects

D.8.1 The Dutch economy

The gross domestic product (GDP) per resident of the Netherlands was just over 53,000 euro in 2022. This puts the Netherlands in fourth place in the European Union[40]. There may be regional differences, however. Municipalities where the average income is high can mainly be found in the northern part of the Randstad conurbation, the area referred to as 'Het Gooi', and the area around Utrecht. Municipalities with a low disposable income are concentrated mainly in the north of the country.

Figure D.34: Average standardised income 2018 (per municipality per person)

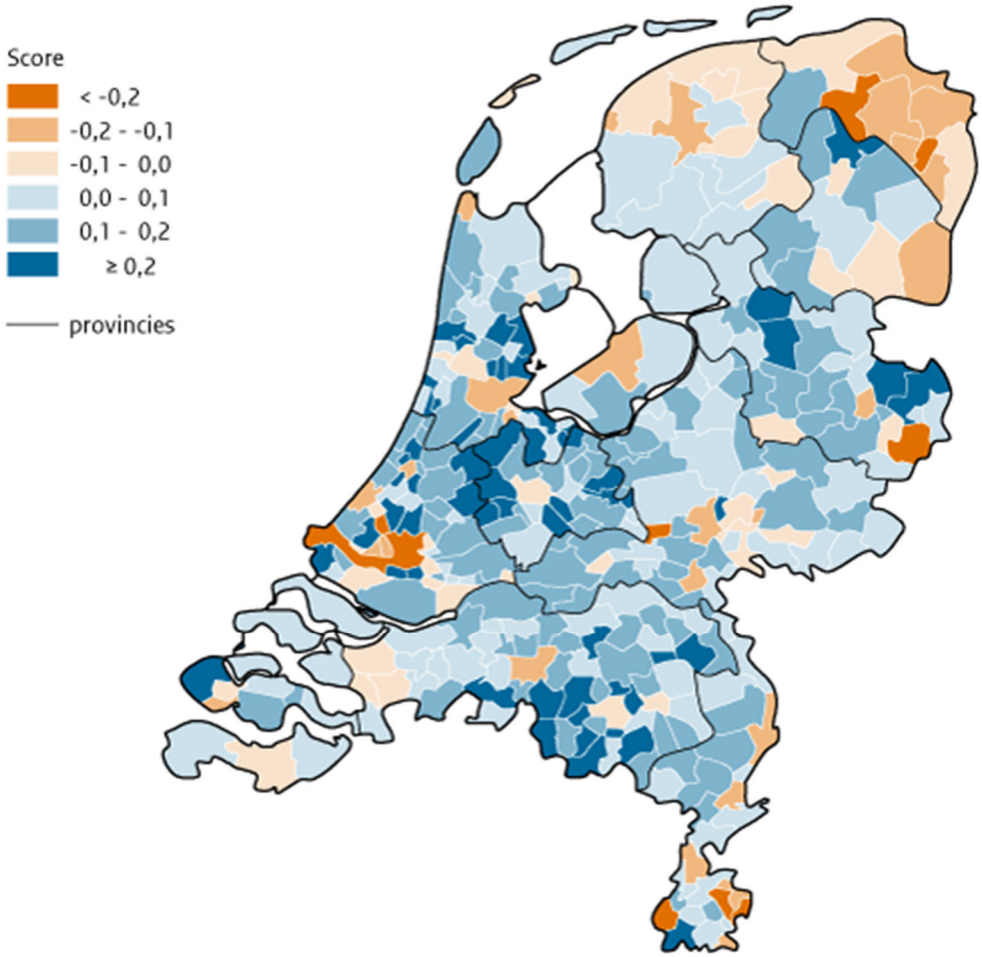


Source: Statistics Netherlands (2023), StatLine - Personal income; personal characteristics, region (classification of 2019) (cbs.nl) (only in Dutch)

[40] Statistics Netherlands (2023), Dutch GDP per capita ranks fourth in the EU (cbs.nl)).

Statistics Netherlands has developed a SES score, to offer insight into the socio-economic status of municipalities, districts and neighbourhoods. The socio-economic status is described in terms of the financial prosperity, education level and recent employment history of private households. Where the score is higher, residents are more prosperous and/or educated to a higher level and/or employed for longer. An overview of the SES scores of municipalities for 2019 is presented in Figure D.35.

Figure D.35: Socio-economic status per municipality 2019



Source: Statistics Netherlands (2019), Socio-Economic Status | Regional | General | Public Health and Healthcare (vzinfo.nl) (only in Dutch)

D.8.2 Tourism

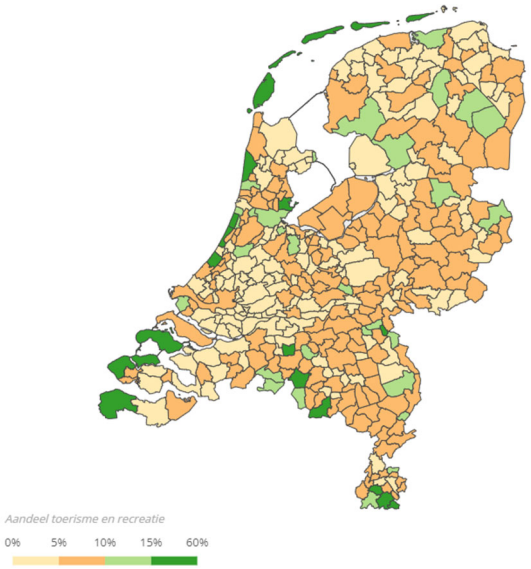
Tourism plays a significant role in the Dutch economy, and contributes to economic growth and prosperity. Every year the Netherlands attracts a great number of international and domestic visitors due to its diverse cultural heritage, historic towns and cities, landscapes and natural areas. Tourism generates income from a variety of sources, including accommodation, restaurants, attractions, transport and shops. This boosts the economy in various areas, like hospitality, retail, the transport industry and the cultural sector.

Prior to the outbreak of the COVID-19 crisis, in 2019, the tourism sector had a considerable economic impact, with a turnover of EUR 90.8 billion, which represents 4.4% of the gross

domestic product (GDP) of that year. In addition, tourism provided jobs for 811,000 workers. In 2019, 20.1 million foreign and 25.8 million domestic tourists visited the Netherlands[41].

During the COVID-19 crisis in 2020 and 2021 there was a significant drop in the number of visitors. In 2020, 7.3 million international and 20 million domestic overnight visitors were recorded. These numbers recovered somewhat in 2021, to 6.3 million international and 25.7 million domestic overnight visitors. The turnover of the sector was hit hard in 2020 due to the COVID-19 measures, and dropped to EUR 52 billion. Although there was an improvement in 2021, at EUR 59.6 billion the turnover still remained well below that of 2019[42].

Figure D.36: Share of jobs in tourism 2019



Source: NBTC (2019), Netherlands Board of Tourism & Conventions (NBTC) | Policy Instrument | Business Policy in the Picture (only in Dutch).

[41] Ministry of Economic Affairs (2019), Netherlands Board of Tourism & Conventions (NBTC) | Policy Instrument | Business Policy in the Picture (only in Dutch)

[42] Ministry of Economic Affairs (2019), Netherlands Board of Tourism & Conventions (NBTC) | Policy Instrument | Business Policy in the Picture (only in Dutch)

D.9 Culture

Our cultural heritage in the Netherlands is characterised by a great variety, and is divided and subdivided in several different ways. Our cultural heritage includes, among other things:

- Nationally listed buildings
- UNESCO World Heritage Sites
- Archaeological heritage
- Cultural landscape

D.9.1 Nationally listed buildings

Cultural heritage includes structures created by humans, such as houses, churches, farms, mills, bridges, gardens, defences and archaeological sites[43]. Nationally listed buildings are monuments protected under the Heritage Act (in Dutch: *Erfgoedwet*) and included in the National Listed Buildings Register. Nationally listed buildings are of national importance because of their beauty, scientific value or cultural significance. Cultural heritage makes us understand more about the lives of previous generations and it defines people's identity. It creates a sense of connection with places by telling colourful stories. In addition, cultural heritage adds to the quality of the living environment and increases the value of real estate. It also serves as an important source of inspiration for new developments in cities and regions.

Figure D.37: Locations of nationally listed buildings

Source: Cultural Heritage Agency (2019), via Maps | Environmental Health Atlas (only in Dutch)

D.9.2 UNESCO World Heritage Sites

UNESCO is known for the World Heritage Convention and the associated World Heritage List. The Convention, which was adopted in 1972, aims to ensure that cultural and natural heritage that is of unique and universal value to mankind can be better preserved for future

[43] Nationally Listed Buildings and the Heritage Act | Heritage Act | Cultural Heritage Agency (only in Dutch)

generations[44]. The Dutch World Heritage Sites offer us insight into the Netherlands and our place in the world. The Netherlands has 12 World Heritage Sites and 3 themes: the Netherlands as a country of water, the Netherlands as a civil society, and the Netherlands as a designed country[45].

- Lower German Limes (2021)
- Dutch Water Defence Lines (2021) (Defence Line of Amsterdam, extended in 2021 with the New Dutch Water Line)
- Colonies of Benevolence (with Belgium) (2021)
- Van Nelle Factory in Rotterdam (2014)
- Amsterdam Canal District (2010)
- Wadden Sea (jointly with Germany and Denmark) (2009)
- Rietveld Schröder House in Utrecht (2000)
- Beemster Polder in Noord-Holland (1999)
- D.F. Wouda Steam Pumping Station, near Lemmer (1998)
- Historic Willemstad on Curaçao (1997)
- Mill Network at Kinderdijk-Elshout (1997)
- Schokland and Surroundings in the Noordoostpolder area (1995)

Figure D.38: UNESCO World Heritage Sites in the Netherlands

Source: Cultural Heritage Agency (2019), via Maps | Environmental Health Atlas (only in Dutch)

[44] UNESCO | World Heritage Sites (only in Dutch)

[45] World Heritage in the Netherlands | World Heritage | Cultural Heritage Agency

D.9.3 Protected townscapes

A protected townscape is a recognition at national level of the historic value of an area. The Heritage Act describes protected townscapes as groups of buildings or plots of land which are important because of their beauty, spatial cohesion, scientific value or historic significance, and which include one or more listed buildings. The Netherlands has over 400 protected townscapes covered by national protection[46]. Most of these townscapes are built-up areas, such as old town and village centres and expansion districts, but some of them also include rural areas. Since 2012, no new protected townscapes have been designated. The purpose of this status is to conserve the distinctive spatial quality of a place, without the area being frozen in time. New developments remain possible, but we need to look carefully at the existing quality, and new developments should be consistent with this. Townscapes are protected by means of a special 'protective land use plan' setting out the historic and spatial characteristics. In addition, an integrated environmental license is required for construction or demolition activities in a protected townscape. The map below shows all nationally protected townscapes.

Figure D.39: Protected townscapes

Source: Cultural Heritage Agency (2019), via Maps | Environmental Health Atlas (only in Dutch)

D.9.4 Archaeology

Archaeology is of great importance if we want to understand the Netherlands' past. The Netherlands has a rich history and many archaeological sites. Archaeological research has given us insight into various periods, from early prehistoric eras to more recent times, and has

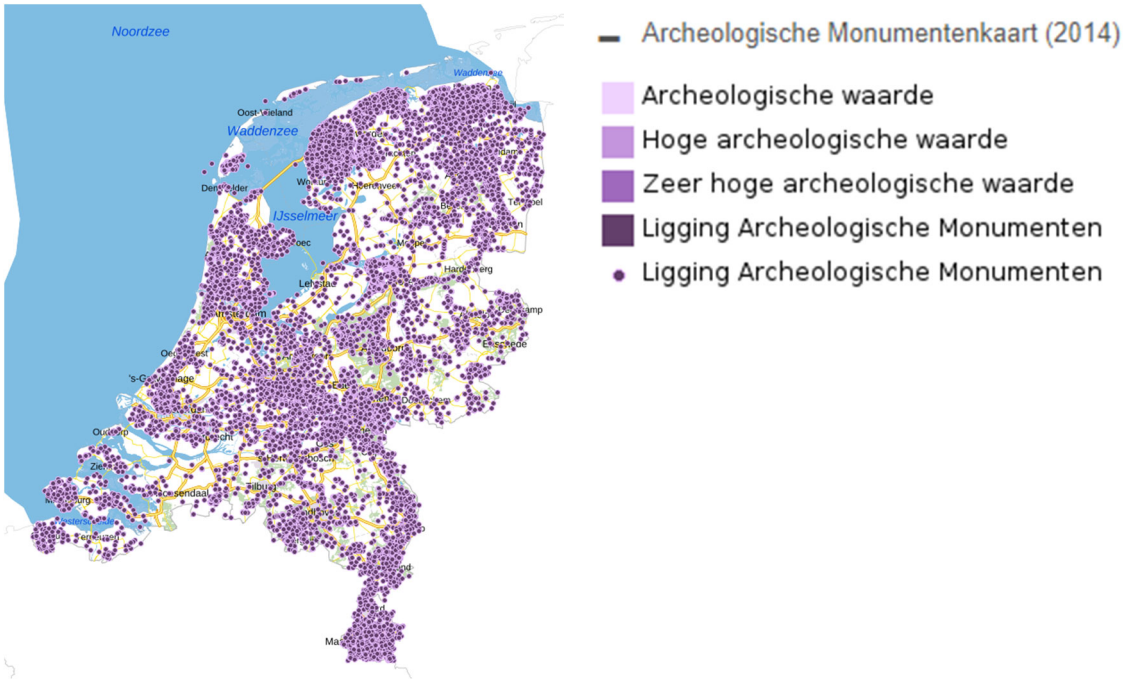
[46] Map of Protected Townscapes | Sources and Maps | Cultural Heritage Agency (only in Dutch)

provided knowledge about lifestyle, cultures, trade, technology and social structures of earlier inhabitants.

The Dutch government has adopted laws and regulations to protect our cultural heritage and the archaeological sites. This includes the performance of archaeological research before building and infrastructure projects take place, to ensure that archaeological findings are conserved and documented[47].

There are two maps which are relevant for archaeology in the Netherlands. The Map of Protected Archaeological Sites ('AMK' in Dutch) contains information on archaeological sites, including legally protected historic monuments. However, this map has not been actively updated since 2014. The Indicative Map of Archaeological Values ('IKAW' in Dutch) gives a global idea of the likelihood of archaeological remains being present in the soil and under water. It divides areas into categories with, for example, a 'high', 'medium', 'low' or 'very low' likelihood, or 'not charted' if no data were available. The colours on the map vary depending on whether it concerns land or water.

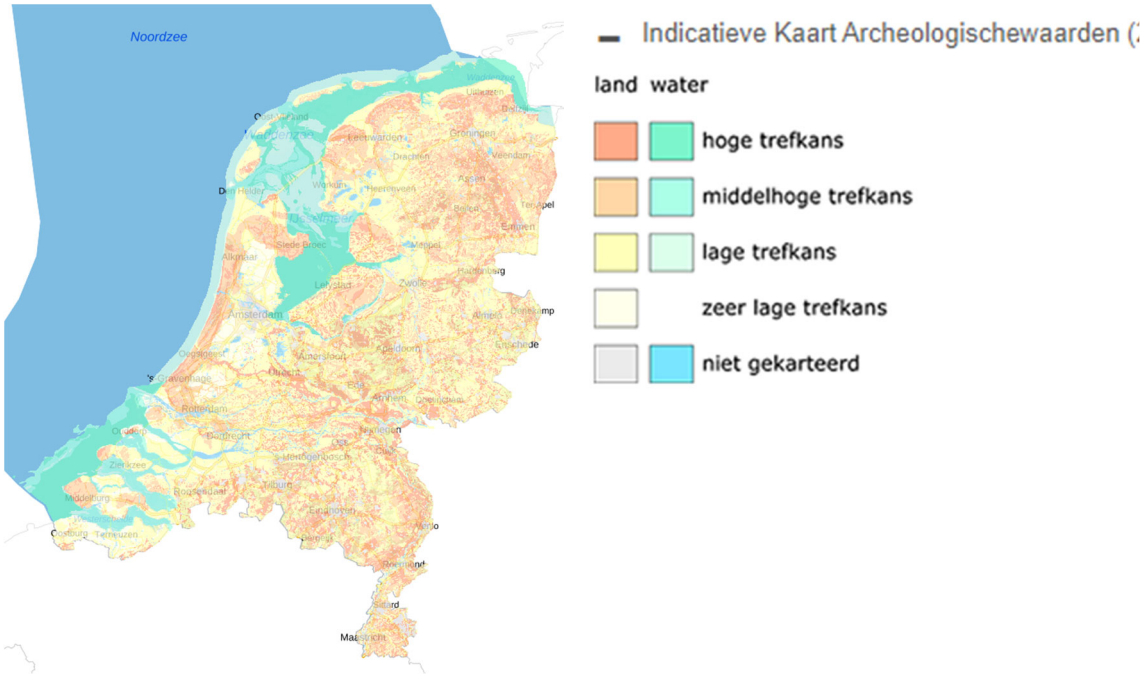
Figure D.40: Map of Protected Archaeological Sites



Source: Cultural Heritage Agency (2014), via Archaeology in the Netherlands (webgispublisher.nl) (only in Dutch)

[47] Archaeology in the Netherlands - AMK and IKAW | Sources and Maps | Cultural Heritage Agency (only in Dutch)

Figure D.41: Indicative Map of Archaeological Values 2008



Source: Cultural Heritage Agency (2008), via Archaeology in the Netherlands (webgispublisher.nl) (only in Dutch)

D.10 Landscape

The Netherlands is located in the Northwest European lowlands and forms a delta which has been largely transformed by human activity. The landscape in the Netherlands is therefore an example of a cultural landscape, which is the result of interactions between human spatial design and usage on the one hand, and natural elements like water, soil and ecosystems on the other. These interactions have led to a variety of landscape types in the Netherlands.

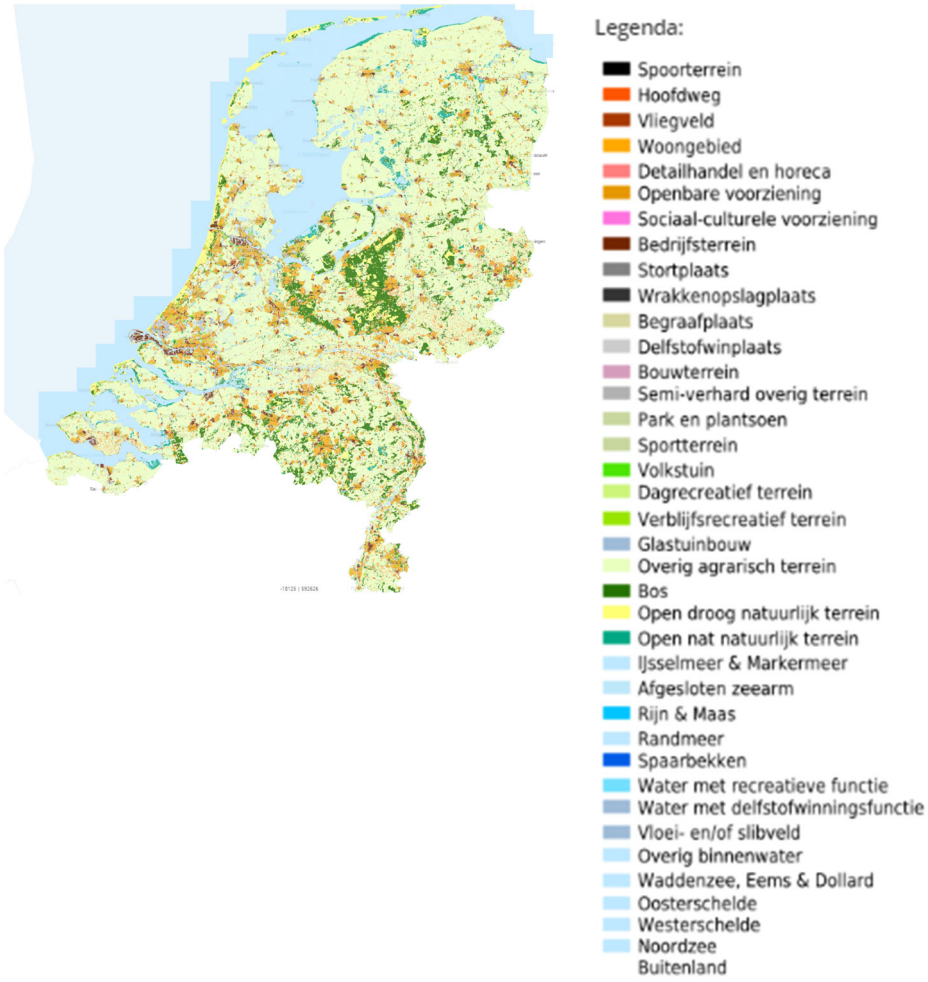
Over the past 70 years, the Dutch landscape has changed constantly. More buildings were added and the landscape became more fragmented due to the realisation of residential districts, infrastructure, commercial and industrial sites, horticulture complexes and leisure parks. These changes are largely a consequence of autonomous developments in the national and regional economies and demography, and partly also of past policy decisions. Even where no buildings have been constructed, changes in the landscape have nevertheless occurred, like rationalisation, scaling up and industrialisation of agriculture. Ditches were closed, the land was drained to a deeper level, plots were joined, roads were constructed, and historic farms were replaced with modern agricultural buildings. In the countryside, new natural areas were created and wind turbines and solar parks appeared in the landscape.

The Dutch landscape is expected to keep on changing in the future. This is due to several challenges that converge. Besides the necessity of the energy transition and climate adaptation, there is also a need for nature development and continuous urbanisation. At the same time, agriculture, which has traditionally formed the basis of the Dutch landscape, is on the eve of an enormous transition. This transition means that the current linear operations must be transformed to a sustainable, circular and possibly even ‘nature-inclusive’ way of farming, which will also lead to different use of the available space[48].

An overview of the land use in the Netherlands in 2017 is presented in Figure D.42.

[48] Landscape Introduction | PBL Netherlands Environmental Assessment Agency (only in Dutch)

Figure D.42: Land use in the Netherlands 2017



Source: Statistics Netherlands (2017), via Maps | Environmental Health Atlas (only in Dutch)

D.10.1 National Landscapes

There are specific areas in the Netherlands, referred to as National Landscapes, which are characterised by unique properties such as uncommon plant and animal species, stream valleys, *terps* (artificial dwelling mounds), agriculture, and water management. Under several regulations, new spatial developments in these areas are only permitted if the essential characteristics of the landscape remain intact or are further developed. The provinces are responsible for maintaining these boundaries and key qualities.

Figure D.43: National Landscapes

Source: Statistics Netherlands (2017), via Maps | Environmental Health Atlas (only in Dutch)

D.11 Infrastructure

D.11.1 Roads and railway network

The Netherlands has over 139,000 kilometres of roads. Municipal streets and roads are the most common roads in the Netherlands, accounting for 85%. In the three northern provinces and the province of Flevoland, the network density (the number of metres of infrastructure per square kilometre) of both roads and railways is generally lower than the national average. The density in the Randstad provinces and in the province of Limburg is above the national average. The province of Utrecht stands out with its high concentration of motorways. The Dutch railway network has a total length of over 3,000 kilometres. Over three quarters of this is electrified. The non-electrified tracks are mainly located in the north and east of the Netherlands[49].

Figure D.44: Overview of motorways and provincial roads 2016

Source: Statistics Netherlands (2016), via Infrastructure, 2016 | Environmental Data Compendium (clo.nl) (only in Dutch)

Figure D.45: Railway network 2016

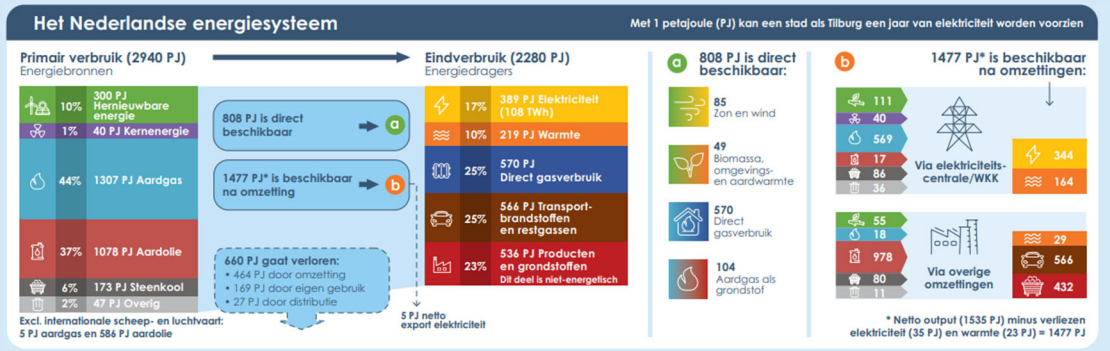
Source: Statistics Netherlands (2016), via Infrastructure, 2016 | Environmental Data Compendium (clo.nl) (only in Dutch)

D.11.2 Energy system

The figure below summarises the Dutch energy system based on data from 2020 provided by Statistics Netherlands.

[49] Source: Statistics Netherlands (2016), via Infrastructure, 2016 | Environmental Data Compendium (clo.nl) (only in Dutch)

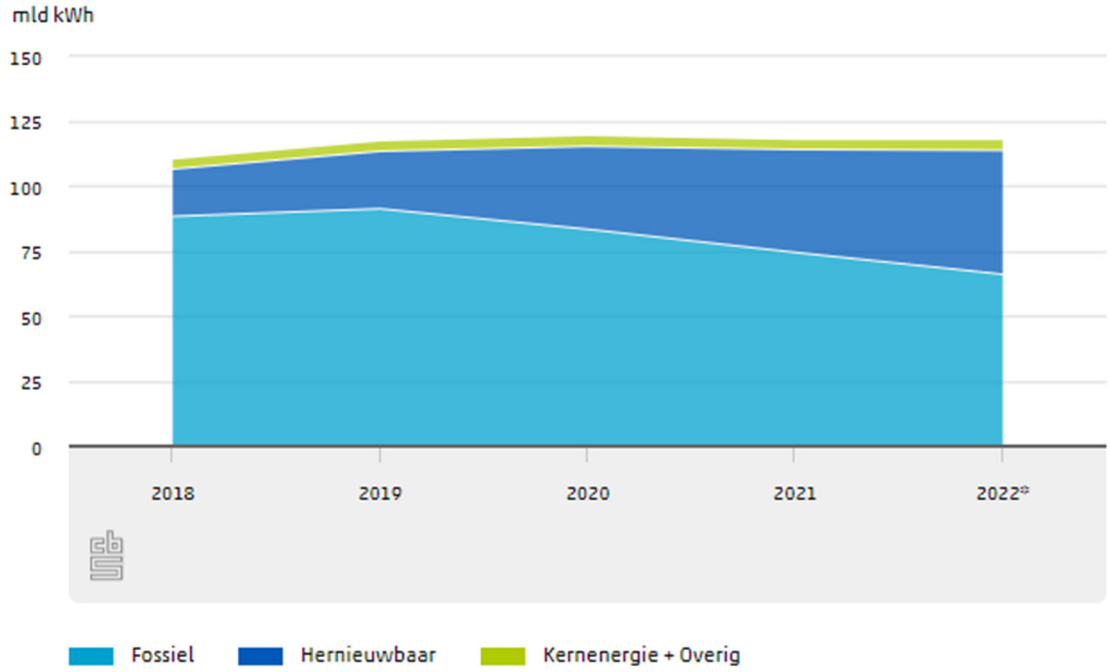
Figure D.46: The Dutch energy system 2020



Source: Statistics Netherlands (2020), A4-digitaal.pdf (energieinnederland.nl) (only in Dutch)

Over the past few years we have seen a trend where the amount of energy originating from fossil fuels has decreased and the amount of sustainable energy has risen.

Figure D.47: Electricity generation according to source in the Netherlands 2018-2022



Source: Statistics Netherlands (2022), Renewable electricity share up by 20 percent in 2022 (cbs.nl)

The draft National Energy System Plan ('NPE' in Dutch) describes a preliminary government vision for the period up to 2050. The five guiding choices in it are:

- **Maximum supply**: Development of maximum supply and infrastructure of electricity, hydrogen, sustainable carbon carriers and heat.
- **Energy reduction**: Energy reduction unavoidable in case of scarcity of energy and infrastructure.

- **Distribution of scarcity**: Distribution and use of energy and energy infrastructure from a system perspective.
- **International collaboration**: The Netherlands as an important energy hub for the EU.
- **Joint control**: With citizens and businesses, leaving room for participation and initiative.

The Netherlands is working on an energy system where hardly any CO_2 is released. In 2050, the energy supply should be almost entirely sustainable and carbon neutral. At the moment the Netherlands is mainly generating sustainable energy by means of[50]:

- Off-shore wind turbines;
- On-shore wind turbines;
- Solar panels on roofs and in solar parks.

In the future, techniques will be added which at present require further development, such as geothermal heat, residual heat and green hydrogen. Plus, over time, new techniques like thorium may also become available for energy production. To achieve its climate goals, the government is focusing on nuclear energy as well. The aim is to build two new nuclear power plants and to keep the existing nuclear power plant in Borssele open for longer. The goal of the sector is to reduce carbon emissions and make smarter use of renewable energy sources. The demand for (sustainable) energy is growing and this offers opportunities for energy production, transport and trade, for example[51].

D.11.3 Waste processing

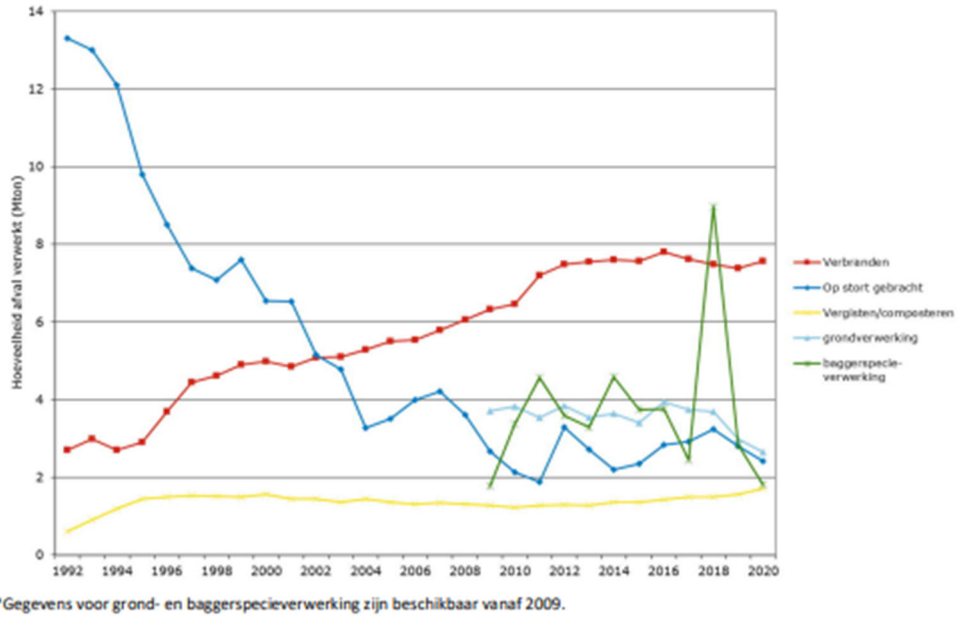
The Working Group on Waste Registration (in Dutch: *Werkgroep Afvalregistratie*) reports on waste processing in the Netherlands. In the Netherlands, waste is incinerated, landfilled and digested/composted. In addition, we have the categories of soil processing and dredging sludge processing[52]. The trends regarding the different waste processing methods are presented in the figure below.

[50] Central Government Encourages Sustainable Energy | Sustainable Energy | Government.nl

[51] Central Government Encourages Sustainable Energy | Sustainable Energy | Government.nl

[52] Waste Processing in the Netherlands: Data from 2020 - Circular Waste (only in Dutch)

Figure D.48: Waste processing in the Netherlands 2020



Source: Working Group on Waste Registration (2020), Waste Processing in the Netherlands: Data from 2020 - Circular Waste (only in Dutch)

E. Overview of related programmes in the Netherlands

In connection with the new Environment and Planning Act, the central government, provinces and municipalities are each drawing up a Strategy on Spatial Planning and the Environment (in Dutch: *Omgevingsvisie*). A Strategy on Spatial Planning and the Environment is an ambition for the long term which relates to the entire physical living environment. It sets out the links between different aspects such as space, water, environment, nature, landscape, traffic and transport, infrastructure and cultural heritage. To realise the priorities from the National Strategy on Spatial Planning and the Environment (Dutch acronym: NOVI), several programmes are being developed. The objectives and challenges referred to in these programmes correspond in full or in part with the targets mentioned in the assessment framework.

In addition to the programmes developed in connection with the Strategy on Spatial Planning and the Environment, there are some other programmes related to this NRD. The table below presents an overview of these programmes, including targets and relation to this NRD.

Table E.4: Overview of other programmes

Programme	Targets / Challenges	Relation to the NRD for the NPRA
National Strategy on Spatial Planning and the Environment (NOVI)	Direction and development of the living environment The NOVI includes the following challenges, among other things: ● Dealing with climate change: – Prolonged periods of drought – Coordination of the soil-water system – Sea level rise ● Energy transition ● Circular economy ● Accessibility: – Alternative clustering of (large-scale) logistical functions at logistical hubs along national and international corridors – Development of the Urban Network of the Netherlands ● Residential construction: – Enormous current need for homes – Climate-proof and 'nature-inclusive' construction ● Nitrogen problems ● Nature, the landscape and the future of agriculture are under pressure	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Climate factors – Infrastructure – Socio-economic factors – Biodiversity, flora and fauna
Climate Agreement (in Dutch: *Klimaatakkoord*)	● Reduction in carbon emissions by 49% in 2030 compared to 1990 ● Reduction in carbon emissions by 95% in 2050 compared to 1990	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Climate factors
Biodiversity Reinforcement Programme (under development; in Dutch: *Programma Versterking Biodiversiteit*)	● In 2050, 100% target scope of the Birds and Habitats Directives in the Netherlands ● In 2050, halving of the ecological footprint	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Biodiversity, flora and fauna
Clean Air Agreement (SLA)	● Health gains of at least 50% in 2030 compared to 2016	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Air
National Water Plan 2022-2027	● We need to prepare for the consequences of climate change in the Netherlands, by means of adequate protection against floods, water-resistant spatial planning, and a freshwater supply that will still be adequate in case of increasing drought. ● Another challenge is that we need to combat subsidence.	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Water

Programme	Targets / Challenges	Relation to the NRD for the NPRA
	● The Netherlands needs to keep working on the quality and quantity of our groundwater and surface water, the restoration of biodiversity, and the realisation of a sustainable drinking water supply. ● There are many functions in the North Sea that need to be balanced, like wind energy, nature development, fishing, shipping and sand extraction. ● The infrastructure, like flood defence systems, bridges, locks and sluices, will need to be maintained, and replaced or renovated where necessary. ● Finally, we need to tackle the challenge of ensuring an efficient, safe, robust and sustainable system for transport by water.	
National Delta Programme	● Water safety: proper protection against flooding ● Freshwater: sufficient freshwater in the right places and resilience to drought ● Spatial adaptation: robust spatial design to limit the consequences of flooding, problems due to heavy rainfall, drought and heat	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Water
Vision of Agriculture, Nature and Food (in Dutch: *Visie landbouw, natuur en voedsel*)	● Reduction of greenhouse gas emissions ● Making more careful use of raw materials, natural resources and the natural environment (circular agriculture) ● Wastage occurring at different links in the food chain ● Connection between agriculture and nature	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Climate factors – Biodiversity, flora and fauna
National Programme for Rural Areas (still under development)	● Future-proof development of rural areas and requirement to meet the international obligations for nature (including the national nitrogen targets), water and climate ● The targets to be achieved with regard to nature, nitrogen, water, soil and climate are approached jointly and in cohesion	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Climate factors – Water – Soil – Socio-economic factors – Biodiversity, flora and fauna
Government-wide circular economy programme: 'A Circular Economy in the Netherlands by 2050'	● Guiding target: by 2030 the Netherlands should use 50% fewer primary abiotic raw materials (minerals, metals and fossil fuels) ● The Netherlands wants to have a circular economy by 2050. This is an economy where: – Raw materials used are renewable wherever possible – Products and raw materials are reused – There is hardly any waste at all	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Climate factors – Soil – Socio-economic factors

Programme	Targets / Challenges	Relation to the NRD for the NPRA
Main Energy Structure Programme (in Dutch: *Energiehoofdstructuur Programma*)	● A lot of infrastructure is needed to make the transition to new energy systems possible, and this demands physical space for cables and pipelines, but also for batteries, hydrogen production and sustainable power plants. ● Combining the above challenge with transitions in other domains	● Among other things, the programme describes the choice of large-scale energy production and assurance policy for nuclear energy. In the programme it has been examined to what extent the designated locations for nuclear power plants are (still) suitable and should be maintained. The locations for nuclear power plants are relevant for the policy scenarios.
National Environmental Policy Plan (still under development; in Dutch: *Nationaal Milieuprogramma* or NMP)	● The plan for 2050 is that the Dutch living environment will be healthy, clean and safe, and that any environmental risks are negligible. ● Clear air, water and soil are indispensable for a healthy life and a sustainable, prosperous economy (e.g. for arable agricultural land and the storage of our drinking water supplies). However, the ecosystems in the Netherlands are under considerable pressure and more action is needed. ● We need to have space for living, nature, mobility and economic activity. All these functions require space and affect the quality (environmental and otherwise) of the living environment. (Think of noise nuisance or air pollution.) ● Focus on circular economy, REACH, biotechnology and the 'Safe by Design' approach. Safe by Design means that product developers take safety into account at the earliest possible stage of product and process development.	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Climate factors – Air – Water – Soil – Socio-economic factors – Biodiversity, flora and fauna – Infrastructure – Noise
Circular Economy Implementation Programme 2019-2023 (in Dutch: *Uitvoeringsprogramma Circulaire Economie 2019-2023*)	● Via the transition to a circular economy, we can make an important contribution with regard to four major challenges facing society: carbon reduction, biodiversity, improvement of air, water and soil quality, and security of supply of raw materials. The government has set the aim of halving the use of raw materials by 2030 and having a fully circular economy by 2050.	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Climate factors
Heritage Deal (in Dutch: *Erfgoeddeal*)	● Conservation and development of heritage	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Culture
Soil Structure Vision (in Dutch: *Structuurvisie Bodem*)	● Sustainable, safe and efficient use of soil and subsoil ● Taking account of the characteristics and the natural functioning of the soil-water system: maintaining closed loops of water, nutrients and energy. Raw materials are not wasted and are reused as much as possible. New	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Soil – Water

Programme	Targets / Challenges	Relation to the NRD for the NPRA
	contaminations are prevented as much as possible and existing contaminated locations are remediated or controlled	
OUR Landscape programme (in Dutch: *Programma ONS Landschap*)	● To protect existing landscape values and make arrangements for how new landscape value can be realised with the integration of the various transitions in the following priority areas: – IJsselmeer – Wadden Sea – Coast – New Dutch Water Line – Veluwe – Green Heart – National Parks	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Landscape – Water – Biodiversity, flora and fauna – Culture
Freshwater Delta Plan (in Dutch: *Deltaprogramma zoetwatervoorziening*)	● 'The Netherlands will be resilient to freshwater shortages by 2050'; ● The demand for water will be adapted to the availability of water, by taking account of the water availability in specific areas when allocating water to water-demanding functions, and by focusing on sparse use of water by water-demanding functions.	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Water
Nature Programme (in Dutch: *Programma Natuur*)	● Acceleration and intensification of recovery measures for nature ● Improvement of hydrology in and around natural areas ● Accelerated recruitment and development of land for the National Ecological Network and planting of new forest to compensate for tree felling as a consequence of Natura 2000 management plans.	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Water – Biodiversity, flora and fauna
Realisation Plan for Vision of Agriculture, Nature and Food	● Nature in the natural areas, on agricultural land and in major waterways is richer and more versatile. The biodiversity and quality of the landscape are increasing. Agriculture and nature are interconnected	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Biodiversity, flora and fauna
Integrated River Management (in Dutch: *Integraal riviermanagement*)	A future-proof river system that can be used in multiple ways and that functions well as a system. The system needs to tackle the challenges listed below. ● New water safety standards ● Problems related to low water levels ● Facilitation of shipping ● Sustainable freshwater supply, and ● Good ecological quality of water and nature (also in case of prolonged periods of drought)	● Targets of the programme correspond in full or in part with SEA objectives relating to: – Water

Programme	Targets / Challenges	Relation to the NRD for the NPRA
OPERA research programme and Long-Term Research Programme (LTRP) for the Geological Disposal of Radioactive Waste	● (OPERA, 2011-2016). This programme was intended to study how safe, long-term geological disposal of radioactive waste in the Netherlands can be realised. In this programme several types of disposal were investigated. An LTRP follow-up study will be conducted from 2020 to 2025. The aim of the LTRP is to acquire knowledge on safe and efficient implementation of geological disposal of radioactive waste in clay layers and salt layers in the Dutch underground, taking into account the beginning and end of the radioactive waste chain.	● These programmes deal with radioactive waste in the long term / geological disposal (2130), while the scope of the NPRA runs until 2035 with a forward view up to 2050.
National Waste Management Plan (in Dutch: *Landelijk Afval Beheerplan*)	● The objectives of the National Waste Management Plan are: – Limiting the generation of waste – Reducing the environmental burden caused by production chains – Optimising the use of waste in a circular economy	● The NPRA also includes short-lived radioactive waste with a half-life of less than 100 days. This waste can be stored for a period of up to 2 years in a suitable space at the producer's location. If the waste remains below the release thresholds, it can be subsequently disposed of as conventional waste.

F. Research and scoring criteria

The assessment framework for the Strategic Environmental Assessment consists of research and scoring criteria. These criteria have been drawn up for each item and are shown below.

F.1 Research criteria

Item	SEA objective	Research criteria
Biodiversity, flora and fauna	Protect, maintain and improve biodiversity, flora and fauna in the Netherlands.	● Will the implementation of the NPRA influence the conservation of Natura 2000 areas, National Parks and the National Ecological Network? ● Will the implementation of the NPRA protect and improve the ecology of the North Sea and the Wadden Sea? ● Will the implementation of the NPRA protect, maintain and improve ecosystems, habitats, flora and fauna in the Netherlands? ● Will the implementation of the NPRA improve biodiversity? ● Will the implementation of the NPRA support the UN's sustainable development goal of 'life on land'?
Water	Minimise the deterioration of the water environment and reduce the risk of flooding.	● Will the implementation of the NPRA protect and improve the quality of the surface water or groundwater? ● Will the implementation of the NPRA affect the availability of water sources? ● Will the implementation of the NPRA reduce the risk of flooding? ● Will the implementation of the NPRA affect the water surfaces of the Water Framework Directive (WFD)? ● Will the implementation of the NPRA support the UN's sustainable development goals of 'life on land' and 'life below water'? ● Will the implementation of the NPRA affect the National Delta Programme and the National Water Plan?
	Maintain the quality and quantity of drinking water sources.	● Will the implementation of the NPRA reduce the availability or quality of drinking water? ● Will the implementation of the NPRA have consequences for the National Water Plan?
Soil	Avoid negative effects on the soil and geological characteristics.	● Will the implementation of the NPRA protect and improve the soil environment? ● Will the implementation of the NPRA affect the agricultural lands? ● Will the implementation of the NPRA support reuse of brownfield lands?

		● Will the implementation of the NPRA protect and improve geological characteristics? ● Will the implementation of the NPRA increase the risk of soil contamination or will it support remediation?
Air	Minimise emissions of polluting gases and particles, and improve air quality.	● Will the implementation of the NPRA affect local or national air quality? ● Will the implementation of the NPRA increase traffic movements and the associated emissions into the air? ● Will the implementation of the NPRA support the Dutch Clean Air Agreement?
Climate factors	Minimise greenhouse gas emissions and ensure sufficient resilience to the possible consequences of climate change.	● Will the implementation of the NPRA lead to increased greenhouse gas emissions? ● Will the implementation of the NPRA support low-carbon energy? ● Will the implementation of the NPRA include measures to limit climate change to reduce its carbon footprint? ● Will the implementation of the NPRA support climate measures to limit climate change? ● Will the implementation of the NPRA support the climate actions of the UN?
Cultural heritage factors	Avoid effects on historic buildings and their surroundings.	● Will the implementation of the NPRA affect designated or non-designated historic buildings, locations and characteristics? ● Will the implementation of the NPRA affect the surroundings or significance of historic buildings? ● Will the implementation of the NPRA affect historic landscapes/townscapes?
Landscape	Protect and improve the quality of the landscape, townscapes and visual impact mitigation.	● Will the implementation of the NPRA protect and improve the designated landscapes, functions and local environments? ● Will the implementation of the NPRA affect the character of the landscape, townscapes or seascapes, including views/panoramas?
Population and public health	Minimise inconvenience/disturbance for local communities.	● Will the implementation of the NPRA protect the population against the harmful consequences of radioactive waste? ● Will the implementation of the NPRA support safe transport, storage, management and disposal of radioactive waste?
	Avoid damage to public health.	● Will the implementation of the NPRA lead to nuisance due to noise, vibrations, light or visual effects? ● Will the implementation of the NPRA increase traffic movements and/or negatively affect local residents?

Socio-economic factors	Promote sustainable development and support local economies.	● Will the implementation of the NPRA promote sustainable development in the Netherlands? ● Will the implementation of the NPRA offer employment opportunities and possibilities for skill development in the Netherlands and in areas of low employment? ● Will the implementation of the NPRA promote good governance and increase the public's confidence in the decision-making?
	Ensure properly funded management of radioactive waste.	● Will the implementation of the NPRA offer sufficient support for the funding of radioactive waste management? ● Will the implementation of the NPRA promote the principle of 'the polluter pays'? ● Will the implementation of the NPRA ensure that there is sufficient infrastructure to meet the development needs associated with population growth and population ageing?
Infrastructure	Minimise the effects on existing buildings and other infrastructure.	● Will the implementation of the NPRA have consequences for existing infrastructure in the Netherlands? ● Will the implementation of the NPRA have consequences for the transport infrastructure and networks?
	Minimise the need for resources.	● Will the implementation of the NPRA minimise the use of material resources and energy? ● Will the implementation of the NPRA correspond with responsible use of radioactive materials and correct management and disposal of waste?
	Increase the amount of recycled or reused waste.	● Will the implementation of the NPRA promote reduction, reuse and recycling of radioactive waste? ● Will the implementation of the NPRA support the reduction of other non-radioactive waste? ● Will the implementation of the NPRA support the UN's sustainable development goal of 'responsible consumption and production'?

F.2 Scoring criteria

Item	Main elements	Effect		Description
Biodiversity, flora and fauna • Protect, maintain and improve biodiversity, flora and fauna in the Netherlands.	• National Parks • Natura 2000 areas • National Ecological Network • Protected animal and plant species	++	Important positive	• The implementation of the NPRA will significantly improve biodiversity and the protection of certain species. • The implementation of the NPRA will significantly improve certain areas.
		+	Limited positive	• The implementation of the NPRA will result in limited improvements in the habitats and the number of species.
		0	Neutral	• The implementation of the NPRA will not have any effect on biodiversity, flora and fauna.
		-	Limited negative	• The implementation of the NPRA will result in a limited decline of habitats and the number of species.
		--	Important negative	• The implementation of the NPRA will significantly deteriorate biodiversity and the protection of certain species. • The implementation of the NPRA will cause significant deterioration of certain areas.
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.
Water: • Minimise the deterioration of the water environment and reduce the risk of flooding. • Maintain the quality and quantity of drinking water sources.	• National Water Plan • National Delta Programme • Flood defence systems • WFD status • Drinking water • Bodies of water: – Canals – Rivers – Deltas – Lakes	++	Important positive	• The implementation of the NPRA will lead to better water quality. • The implementation of the NPRA will lead to a significant reduction of the risk of flooding. • The implementation of the NPRA will protect the Netherlands against high water levels and ensure that there is sufficient freshwater. • The implementation of the NPRA will protect and improve the quality and quantity of the available drinking water sources.
		+	Limited positive	• The implementation of the NPRA will lead to a minor reduction of the risk of flooding. • The implementation of the NPRA will lead to a minor water quality improvement. • The implementation of the NPRA will lead to minor improvements in the availability and quality of drinking water sources.
		0	Neutral	• The implementation of the NPRA will not have any effect on the water environment.

		-	Limited negative	• The implementation of the NPRA will result in a minor increase in the risk of flooding. • The implementation of the NPRA will lead to a minor deterioration of the water quality. • The implementation of the NPRA will lead to a minor reduction in the availability of drinking water sources or the drinking water quality.
		--	Important negative	• The implementation of the NPRA will lead to a major increase in the risk of flooding. • The implementation of the NPRA will lead to a major deterioration of the water quality. • The implementation of the NPRA will lead to a significant reduction in the availability of drinking water sources or the drinking water quality.
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.
Soil: • Avoid negative effects on the soil and geological characteristics.	• Agricultural land • National Programme for Rural Areas • Soil and Subsoil Programme	++	Important positive	• The implementation of the NPRA will lead to a significant improvement in the soil quality and help avoid soil depletion. • The implementation of the NPRA will promote sustainable, safe and efficient use of the soil. • The implementation of the NPRA will protect and improve geological characteristics. • The implementation of the NPRA will lead to remediation of contaminated soil.
		+	Limited positive	• The implementation of the NPRA will lead to a minor improvement in the soil quality. • The implementation of the NPRA will protect geological characteristics. • The implementation of the NPRA will result in reuse of brownfield lands.
		0	Neutral	• The implementation of the NPRA will not have any effect on the soil.
		-	Limited negative	• The implementation of the NPRA will result in a minor loss of greenfield or agricultural land. • The implementation of the NPRA will lead to soil contamination. • The implementation of the NPRA will have limited negative effects on geological characteristics.

		--	Important negative	• The implementation of the NPRA will lead to a significant loss of agricultural land. • The implementation of the NPRA will lead to significant soil contamination. • The implementation of the NPRA will have major negative effects on geological characteristics.
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.
Air: • Minimise emissions of polluting gases and particles, and improve air quality.	• Clean Air Agreement • Emissions into the air: – Particulate matter – Nitrogen dioxide – Sulphur dioxide – Soot (EC)	++	Important positive	• The implementation of the NPRA will lead to significant air quality improvements. • The implementation of the NPRA will result in a significant reduction in polluting gases and/or particles.
		+	Limited positive	• The implementation of the NPRA will lead to minor air quality improvements. • The implementation of the NPRA will result in a minor reduction in polluting gases and/or particles.
		0	Neutral	• The implementation of the NPRA will not have any effect on air quality.
		-	Limited negative	• The implementation of the NPRA will lead to a minor air quality reduction. • The implementation of the NPRA will increase emissions of polluting gases and particles.
		--	Important negative	• The implementation of the NPRA will lead to a significant air quality reduction. • The implementation of the NPRA will significantly increase emissions of polluting gases and particles,
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.
Climate factors: • Minimise greenhouse gas emissions and ensure sufficient resilience to the possible consequences of climate change.	• Carbon data • Sea level rise projections • Climate projections • Netherlands Climate Agreement • Natural disasters	++	Important positive	• The implementation of the NPRA will support the Netherlands in the realisation of a 40% reduction in carbon emissions by 2030. • The implementation of the NPRA will lead to a significant reduction in greenhouse gas emissions. • The implementation of the NPRA will lead to significantly better resilience to the consequences of climate change.
		+	Limited positive	• The implementation of the NPRA will lead to a minor reduction in greenhouse gas emissions. • The implementation of the NPRA will lead to slightly better resilience to the effects of climate change.

		0	Neutral	• The implementation of the NPRA will not have any effect on greenhouse gas emissions, and the NPRA will not affect the resilience to climate change either.
		-	Limited negative	• The implementation of the NPRA will lead to the generation of additional carbon emissions. • The implementation of the NPRA will increase our vulnerability to the consequences of climate change.
		--	Important negative	• The implementation of the NPRA will significantly increase our vulnerability to the consequences of climate change. • The implementation of the NPRA will lead to the generation of significantly more carbon emissions.
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.
Cultural heritage factors: • Avoid effects on historic buildings and their surroundings.	• Nationally listed buildings • UNESCO World Heritage Sites • Archaeological heritage • Heritage landscapes / townscapes • Heritage Deal	++	Important positive	• The implementation of the NPRA will result in a significant improvement of designated and non-designated historic buildings, locations and characteristics.
		+	Limited positive	• The implementation of the NPRA will ensure protection of the historic environment. • The implementation of the NPRA will result in a minor improvement of designated and non-designated heritage objects and cultural heritage.
		0	Neutral	• The implementation of the NPRA will not have any consequences for the historic environment and cultural heritage.
		-	Limited negative	• The implementation of the NPRA will result in minor damage to designated and non-designated historic buildings, locations and characteristics. • The implementation of the NPRA will have minor negative effects on historic buildings, locations and characteristics.
		--	Important negative	• The implementation of the NPRA will result in considerable damage to designated and non-designated historic buildings, locations and characteristics, leading to loss of significance. • The implementation of the NPRA will have considerable negative effects on the surroundings of heritage objects.
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.

Landscape: ● Protect and improve the quality of the landscape, townscapes and visual impact mitigation.	● National Parks ● Urban and rural areas ● Landscape characterisations ● National Landscapes	++	Important positive	● The implementation of the NPRA will lead to significant improvements in the quality of the local landscape, townscape or seascape and visual impact mitigation.
		+	Limited positive	● The implementation of the NPRA will result in minor improvements in the quality of the local landscape, townscape or seascape and visual impact mitigation. ● The implementation of the NPRA will reduce visual effects of above-ground structures.
		0	Neutral	● The implementation of the NPRA will not have any effect on the landscape, townscapes and seascapes.
		-	Limited negative	● The implementation of the NPRA will have minor negative effects on the local landscape, townscapes or the quality of seascapes and the visual experience. ● The implementation of the NPRA will result in minor new above-ground infrastructure with negative visual effects.
		--	Important negative	● The implementation of the NPRA will have major negative effects on the local landscape, the quality of townscapes or seascapes and the value of the visual experience. ● The implementation of the NPRA will result in significant new above-ground infrastructure with negative visual effects.
		U	Uncertain	● Based on the available information, no conclusive evidence can be gathered.
Population and public health: ● Minimise inconvenience/disturbance for local communities. ● Avoid damage to public health.	● Noise ● Functional sites: – Schools – Medical facilities – Homes – Religious buildings ● National Parks ● Green spaces ● Public health ● Population growth ● Quiet zones	++	Important positive	● The implementation of the NPRA will lead to a significant improvement in people's health, safety or well-being. ● The implementation of the NPRA will lead to significant social improvements for local communities.
		+	Limited positive	● The implementation of the NPRA will result in a minor improvement in people's health, safety or well-being. ● The implementation of the NPRA will lead to minor social improvements for local communities.
		0	Neutral	● The implementation of the NPRA will not have any consequences for local communities or people's health.
		-	Limited negative	● The implementation of the NPRA will lead to minor inconvenience for local communities. ● The implementation of the NPRA will negatively affect people's well-being.

		--	Important negative	• The implementation of the NPRA will lead to significant inconvenience for local communities. • The implementation of the NPRA will lead to damage to people's health or safety.
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.
Socio-economic factors: • Promote sustainable development and support local economies. • Ensure properly funded management of radioactive waste.	• Waste facilities • Tourism • Economy • Sustainable procurement • Average standardised income • Support for local businesses	++	Important positive	• The implementation of the NPRA will lead to significant economic development in the Netherlands. • The implementation of the NPRA will generate significant employment opportunities. • The implementation of the NPRA will lead to a significant contribution to the funding of radioactive waste management.
		+	Limited positive	• The implementation of the NPRA will lead to limited economic development in the Netherlands. • The implementation of the NPRA will generate minor employment opportunities. • The implementation of the NPRA will result in a small contribution to the funding of radioactive waste management.
		0	Neutral	• The implementation of the NPRA will not have any consequences for the local economy and will not promote sustainable development.
		-	Limited negative	• The implementation of the NPRA will lead to a slight decrease in funding for radioactive waste management. • The implementation of the NPRA will lead to a minor decrease of economic development or employment in the Netherlands. • The implementation of the NPRA will cancel out the effects of the principle of 'the polluter pays'.
		--	Important negative	• The implementation of the NPRA will lead to a significant decrease in funding for the provision of waste management. • The implementation of the NPRA will lead to a major decrease of economic development or employment in the Netherlands. • The implementation of the NPRA will not provide adequate solutions for radioactive waste management.
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.

Infrastructure: ● Minimise the effects on existing buildings and other infrastructure. ● Minimise the need for resources. ● Increase the amount of recycled or reused waste.	● Transport: – Main roads – Railway network – Canals – Cycle lanes ● Infrastructure ● Waste facilities ● COVRA (nuclear assets)	++	Important positive	● The implementation of the NPRA will lead to a significant increase in the reuse or recycling of waste, or in reduced waste production. ● The implementation of the NPRA will lead to a major drop in the consumption of materials and energy. ● The implementation of the NPRA will render the long-term management of radioactive waste significantly more future-proof. ● The implementation of the NPRA will offer major benefits for existing buildings and infrastructure. ● The implementation of the NPRA will support the Netherlands' ambition to realise a circular economy by 2050.
		+	Limited positive	● The implementation of the NPRA will lead to a minor increase in the reuse or recycling of waste, or in reduced waste production. ● The implementation of the NPRA will lead to a minor drop in the consumption of materials and energy. ● The implementation of the NPRA will render the management of radioactive waste future-proof in the medium term. ● The implementation of the NPRA will lead to minor benefits for existing buildings and infrastructure.
		0	Neutral	● The implementation of the NPRA will not have any consequences for buildings and Infrastructure.
		-	Limited negative	● The implementation of the NPRA will lead to minor negative effects on existing buildings and infrastructure. ● The implementation of the NPRA will require a moderate to low level of new infrastructure. ● The implementation of the NPRA will lead to a minor increase in the consumption of materials and energy. ● The implementation of the NPRA will lead to a minor reduction in the reuse or recycling of radioactive waste. ● The implementation of the NPRA will increase non-radioactive waste flows and quantities of waste.
		--	Important negative	● The implementation of the NPRA will lead to major negative effects on existing buildings and infrastructure. ● The implementation of the NPRA will require significant new infrastructure.

				• The implementation of the NPRA will lead to a major increase in the consumption of materials and energy. • The implementation of the NPRA will lead to a significant reduction in the reuse or recycling of radioactive waste. • The implementation of the NPRA will significantly increase waste quantities and waste flows.
		U	Uncertain	• Based on the available information, no conclusive evidence can be gathered.

Figuur 3.1: Nucleaire en medische isotopen ketenpartners in Nederland	**Figure 3.1: Nuclear and medical isotope chain partners in the Netherlands**
Hoge Flux Reactor (HFR)	High Flux Reactor (HFR)
Hoger Onderwijs Reactor	Higher Education Reactor
Reactor Instituut Delft	Reactor Institute Delft
Kerncentrale Borssele/EPZ	Borssele Nuclear Power Plant/EPZ
Kernfysisch Versneller Instituut	KVI Nuclear Physics Accelerator Institute

Figuur 4.1 : High level overzicht scenario's	**Figure 2.1: High-level overview of scenarios**
Scenario B	Scenario B
Scenario A (Aangewezen scenario)	Scenario A (Designated scenario)
Scenario C	Scenario C
Opwerking	Reprocessing
Opwerking	Reprocessing
2 nieuwe kernreactoren	2 new nuclear reactors
2 SMR's	2 SMRs
Shine	Shine
Pallas	PALLAS
Borssele +10	Borssele +10
Borssele +10	Borssele +10
Pallas	PALLAS
Deponieën	Landfill sites
NORM	NORM

FiguurC 1: De COVRA-classificatie voor radioactief afval	**Figure C 1: The COVRA classification for radioactive waste**
Hoog-radioactief afval	High-level radioactive waste
Laag- en middelradioactief afval	Low-level and intermediate-level radioactive waste
Kortlevend radioactief afval	Short-lived radioactive waste
Vrijgesteld afval	Exempt waste

Figuur C 2: Activiteit en volume van het radioactief afval opgeslagen bij COVRA (december 2020)	**Figure C 2: Activity and volume of radioactive waste stored at COVRA (December 2020)**
Volume	Volume
NORM 65,1%	NORM 65.1%
LMRA 34,6%	LLW/ILW 34.6%
HRA 0,3%	HLW 0.3%
Activiteit	Activity
NORM 0,2%	NORM 0.2%
LMRA 0,22%	LLW/ILW 0.22%
HRA 99,76%	HLW 99.76%

Figuur C 3: Afkomst radioactief afval voor de periode 2018-2020 opgeslagen bij COVRA	**Figure C 3: Origin of radioactive waste stored at COVRA for the period 2018-2020**
HRA	HLW
Onderzoek en onderwijs	Research and education
Productie medische radio-isotopen	Production of medical radio-isotopes
Nucleair	Nuclear
LMRA	LLW/ILW
Onderzoek en onderwijs	Research and education
Productie medische radio-isotopen	Production of medical radio-isotopes
Nucleair	Nuclear
Medisch	Medical
Olie en gas	Oil and gas
Schroot	Scrap
Industrie	Industry
Rookmelders	Smoke detectors
Overig	Other

Figuur C 4: Te verwachten hoeveelheden HRA voor de verschillende scenario's (in m³)	**Figure C 4: Expected quantities of HLW for the different scenarios (in m³)**
2030	2030
173 m³	173 m³
360	360
10	10
91	91
56	56
191	191

2050	2050
708 m³	708 m³
540	540
36	36
2924	2924
56	56
191	191
2130	2130
3.747 m³	3,747 m³
Huidige installaties	Current installations

Figuur C 5: Te verwachte hoeveelheden LMRA voor de verschillende scenario's (in m³)	**Figure C 5: Expected quantities of LLW/ILW for the different scenarios (in m³)**
2030	2030
14.548 m³	14,548 m³
11.520	11,520
2.000	2,000
6.750	6,750
700	700
18.615	18,615
2050	2050
39.585 m³	39,585 m³
17.280	17,280
7.152	7,152
52.485	52,485
700	700
24.309	24,309
2130	2130
101.926 m³	101,926 m³
Huidige installaties	Current installations

Figuur C 6: Te verwachte hoeveelheden ontmantelingsafval voor de verschillende scenario's (in m³)	**Figure C 6: Expected quantities of decommissioning waste for the different scenarios (in m³)**
2030	2030

1.021 m³	1,021 m³
992	992
29	29
2050	2050
3.496 m³	3,496 m³
1.892	1,892
152	152
1.423	1,423
29	29
2130	2130
16.299 m³	16,299 m³
12.485	12,485
152	152
166	166
1.892	1,892
152	152
1.423	1,423
29	29
2 nieuwe centrales	2 new power plants

Figuur D 7: Nationale Parken	**Figure D 7: National Parks**
Legenda:	Legend:
Nationaal park	National Park

Figuur D 8: Natura 2000 gebieden	**Figure D 8: Natura 2000 areas**
Legenda:	Legend:
HR	HD
VR	BD
VR + HR	BD + HD
HR groeve	HD quarry

Figuur D 9: RAMSAR gebieden	**Figure D 9: Ramsar sites**
Legenda:	Legend:
Wetlandgebieden (RAMSAR)	Wetland areas (Ramsar)

Figuur D 10: Natuurnetwerk Nederland	**Figure D 10: National Ecological Network**
Legenda:	Legend:

Natuurnetwerk Nederland	National Ecological Network

Figuur D 11: Grote rivieren Nederland	**Figure D 11: Major rivers in the Netherlands**
De grote rivieren van Nederland	The major rivers of the Netherlands
Noordzee	North Sea
Stroomgebied Maas en Rijn	Meuse and Rhine river basins
Eems	Ems
Lengte: 371 km	Length: 371 km
Internationaal stroomgebied Duitsland en Nederland in totaal 17.930 km²	International river basin in Germany and the Netherlands of 17,930 km² in total
Debiet: gemiddeld 80 m³/s	Flow rate: 80 m³/s on average
Vooral grond- en regenwater	Mainly groundwater and rain water
Rijn	Rhine
Lengte: 1.230 km	Length: 1,230 km
Stuwen in Nederland: 3	Dams in the Netherlands: 3
Internationaal stroomgebied Italië, Oostenrijk, Zwitserland, Liechtenstein, Frankrijk, Luxemburg, België, Duitsland en Nederland 185.000 km², waarvan ongeveer 20.000 km² in Nederland	International river basin in Italy, Austria, Switzerland, Liechtenstein, France, Luxembourg, Belgium, Germany and the Netherlands of 185,000 km², of which about 20,000 km² is in the Netherlands
Komt Nederland binnen bij Lobith	Enters the Netherlands at Lobith
Debiet: gemiddeld 2.200 m³/s	Flow rate: 2,200 m³/s on average
Vooral smelt-, maar daarnaast ook grond- en regenwater	Mainly melt water, but additionally groundwater and rain water as well
Maas	Meuse
Lengte 925 km	Length 925 km
Stuwen in Nederland: 7	Dams in the Netherlands: 7
Internationaal stroomgebied Frankrijk, België, Duitsland en Nederland 36.000 km² waarvan 7.700 km² in Nederland	International river basin in France, Belgium, Germany and the Netherlands of 36,000 km² of which 7,700 m² is in the Netherlands
Komt Nederland binnen in Eijsden	Enters the Netherlands at Eijsden
Debiet: gemiddeld 250 m3/s	Flow rate: 250 m³/s on average
Vooral grond- en regenwater	Mainly groundwater and rain water
Schelde	Scheldt
Lengte: 350 km	Length: 350 km
Internationaal stroomgebied Noord-Frankrijk, België en Nederland in totaal 21.860 km²	International river basin in Northern France, Belgium and the Netherlands of 21,860 km² in total
Debiet: gemiddeld 120 m³/s	Flow rate: 120 m³/s on average
Vooral grond- en regenwater	Mainly groundwater and rain water

Figuur D 12: Grondwaterbeschermingskaart rondom bronnen voor drinkwater	**Figure D 12: Groundwater protection map of areas around drinking water sources**
Legenda:	Legend:
Grondwaterbeschermingskaart 2022	Groundwater protection map for 2022
Waterwingebied	Water catchment area
Grondwaterbeschermingsgebied	Groundwater protection area
100-jaarszone	100-year zone
Intrekgebied op basis van omgevingsverordening	Recharge area based on environmental regulation
Boringsvrije zone	Drilling-free zone

Figuur D 13: Normering dijktrajecten	**Figure D 13: Classification of dike sections**
Kans per jaar	Likelihood per year

Figuur D.14-D.17	**Figure D.14-D.17**
Legenda:	Legend:
Minder dan 0,5 meter	Less than 0.5 metre
0,5 – 1,0 meter	0.5 – 1.0 metres
1,0 – 1,5 meter	1.0 – 1.5 metres
1,5 – 2,0 meter	1.5 – 2.0 metres
2,0 – 5,0 meter	2.0 – 5.0 metres
Meer dan 5,0 meter	More than 5.0 metres

Figuur D 18: Grondsoorten kaart Nederland	**Figure D 18: Map of soil types in the Netherlands**
Veen	Peat
Zand	Sand
Lichte zavel	Light sandy clay loam (‘zavel’)
Zware zavel	Heavy sandy clay loam (‘zavel’)
Lichte klei	Light clay
Zware klei	Heavy clay
leem	Loam

Figuur D 19: Bouwsoorten kaart Nederland	**Figure D 19: Map of land use in the Netherlands**
Rode ruimte	Red space
Woonterrein	Residential area
Bouwterrein	Building site
Overig bebouwd	Other built-up area

Groene ruimte	Green space
Recreatieterrein	Recreational area
Agrarisch terrein	Agriculture
Bos	Woodland
Natuurlijk terrein	Nature
Blauwe ruimte	Blue space
Water	Water

Figuur D 21: Fijnstof (PM10) Nederland 2020	**Figure D 21: Particulate matter (PM_{10}) in the Netherlands 2020**
Legenda:	Legend:
Fijn stof conc.	Particulate matter conc.
WHO advieswaarde	WHO guideline

Figuur D 22: Roet (EC) Nederland 2019	**Figure D 22: Soot (EC) in the Netherlands 2019**
Legenda:	Legend:
Roet conc.	Soot conc.

Figuur D 23: Fijnstof (PM2,5) Nederland 2020	**Figure D 23: Particulate matter ($PM_{2.5}$) in the Netherlands 2020**
Legenda:	Legend:
Fijn stof conc.	Particulate matter conc.
WHO advieswaarde	WHO guideline

Figuur D 24: Stikstofdioxide Nederland 2019	**Figure D 24: Nitrogen dioxide in the Netherlands 2019**
Legenda:	Legend:
NO2 conc.	NO_2 conc.
WHO advieswaarde	WHO guideline

Figuur D 25: Stikstofdepositie 2018	**Figure D 25: Nitrogen deposition 2018**
Legenda:	Legend:
Stikstofdepositie 2018 (Ntot)	Nitrogen deposition 2018 (Ntot)
(mol/ha/jaar)	(mol/ha/year)

Figuur D 26: Stikstofdepositie naar oorsprong 2020	**Figure D 26: Nitrogen deposition according to origin 2020**
3,0%	3.0%
8,9%	8.9%
11,9%	11.9%
31,7%	31.7%
44,6%	44.6%
Landbouw	Agriculture
Verkeer	Traffic
Ammoniak van zee	Ammonia from the sea
Buitenland	Other countries
Industrie en gebouwde omgeving	Industry and built environment

Figuur D 27: Gemiddelde jaartemperatuur Nederland (1906 – 2022)	**Figure D 27: Annual average temperature in the Netherlands (1906-2022)**
Normaal rond 2085	Normal around 2085
WH-scenario	WH scenario
WL-scenario	WL scenario
GH-scenario	GH scenario
GL-scenario	GL scenario
Gemiddelde jaartemperatuur	Annual average temperature
De Bilt, dinsdag 16 mei 2023	De Bilt, Tuesday 16 May 2023
Verwachting	Expected
Gemiddelde	Average
Normaal	Normal
Trendlijn	Trend line
KNMI'14-klimaatscenario's	KNMI'14 climate scenarios

Figuur D 28: Bevolkingsdichtheid Nederland (2022)	**Figure D 28: Population density in the Netherlands (2022)**
Minder dan 250 (inwoners per km² land)	Fewer than 250 (inhabitants per km² of land)
250 tot 500 (inwoners per km² land)	250 to 500 (inhabitants per km² of land)
500 tot 1000 (inwoners per km² land)	500 to 1000 (inhabitants per km² of land)
1000 tot 2000 (inwoners per km² land)	1000 to 2000 (inhabitants per km² of land)
2000 of meer (inwoners per km² land)	2000 or more (inhabitants per km² of land)

Figuur D 29: Bevolkingsgroei in Nederland (1900 tot 2023)	**Figure D 29: Population growth in the Netherlands (1900-2023)**

Bevolking	Population
X mln	x million

Figuur D 30: Bevolkingsontwikkeling 2021 tot 2035 prognose	**Figure D 30: Prognosis of population development from 2021 to 2035**
Verandering in procenten	Change in percentage
< -5,0	< -5.0
-5,0 - -2,5	-5.0 - -2.5
-2,5 - 2,5	-2.5 - 2.5
2,5 - 5,0	2.5 - 5.0
5,0 - 10,0	5.0 - 10.0
> 10,0	> 10.0
Provincies	Provinces

Figuur D 31: Gemiddelde levensverwachting Nederland	**Figure D 31: Average life expectancy in the Netherlands**
Levensverwachting	Life expectancy
Leeftijd	Age
Totaal mannen en vrouwen	Total men and women
Mannen	Men
Vrouwen	Women

Figuur D 32: Geluid in Nederland (2020)	**Figure D 32: Noise in the Netherlands (2020)**
Legenda:	Legend:
Geluid alle bronnen (Icum)	Noise from all sources (Icum)
Zeer goed	Very good
Goed	Good
Redelijk	Reasonable
Matig	Moderate
Tamelijk slecht	Fairly poor
Slecht	Poor
Zeer slecht	Very poor

Figuur D 34: Gemiddeld gestandaardiseerd inkomen 2018 (per gemeente per persoon)	**Figure D 34: Average standardised income 2018 (per municipality per person)**
Euro	Euro

25.800 – 30.000	25,800 – 30,000
30.000 – 32.500	30,000 – 32,500
32.500 – 35.000	32,500 – 35,000
35.000 – 57.500	35,000 – 57,500
Geen gegevens	No data
Provincies	Provinces

Figuur D 35: Sociaal economische status per gemeente 2019	**Figure D 35: Socio-economic status per municipality 2019**
Score	Score
< -0,2	< -0.2
-0,2 - -0,1	-0.2 - -0.1
-0,1 - 0,0	-0.1 - 0.0
0,0 - 0,1	0.0 - 0.1
0,1 - 0,2	0.1 - 0.2
> 0,2	> 0.2
Provincies	Provinces

Figuur D 36: Aandeel banen in toerisme 2019	**Figure D 36: Share of jobs in tourism 2019**
Aandeel toerisme en recreatie	Share of tourism and recreation

Figuur D 39: Beschermde Stads- en dorpsgezichten	**Figure D 39: Protected townscapes**
Legenda:	Legend:
Gewaardeerd, niet beschermd	Valued, not protected
In procedure	In procedure
Rijksmonument	Nationally listed building
Ligging aangewezen Stads- en Dorpsgezichten	Location of designated townscapes
Ligging stads- en dorpsgezichten in procedure	Location of townscapes in procedure
Ligging ingetrokken stads- en dorpsgezichten	Location of revoked townscapes

Figuur D 40: Archeologische monumentenkaart	**Figure D 40: Map of Protected Archaeological Sites**
Archeologische Monumentenkaart (2014)	Map of Protected Archaeological Sites (2014)
Archeologische waarde	Archaeological value
Hoge archeologische waarde	High archaeological value
Zeer hoge archeologische waarde	Very high archaeological value

Ligging archeologische monumenten	Location of archaeological monuments
Ligging archeologische monumenten	Location of archaeological monuments

Figuur D 41: Indicatieve kaart archeologische waarden 2008	**Figure D 41: Indicative Map of Archaeological Values 2008**
Indicatieve Kaart Archeologische waarden (2008) – IKAW3	Indicative Map of Archaeological Values (2008) – IKAW3
Land	Land
Water	Water
Hoge trefkans	High likelihood of being affected
Middelhoge trefkans	Medium likelihood of being affected
Lage trefkans	Low likelihood of being affected
Zeer lage trefkans	Very low likelihood of being affected
Niet gekarteerd	Not charted

Figuur D 42: Bodemgebruik Nederland 2017	**Figure D 42: Land use in the Netherlands 2017**
Legenda:	Legend:
Spoorterrein	Railway area
Hoofdweg	Motorway
Vliegveld	Airport
Woongebied	Residential area
Detailhandel en horeca	Retail and hospitality
Openbare voorziening	Public utility area
Sociaal-culturele voorziening	Social/cultural facility
Bedrijfsterrein	Business site
Stortplaats	Landfill site
Wrakkenopslagplaats	Scrap yard
Begraafplaats	Cemetery
Delfstofwinplaats	Mineral extraction site
Bouwterrein	Building site
Semi-verhard overig terrein	Other semi-paved area
Park en plantsoen	Park or public garden
Sportterrein	Sports site
Volkstuin	Allotment garden
Dagrecreatief terrein	Day recreation area
Verblijfsrecreatief terrein	Recreational accommodation
Glastuinbouw	Horticulture under glass
Overig agrarisch terrein	Other agricultural area
Bos	Woodland
Open droog natuurlijk terrein	Open dry natural area
Open nat natuurlijk terrein	Open wet natural area
IJsselmeer & Markermeer	IJsselmeer & Markermeer

Afgesloten zeearm	Closed sea inlet
Rijn & Maas	Rhine & Meuse
Randmeer	Bordering lake
Spaarbekken	Water reservoir
Water met recreatieve functie	Water for recreation
Water met delfstofwinningsfunctie	Water for mineral extraction
Vloei- en/of slibveld	Sludge area
Overig binnenwater	Other inland water
Waddenzee, Eems & Dollard	Wadden Sea, Ems & Dollard
Oosterschelde	Eastern Scheldt
Westerschelde	Western Scheldt
Noordzee	North Sea
Buitenland	Other countries

Figuur D 44: Overzicht rijkswegen en provinciale wegen 2016	**Figure D 44: Overview of motorways and provincial roads 2016**
Rijkswegen	Motorways
Provinciale wegen	Provincial roads

Figuur D 45: Spoorwegennet 2016	**Figure D 45: Railway network 2016**
Treinstation	Train station
Geëlektrificeerd	Electrified
Niet geëlektrificeerd	Non-electrified

Figuur D 46: Nederlands energiesysteem 2020	**Figure D 46: The Dutch energy system 2020**
Het Nederlandse energiesysteem	The Dutch energy system
Met 1 petajoule (PJ) kan een stad als Tilburg een jaar van elektriciteit worden voorzien	With 1 petajoule (PJ) a city like Tilburg can be powered with electricity for a year
Primair verbruik (2940 PJ)	**Primary consumption (2940 PJ)**
Energiebronnen	Energy sources
10%	10%
300 PJ Hernieuwbare energie	300 PJ of renewable energy
1%	1%
40 PJ Kernenergie	40 PJ of nuclear energy
44%	44%
1307 PJ Aardgas	1307 PJ of natural gas
37%	37%
1078 PJ Aardolie	1078 PJ of petroleum
6%	6%
173 PJ Steenkool	173 PJ of coal
2%	2%

47 PJ Overig	47 PJ other
Excl. internationale scheep- en luchtvaart: 5 PJ aardgas en 586 PJ aardolie	Excl. international shipping and aviation: 5 PJ of natural gas and 586 PJ of petroleum
808 PJ is direct beschikbaar → a	808 PJ is immediately available → a
1477 PJ* is beschikbaar na omzetting → b	1477 PJ* is available after conversion → b
5 PJ netto export elektriciteit	5 PJ net export of electricity
660 PJ gaat verloren: • 464 PJ door omzetting • 169 PJ door eigen gebruik • 27 PJ door distributie	660 PJ is lost: • 464 PJ due to conversion • 169 PJ due to own use 27 PJ due to distribution
Eindverbruik (2280 PJ)	**Final consumption (2280 PJ)**
Energiedragers	Energy carriers
17%	17%
389 PJ Elektriciteit (108 TWh)	389 PJ of electricity (108 TWh)
10%	10%
219 PJ Warmte	219 PJ of heat
25%	25%
570 PJ Direct gasverbruik	570 PJ of direct gas use
25%	25%
566 PJ Transportbrandstoffen en restgassen	566 PJ of transport fuels and residual gases
23%	23%
536 PJ Producten en grondstoffen Dit deel is niet-energetisch	536 PJ of products and raw materials This part is non-energetic
a 808 PJ is direct beschikbaar:	a 808 PJ is immediately available:
85 Zon en wind **49** Biomassa, omgevings- en aardwarmte **570** Direct gasverbruik **104** Aardgas als grondstof	**85** Solar and wind **49** Biomass, ambient and geothermal heat **570** Direct gas use **104** Natural gas as a raw material
b 1477 PJ* is beschikbaar na omzettingen:	b 1477 PJ* is available after conversions:
Via elektriciteitscentrale/WKK	Via electrical power plant/CHP
Via overige omzettingen	Via other conversions
* Netto output (1535 PJ) minus verliezen elektriciteit (35 PJ) en warmte (23 PJ) = 1477 PJ	* Net output (1535 PJ) minus loss of electricity (35 PJ) and heat (23 PJ) = 1477 PJ

Figuur D 47: Elektriciteitsproductie per bron Nederland 2018-2022	**Figure D 47: Electricity generation according to source in the Netherlands 2018-2022**
Mld kWh	Billions of kWh
Fossiel	Fossil
Hernieuwbaar	Renewable
Kernenergie +overig	Nuclear energy + other

Figuur D 48: Afvalverwerking in Nederland 2020	**Figure D 48: Waste processing in the Netherlands 2020**
Verbranden	Incinerated
Op stort gebracht	Landfilled
Vergisten/compostterrein	Digested/composted
Grondverwerking	Soil processing
Baggerspecieverwerking	Dredging sludge processing
Gegevens voor grond- en baggerspecieverwerking zijn beschikbaar vanaf 2009	Data for soil and dredging sludge processing are available from 2009