




 **Green** Inland Ports

Good Practices

Funded by
the European Union



A large blue and white cargo ship is sailing on a river, carrying several red and yellow shipping containers. In the background, a green steel truss bridge spans the water, and a tall, modern blue skyscraper with a grid-like facade stands prominently. Other smaller buildings are visible in the distance. The sky is clear and blue.

Maintaining soil quality

Maintaining soil quality

1.1 Description

Soil is the top terrestrial layer of the Earth, which is composed of a mixture of mineral and organic compounds, water, air and living organisms. The most important services that soil offers are biomass (production of wood and fibre and growth of crops), water (filtering of contaminants and water storage), climate (soil stores carbon), biodiversity (habitat for plants, insects, microbes and fungi), and infrastructure (the soil serves as a platform for infrastructure) (European Environment Agency, 2023). Soil quality can degrade over time through (historical) soil degradation through companies in the port area, unnecessary dredging and formerly approved chemicals in for example paint for ships. Soil degradation can have many consequences. It can, for example, be unsafe to build on and be harmful for agriculture. This good practice therefore aims at maintaining soil quality. This can be applicable to terrestrial soil, but also for subaqueous soil, which also relates to other good practices that prevent waste or toxins from entering the water:

- [Binding regulations for wastewater](#)
- [Collecting water after cleaning containers](#)

The main soil threat indicators are soil organic carbon (a key element of healthy soils, affecting the quality of water, air, biodiversity and ultimately, food and water security), soil nutrient status (affects biomass production in natural soils and crop yields in agricultural soils), soil acidification (occurs when the acid neutralising capacity of the soil is reduced, which leads to a decrease in pH, which could lead to crop yields decline), soil pollution (affects human health and/or ecosystem functioning, as soil functions can be impaired through exceedance of critical values), soil biodiversity (soil organisms are the biological engine of the Earth and crucial for soil functioning), soil erosion (loss of fertile topsoil after erosive rain events due to absence of sufficient vegetation cover), soil compaction (harms physical structure of soils and affects important ecological and economic soil functions by reducing pore volume and pore continuity as well as particle surface accessibility), and soil sealing (destruction or covering of the soil by an impermeable material, which leads to irreversible loss of soil and its biological functions and loss of biodiversity) (European Environment Agency, 2023).

Soil quality can be maintained through monitoring the soil indicators mentioned above and identification of critical limits (limits could inform us of any potential risks to degraded soils and ecosystems, water and human health (European Environment Agency, 2023)) near the port, regularly planting trees, implementing green belts and open areas, and soil remediation to remove pollution or fix degradation caused by factories. Planting of trees and green belts can absorb air and water pollution, lessen noise and erosion, and produce aesthetic background.

1.2 The aim of maintaining soil quality

Goals can differ for each port, but in general the goal is to clean up the (historical) soil degradation and to minimise/fully prevent current soil degradation through the soil threat indicators mentioned before. The soil within port areas must be healthy and strong to be able to form the foundation for heavy port infrastructure, it must be able to have sufficient load-bearing capacity as ports handle heavy load in general, and polluted soil can have negative effects on the surrounding ecosystems.

1.3 Parties that focus on soil quality

- Port of Antwerp-Bruges
- Port of Rotterdam
- Port of Barcelona
- Port of Mulhouse Rhine
- Port of Brussels
- Port of Switzerland (Basel)
- Compagnie Nationale du Rhône (Port of Lyon)
- DeltaPort (Wessel)
- Bayernhafen
- Port of Hamm
- Port of Stuttgart
- Port of Giurgiuilesti
- Port of Seville
- Port of Venlo
- Van Berkel Logistics

1.4 Stakeholders

- Port authority: The port authority is responsible for the soil quality within the port area. As the owners and ultimate managers of the environmental state of the port area, the port also aims to ensure the good state of the soil and groundwater (Port de Barcelona, n.d.).
- Companies within the port area: It is the responsibility of companies located in the port area to not jeopardize the soil of the port area through their activities. Increasing efforts to maintain soil quality could potentially influence their activities.
- National authorities: In general, national authorities have policies regarding soil quality. These often indicate that the quality of the soil should match the purpose of the soil and that the soil quality may not deteriorate over time (Rijkswaterstaat, n.d.).
- European authorities: Currently, soils do not receive the same level of legal protection in the EU as air and water. There are plans to develop a legislative proposal to achieve the vision that by 2050, all soil ecosystems should be in healthy condition (EC, 2023).

1.5 Voluntary or mandatory

Mandatory to a certain extent, as it depends on the relevant and applicable laws. For example, in the Netherlands, intervention values apply to classify historically contaminated soils and they mark the limit above which the functional properties of a soil would be severely decreased for humans, flora & fauna. An important policy document with regards to the impact of business activities on soil is the *Wet milieubeheer* (Act on Environmental Management). There are rules and intervention values present for groundwater, which can be a measure for when groundwater is suitable for most functions and there would be no threats for health and wellbeing. For re-using soil and dredged materials, indicators and maximum values are present that decide whether or not re-use of materials is allowed (RIVM, n.d., *Bodemrichtlijn*, n.d.). In Germany, national law governing soil protection is enshrined in many different laws and regulations, such as the Federal Soil Protection Act and the Federal Soil Protection and Contaminated Sites Ordinance. The main goals of the Acts are to sustainably secure or restore soil functions, and to avoid negative effects on soil and to rehabilitate such negative effects when they have occurred.

1.6 Realised/potential impact

It is very difficult to quantify an effect of the quality of soil. However, multiple ports indicated activities executed to safeguard soil quality, which means that it is a topic that requires attention (Ecorys et al., 2024). Measures that occur more often within ports include soil surveys and soil quality control. This can include the management of organic matter, which improves soil structure, enhances water and nutrient holding capacity, and supports a healthy community of soil organisms. It can also include the prevention of soil compaction, which reduces the amount of air, water and space available to roots and soil organisms. It can also measure residue management, as bare soil is susceptible to wind and water erosion, and to drying and crusting (Soil Quality for Environmental Health, 2011).

It is common for inland ports to execute soil quality controls or surveys, but the frequency of which they are performed may vary significantly. It is common for inland ports to check whether contamination does not exceed relevant limits, but when parameters fall into the limits, actions are not required. Some inland ports perform a soil quality analysis only when new companies are located in the port area, with the requirement that soil quality may not worsen than the measurements at the beginning.

1.7 Possible obstacles

- Soil quality research and soil rehabilitation may be very costly and depending on the size and financial resources of a port, it can be too costly (Vanino, S. et al., 2022).
- Lack of public-private partnerships on soil research (Vanino, S. et al., 2022).
- Different methodologies may be applied for soil sampling, analysis and mapping, by researchers, which could lead to different results out of the testing and sampling, which makes comparison more difficult (Vanino, S. et al., 2022).

1.8 Key learnings

- Soil is an important aspect for humans, flora & fauna and goes further than only what happens within the ground. It impacts food and water for all organisms; it affects climate change as it stores carbon (dioxide) and it affects biomass production, to name a few examples.
- In many countries and at a European level, soil quality does not receive as much attention as air and water quality. More attention to soil quality could lead to better insights about the importance and more efforts to improve or maintain in soil quality.
- Monitoring and importance of soil quality differs per country. An overarching (European) framework could guarantee same rules and regulations for each country, which also decreases the chances of unfair competition.

1.9 Sources

Bodemrichtlijn. n.d. Wet- en regelgeving, (land)bodem, landelijk.

<https://www.bodemrichtlijn.nl/Bibliotheek/beleid/algemeen/wet-en-regelgeving-land-bodem-landelijk>.

EC. 2023. Questions and Answers on a Directive on Soil Monitoring and Resilience, European Commission

https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3637.

Ecorys, CE Delft, Panteia, Pro Danube, Erasmus University Rotterdam, Planco & EICB, 2024.

Second survey Green Inland Ports, Rotterdam: Netherlands.

European Environment Agency, 2023. Soil monitoring in Europe – Indicators and thresholds for soil health assessments, Luxembourg.

Port de Barcelona. n.d. Soils, Port de Barcelona

<https://www.portdebarcelona.cat/en/sustainability/environmental-sustainability/environmental-actions/soils>.

Rijkswaterstaat. n.d. Wat is het verschil tussen generiek en gebiedsspecifiek beleid?,

<https://www.bodemplus.nl/onderwerpen/wet-regelgeving/bbk/vragen/grond-bagger-alg/faq/verschil-tussen/#:~:text=Het%20uitgangspunt%20van%20het%20generieke,bodemkwaliteit%20zijn%20hier%20van%20toepassing>.

RIVM. n.d. Bodem, grond en grondwater, Rijksinstituut voor Volksgezondheid en Milieu

<https://rvs.rivm.nl/onderwerpen/normen/milieu/bodem-grond-en-grondwater#:~:text=normen%20zijn%20er%3F-,Bodemkwaliteit,en%20het%20Besluit%20kwaliteit%20leefomgeving>.

Soil Quality for Environmental Health. 2011. Soil Quality Management: Key Strategies for Agricultural Land, <http://soilquality.org/management.html>.

Vanino, S, et al., 2023. Barriers and opportunities of soil knowledge to address soil challenges: Stakeholders' perspectives across Europe, Journal of Environmental Management, Volume 325, Part B.

