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RAWFILL Deliverable
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Introduction

Prior to the geophysical surveys on site, historical documentation was collected and summarized in the Deliverable WP I1.1.1 Archives and inventory report. This report contains available information on waste streams and types of waste materials deposited within the landfill, including their localisation. In addition, remote imaging data was used to assess the overall area and extent of the landfill, as well as its historical extension. This analysis can be found in the Deliverable WP I1.1.2 Remote imaging report. This report aims to provide a summary of these two deliverables. The Resource Distribution Model (RDM), obtained by the correlation between geophysics and waste sample is also presented and compared to the historical data. Further information regarding the RDM of Meerhout landfill can be found in the Deliverable WP T3.1.1. Resource Distribution Model.

Summary of I1.1.1 – Archives and inventory report

The landfill site is located in Meerhout, Belgium and is owned by IOK (Company for Intercommunal Development in the area of Kempen, Flanders). The landfill site is overlaying Quaternary and Tertiary sands, under which a 50 metres thick layer of the Diest Formation can be found. The groundwater, flowing to the southwestern direction, has been identified at one meter depth. The groundwater is very vulnerable as the sandy water-bearing layer is only covered by sandy layer of less than 5 meters thick.

The archives mentioned that the landfill site was operational from 1962 until 1997. The site covered an area of 7.5 hectares. During its landfilling activity period, a total volume of ~1 313 500 m³ waste was deposited, mainly municipal solid waste (approximately 72% of the total volume) and industrial waste to a lesser extent (28%). These waste deposits were accumulated on top of the original ground level in five different stages, which lead to a spatial variation in waste thickness (see next section). After the deposition, the waste was mechanically compacted at a frequent rate (at least once a year).

A few systems were installed in order to monitor different emissions from the landfill and their impact to the environment. Each year, ~814 tonnes of leachate are collected, transported and treated in an external treatment centre. A monitoring system was set up to determine the amount of rainfall and to measure the leachate level within the landfill. Regarding gas emissions, a biogas motor was installed. However, since 2015 it is not operational anymore. Additionally, there is a gas flare which is still operational on a monthly basis.

Currently, the oldest part of the landfill site (northeastern part) is occupied by a waste sorting facility as well as a waste transfer station. This part was not sealed with HDPE foil,

in contrast to the other parts which were properly sealed. The capping of the landfill was performed in 1998 and consists of a HDPE foil, with a 1 m thick top soil layer.

Summary of I1.1.2 – Remote imaging report

Besides data inventories and archives, a lot of information can be retrieved through analysis of (historical) remote imaging. According to the different historical successive extensions of the landfill, five different zones were identified by using and comparing the different images. The waste disposal activity started in 1962 in the most northeastern part of the landfill. Up till 1971, only this zone was used for the disposal of waste (**Fig. 1A**). From then on, the landfill extended towards the west in three phases (1982, 1983 and 1986), resulting in three extra zones. In **Figure 1B** (1987-1988), the waste materials disposed in these zones can be observed. The southern part of the landfill became operational around 1989. From then on, the landfill was extended by increasing its thickness instead of its extent. This can be seen in **Fig. 1C**, where the waste disposal was already finished resulting in a difference of elevation of the landfill. Between 2008 and 2011 (**Fig. 1D**), the landfill was revegetalized with trees and shrubs.

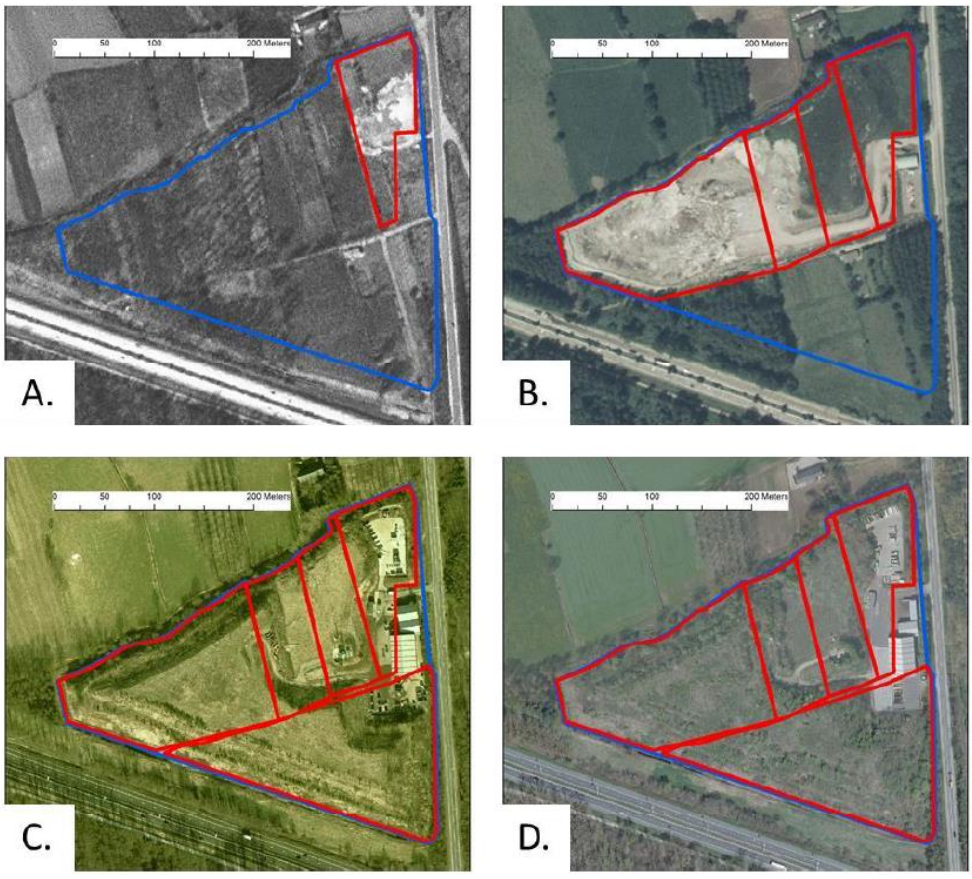

Figure 1 - Evolution of the Meerhout site extension: A. aerial image taken in 1971; B. aerial image taken between 1987 and 1988; C. aerial image taken between 2000-2003; D. aerial image taken between 2008-2011.

The topography of the landfill can be described as follows :

- The southern and the western part of the landfill are characterized by thicker waste deposits (up to 20 m above the initial topographic level (**Fig. 2C**)). This part consists of the most recent disposed waste materials;
- The northeastern part of the landfill correspond to the lowest part of the site characterized by an elevation of 4 m above the initial topographic level.

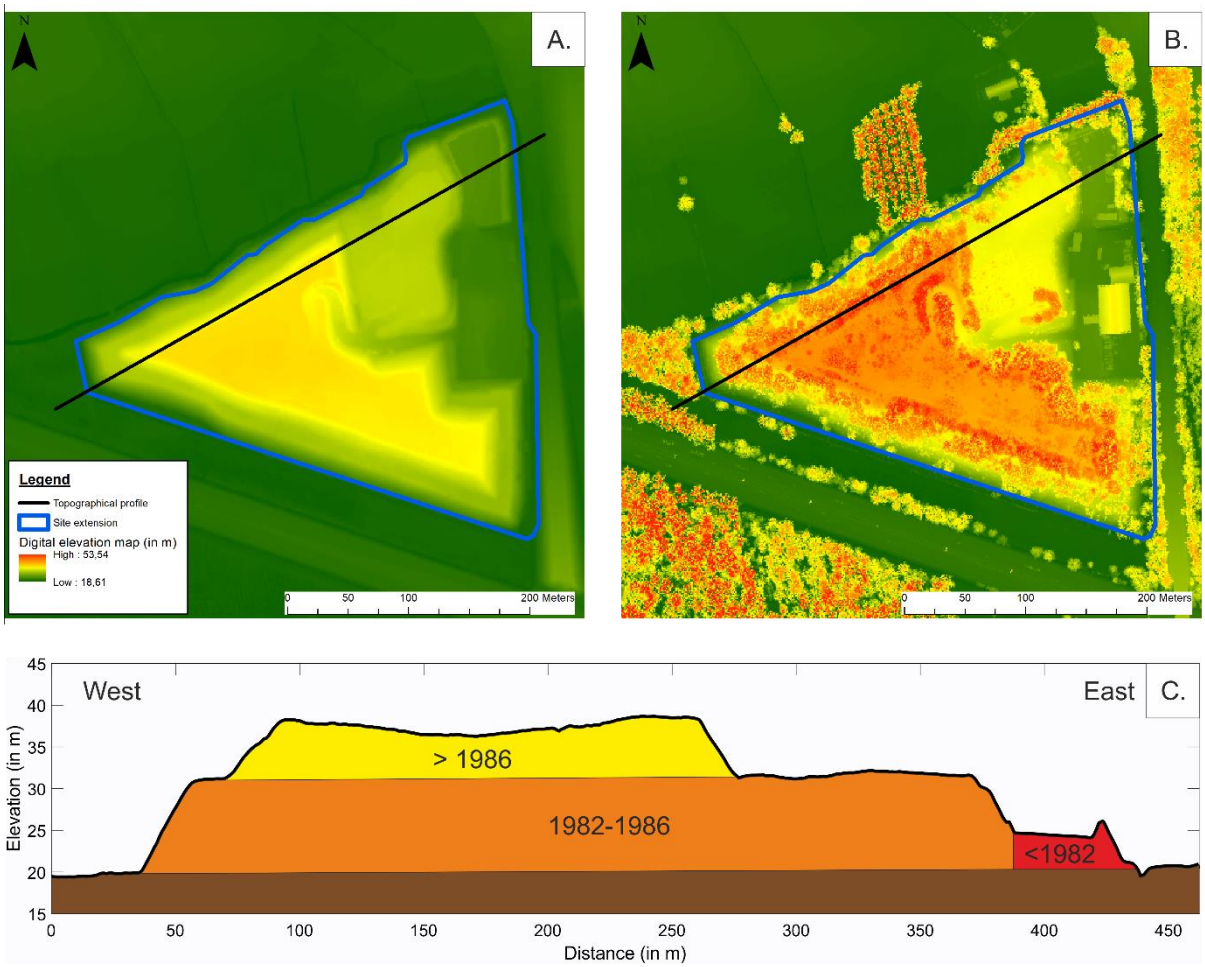

Figure 2 - The Meerhout landfill present topography: a. DEM soil elevation; b. DEM top of vegetation; c. cross-section.

Synthesis for the Meerhout landfill site

The Meerhout landfill site offers a look into the history of waste deposition in Flanders, due to its long period of landfilling activities (i.e. 1962 – 1997). Based on the archives and inventory report (Deliverable WP I1.1.1 Archives and inventory report), municipal solid waste and industrial waste materials are the main waste types that can be found within the landfill. This includes materials like plastics, demolition waste, metals and textile. Records estimated that the landfill has a minimum volume of 1.3 million m³. Considering this number doesn't include the oldest landfilled zones, the total landfill content can be estimated to be more than 1.5 million m³. The remote imaging report (Deliverable WP I1.1.2 Remote imaging report) showed that this total amount of waste was deposited in five phases, resulting in a variable landfill thickness across the site.

Comparison with results of the Resource Distribution Model (RDM)

Within the other activities of workpackage I1, geophysical measurements as well as a sampling campaign were carried out in order to get an accurate and updated view of the waste type and volume inside the landfill. Based on the coupling between geophysical data obtained on site and waste samples (for further information regarding the correlation, please refer to the Deliverable I1.3.4 - Correlation analysis report), a Resource Distribution Model (RDM) of the Meerhout landfill was built. **Figure 3** presents a 3D view of the RDM together with the distribution of the boreholes from the sampling campaign.

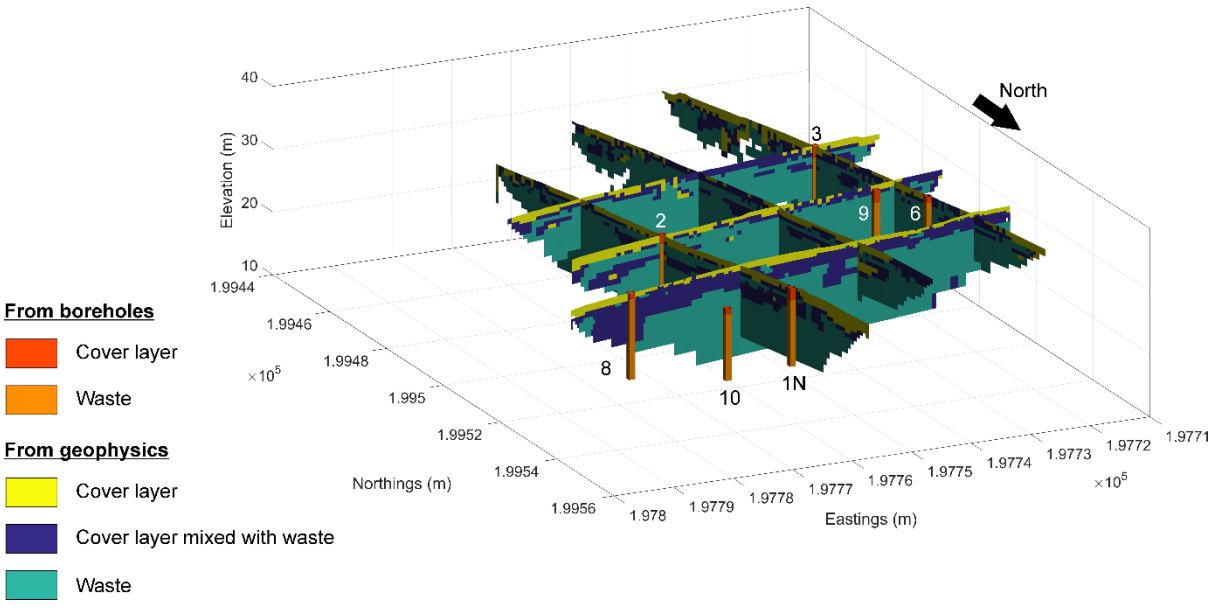

Figure 3 - RDM in the lower zone: the waste body is represented in green, yellow is the cover layer and blue is the cover layer material mixed with waste. Boreholes are the bars where red is the cover layer found and orange the waste extension.

The presented RDM extends only in the lower zone of the landfill which was accessible for the geophysical surveys as it does not have a geomembrane. This zone has a mean waste

thickness of 11 m (see **Fig. 2**). The interpreted layer of waste is displayed in green, in yellow the shallowest cover layer is represented (associated with a larger sand content) and in blue a second cover layer (silty sand mixed with waste) is displayed. Using the Digital Elevation Model (DEM) of the landfill (shown in **Fig. 2**) and the information from the boreholes, it was possible to estimate the total volume of the landfill which is approximately 850 000 m^3. Assuming a homogeneous cover layer of 1.5 m over the whole extent of the landfill, the maximum volume of waste present in Meerhout is 630 000 m^3. However, this amount also encompasses the dikes that were setup to stabilize the waste. Unfortunately, we lack information about the geometry of the latter to infer their volume.

Assuming that the boreholes drilled in the investigated zone are representative of the composition of the entire landfill and neglecting the dikes, it is possible to estimate the following content:

- Plastic (16.7 %): 145 000 T
- Metal (2.39 %): 20 800
- Stones (4.42 %): 38 400 T
- Glass (0.18 %): 1565 T
- Rubber (0.42%): 3650 T
- Paper (0.07%): 610 T

Lastly, there should be noted that the volume based on the Resource Distribution Model (~630 000 m^3) is relatively low in comparison with the volume mentioned within historical documents (see the section *"Summary of I1.1.1 – Archives and inventory report"*), namely ~1 313 500 m^3 of waste. This could be explained by the biodegradation process that has been going on since the closure of the landfill. Furthermore, the compaction of the material inside the landfill will as well contribute the lower volume calculated by means of the RDM.

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