CASE STUDY

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RECLAMATION OF AN EXISTING OPEN DUMP FOR SOLID WASTE IN BRASOV AREA

1. Introduction

Romania's waste system is governed by Law 211/2011, which has since been amended and completed. This complies with the European Parliament and Council Directive 2008/98/EC of November 19, 2008. In 2012 Romania recovered 40% of the total electronic waste generated, according to the latest available data from a study by the European Commission. This percentage is questioned by companies active in the field, which consider that it cannot be a fair share, given that the overall recycling rate in Romania is only 5%. "Statistics say that Romania has recovered 40% of its construction and demolition waste. This number cannot be correct. However, it is good to know that you don't have to start from scratch, there are countries in Europe that offer examples of best practice," said Geert Cuperus, secretary general of the International Recycling Federation (IRF).

At the national level, the Waste Management Plan ensures the extension of each county, ensuring that the laws in force are followed to reduce their negative environmental effects. These waste management strategies are created using the years 2021–2025 as a point of reference. Thus, forecasts are made about waste volume, management strategies, and environmental effects. Due to the categorization of waste under Romanian law, the activity must be quite precise. The unregulated accumulation of waste in Romania between 2014 through 2019 put the local authorities to the test. The storage infrastructure that was already in place was inadequate and frequently inadequate to the actual field circumstances. By 2025, it's anticipated that half of all garbage will be recycled and reused, 65 percent of packaging waste will be recycled and reused, 35 percent of all biodegradable waste will be decreased, and 15 percent of all waste will be reduced. Romania follows the expanding global trend of municipal waste treatment, which at the European level had an average of 23.5% in 2017. Municipal waste recycling also had a comparatively high average in 2017 of nearly 47%.By

2027, Romania and the rest of the EU will have switched over to a circular economy. Based on strategies and action plans that support the EU trend to reduce waste in proportion to investments in infrastructure, monitoring, recycling, and treatment, the waste generation, and management industry reduces waste these investments. Waste must be collected and transported to landfills using reuse and recycling techniques, under the supervision of central public authorities. In attempt to benefit from waste, organic materials must be reprocessed using technological procedures that can only be carried out in places that meet the requirements for selective storage and treatment. The entire populated region of Romania is under to planning. There are some exceptions to the planning, including the following: gaseous effluents released into the atmosphere, carbon dioxide captured and transported for geological storage, soils (in place concrete), including unexcavated contaminated soils, radioactive waste, non-hazardous feces, wastewater from animal products, and so forth. Romania adheres to the circular economy framework approved by the European Commission in 2015, which provides medium- and long-term possibilities to reduce the amount of waste produced [1]. The provisions of the Community Law for waste management are transposed into the appropriate laws for each form of waste. The goal of the national waste management plan is to increase life cycle sustainability, recycle waste, and minimize carbon emissions [2]. Because of the high degree of urban and rural development, population declines, such as those in Tulcea and Neamţ counties, do not always result in a fall in waste production. For instance, Romania had a population density of 83.4 inhabitants per km² in 2014 compared to 116.7 for the European Union. Investments in the infrastructure of landfills fluctuate due to changes in economic activity and the differences between rural and urban locations [3]. This is also the reason for the population's declining incomes and spending, which is also reflected in the amount of garbage (unemployed households, quantities approximately 31.3 percent lower than the normal average, employee households 36.8 percent more than the national average) [3].

2. Rasnov open dump

The open dump of Rasnov has an area of 2.29 hectares and has not been used since 2009, when landfilling was stopped. The closure of the landfill in this locality is part of Romania's obligations when it joined the European Union [4].

The open dump is located within the urban area of Rasnov and is limited by (*Figure 1*):

- To the north by a private property;
- To the north-west - asphalt mix production base;
- To the west - by the Paraul Mare;
- To the east - agricultural wasteland.

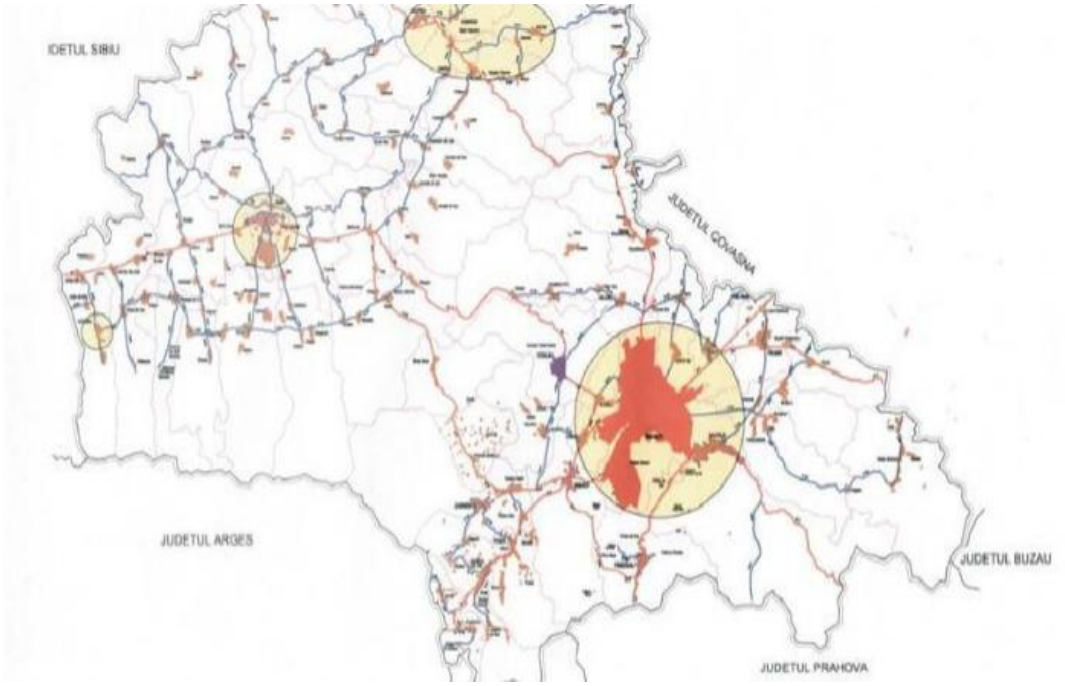

Figure 1. Location details about the open dump [5]

Work on the closure of the former open dump in Rasnov, which began in the first part of last year, is 86% complete [4].

There are several sources of pollution in the area, including garbage storage that resulted in biogas production, emissions, water vapor, leachate, odors, and microbial pollution. The lithology of the soil allows leachate to infiltrate into the groundwater due to the thin topsoil layer of around 0.15 m, which is followed by sandy and clayey soil. Technologies for waste management were nonexistent, unable to be used, and unsafe for disposal. In Brasov county, soils are varied. In the mountain area there are several types of soils: hunicosiliceous soils of alpine meadows (Fagarasului and Bucegi Mountains), humic-feriiluvial podzols and cryptopodzolic brown soils (Fagarasului, Bucegi, Leaota, Garbova, Ciucas Mountains), acid brown soils and podzolic brown soils (Fagarasului, Țaga, Piatra Craiului Mountains, northern side of Bucegi Mountains, Ciucas), acid brown soils (lower step of Fagaras Mountains, also Taga, Poiana Marului Platform, Codlei Mountains, Branului Platform) and locally, podzolic soils, clay-loam soils, cumezobazic brown soils and podzolic brown soils (lower SV step of Persian Mountains). In depressions we find brown soils, yellowish-brown soils and podzolic soils, and in the plains we find alluvial soils. Also on the territory of the county we find other soils, such as pseudorendzinic soils, regosols, acid brown soils. There are several irregularities in this location, including the access road being filled on both sides with a lot of waste and leachate that has created a swampy environment. The waste was not dumped on a ramp, but rather directly from the access road. Bulldozers are used for the waste layer's compaction. At the ramp's exit, the vehicles' cleanliness was not maintained. Foreign people and animals were able to access the storage ramp since it was not secure.

3. Surface water and underground water in Brasov area

The water streams that spring and/or cross Brasov county belong mostly to the Olt river basin. Important water catchments are found in the Harman-Prejmer vertical drainage system, which is composed of 48 boreholes with depths of 35-45 m supplying Brasov and Sacele with drinking water [6]. The boreholes in the eastern perimeter of Prejmer are generally used all year round (boreholes with high operating flow rates, ca. 50 l/s and a very good groundwater quality). The Harseni - Sasciori catchment front consists of 100 wells with depths of 40-60 m

supplying the Chemical Combine and the town of Fagaras. The flow rate supplied is between 800-1000 l/s, and the water is within the drinking water limits for all physico-chemical and bacteriological indicators [6].

On the territory of the county, about 20 communes have water supply in centralized system, mainly, the source of water is represented by spring catchments and groundwater. The population in the communes that do not have a centralized water supply system is supplied individually from the groundwater polluted by village wells or from spring water.

4. Impact of open dump

Water resources

There are no rainwater collection channels or waterproofing on the artificially constructed slopes. This results in more leachate building up. There is no leachate treatment facility because there is no drainage and collecting system. The nearest water source, about 50 meters from the ramp, is currently dry.

Figure 2. Brasov area: water sources.

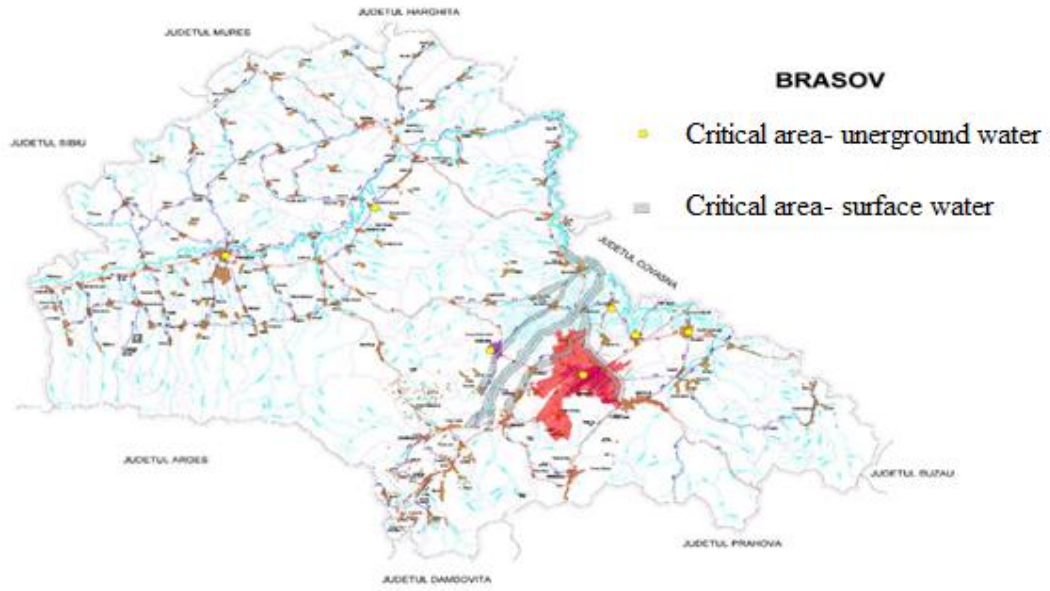

Figure 3. Impact of waste on the water resources in Brasov [7].

Leachate was collected in a natural pond because there was no drainage system or leachate collection, which made the occurrence of natural biological treatment visible.

Physico-chemical indicators, such as heavy metals, pH, nitrates, nitrites, copper, zinc, and biological indicators that indicate the degree of hazard to the population's health, will be used to monitor the quality of the surface and deep water and to demonstrate the possibility of groundwater and surface water contamination [8].

The correct identification of the advance of the contaminants in the soil is made possible by the salinity of the water in the relevant area, which is associated with the lithological distribution of the layers.

Soil

Pollution of the soil with excessive concentrations of heavy metals and harmful substances, as well as groundwater and surface water contamination, negatively affects the environment. Global warming gets worse over time as a result of gas emissions. Within 80 percent of the ramp, the natural vegetation has been completely devastated. Over time, the natural environment lost some of its aesthetic value, and improvements in the area were put off (*Figure 4*). For instance, the A3 road will be built next to the depot [9].

The variety in landfill waste types, the existing unevenness, and partial coatings with inert material cause the initial moisture content of the trash to be between 20 and 30 percent and to rise to 80 percent, causing pollution with chemical agents as well other types of pollutants. As a result, infiltrations into the soil occur, and an accumulation of leachate and rainwater at the ramp's entrance ensures a reduction in the number of pollutants through the swampy area it generates. It is a naturally occurring biological procedure that is specific to swampy locations, however, in the N-E portion of the deposit, the leachate seeps into the soil, causing a visible pollution phenomenon .

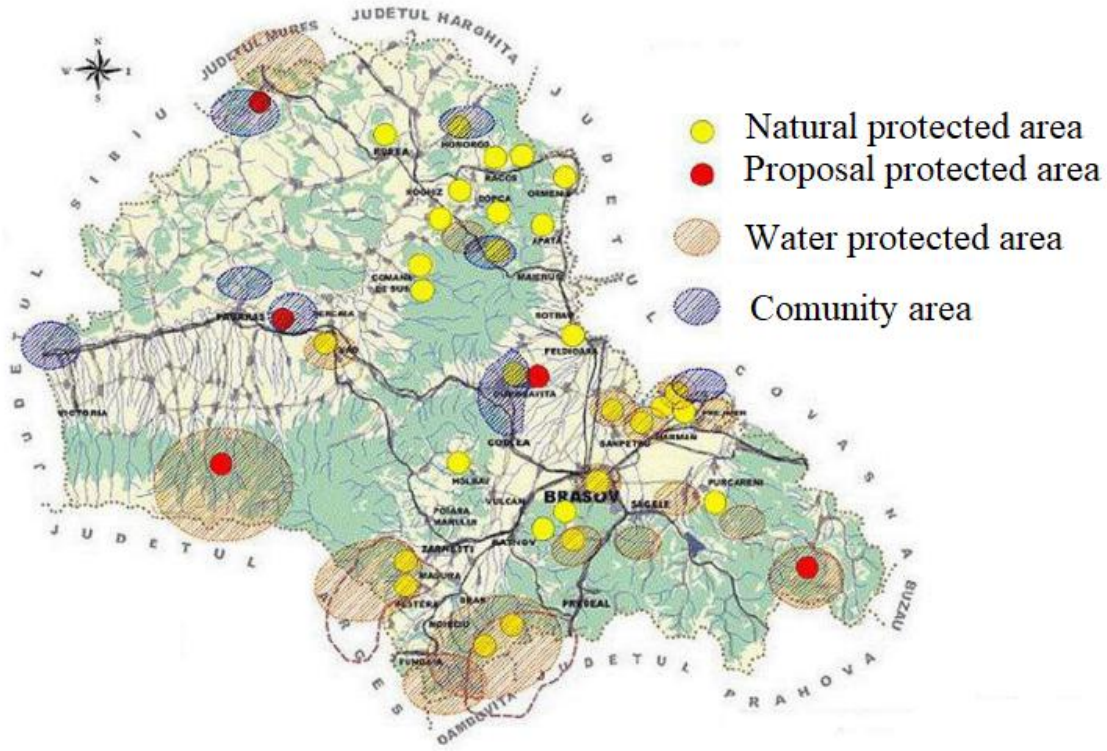

Figure 4. Protected area in Brasov

Air emission

The uncontrolled compaction of waste results in the production of biogas bags, which when not caught cause fires to start during the hot season. Due to the lack of biogas wells and the monitoring of the waste layer's penetration, their extinction cannot be prevented. Emissions from waste storage as a result of fermentation processes and not only, make the pollutants emitted and monitored fall into the following categories:

-Aerosols

-Gase pollutants-CO, CO2, hydrogen, methane, nitrogen

The wind rose highlighted that the fires produced in the respective area led to the spread of pollutants due to combustion products to the inhabited areas and the areas covered by vegetation. Monitoring was done in the N-V direction, in the N direction (Figure 5).

The measured concentrations were more than four times the highest permitted levels (maximum concentration: about 36 mg/m3). The development of acid rain, which is characterized by the burning of vegetation and is discernible by the impression of the matching pollutant feather in the area, is caused by the presence of sulfur oxides. The magnitude of such a breakdown of pollutants can range from 20 to 65 meters (*Figure 6*). In addition to all of these, transport vehicles also emit emissions that are related to the volume of traffic in the area, including carbon dioxide, aromatic hydrocarbons, naphthenes, paraffin, and polycyclic hydrocarbons [9].

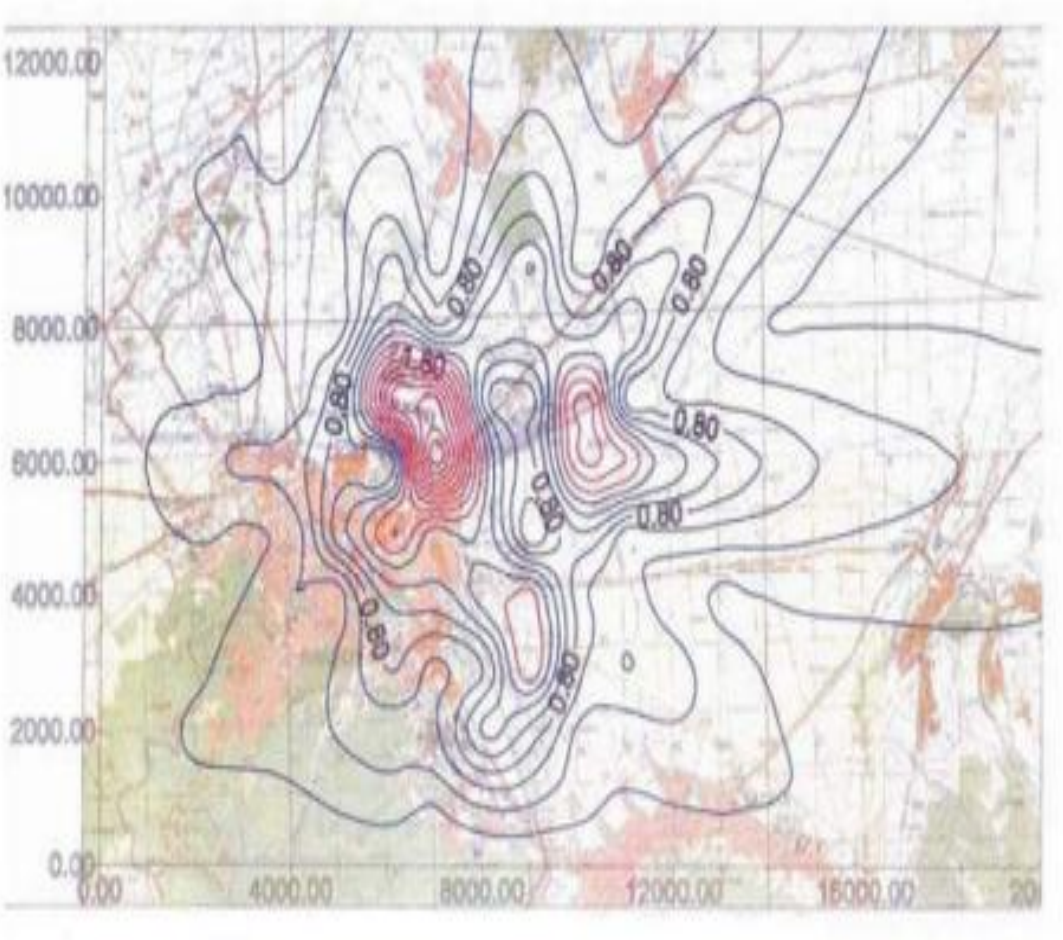

Figure 5. Air emission dispersion in Brasov area

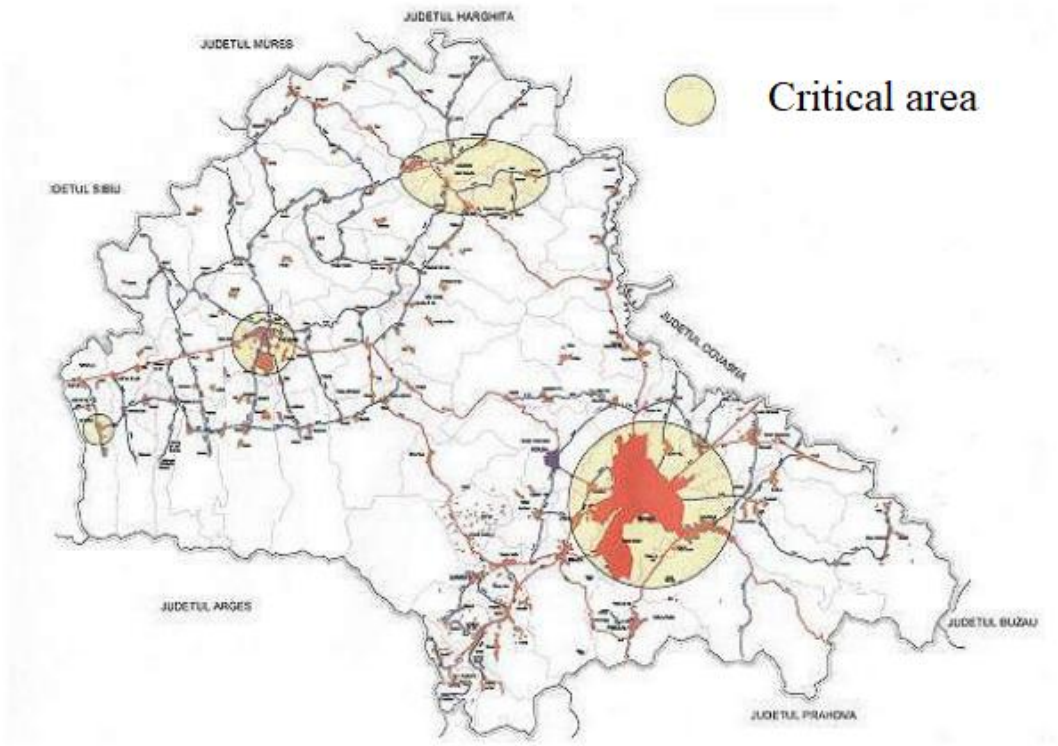

Figure 6. Critical area for air emission in Brasov [9]

5. Conclusions

Because the open dump must later be made green, the accuracy of the initial closure project is essential. Due to the impact of the deposit's activity on environmental elements on the site and in the surrounding areas, the difference between the current situation and the starting situation causes damage to environmental protection. Decision 349 / 21.04.2005, which defines the legislative framework required for the protection of the environment and the health of the population, provides the Romanian legislation for shutting and post-close monitoring of existing deposits. By constructing a waste transfer station nearby and then moving the material to an ecological landfill, this landfill will be replaced. The annual generation of more than 10,000 tons of waste serves as a rationale for the installation of this transfer station. This encourages recycling and recovery efforts for the many waste categories that are individually collected. It takes into account the danger of environmental contamination, infectious diseases, fly and rodent infestations, soil pollution, etc.

The regional waste management plans must be supported by local governments and the technical closure alternatives. The closure strategy calls for totally or partially filling potholes and unevenness, rearranging waste into a cap with a cap slope between 1:20 and 1:3, and closing the road. All of this is included in a simplified scenario based on the uncontrolled landfill's profile. All plastic foil, which is regarded as light waste, has been disposed of by being diverted to a landfill. By covering the waste with a layer of at least 30 cm of clay soil that is evenly spread throughout the dump, the area is considered to have been systematized. The compacted clay layer is also covered with at least 10 cm of topsoil. The upkeep of this green cover and ongoing study of the amount of leachate constitute post-closure monitoring. To determine the level of pollution the deposit has caused, the water from its monitoring wells must be tested. Closure must typically be founded on a functional process, which is based on the following steps:

1. Building the support layer

It must be at least 30 cm thick and not more than 1 meter thick. It needs to be waterproofed and leveled. Construction and demolition waste must not include more than 10% calcium carbonate to be used.

The coating's granulometry must be observed within a 10-cm area. Biogas energy recovery is not feasible since biogas collection cannot be done. The application of a geotextile separating layer should be connected with the waterproofing of the exterior surface (PEMD or PEFMD).

2. The waterproofing layer's construction

Clay material from two compact layers is put with a roller compactor to waterproof. The material's long-term durability is highly after.

3. Creating the rainfall drainage system

It is necessary to follow the guidelines for adhering to the minimum thickness requirement of 0.30 m, with the material being applied having particles between 4 and 32 mm in size. A geotextile layer must be applied in accordance with legal specifications, with respect for mass/unit of surface greater than or equal to 400 g /m2.

4. The green layer

It must have a thickness of at least one meter. At first, only grass will be planted, not any trees.

5. Collecting rainwater

The warehouse is surrounded by a perimeter canal made of reinforced concrete that empties into a retention basin.

6. Gas accumulating storage

It is suggested to collect a biogas collection system based on HDPE pipes with a tube thickness of 110 meters and lengths of approximately 10 meters, as well as concrete pipes with a diameter size of 1000 mm and lengths over 12 meters if it is discovered that the total measured quantity is more significant than 100 m3 per hour.

7. Reconfigure the access road

The access road needs to be over 180 meters long, 5.5 meters wide, and have a slope of about 2 percent. Typically, it should be constructed using crushed gravel that is spread over a layer of compact ballast. We must not lose sight of the 2.4 ha of land that is entirely taken up by rubbish. Because the landfill is not ecological, there is no waterproofing of the soil; the sole waterproofing is provided by the clay-rich lithological profile.

Action plans for reducing uncontrolled storage of applicable waste are base on the follow measures:

- achieve additional recycling capacity for paper / cardboard, metal, wood, glass and plastic packaging;
- construction and operation of fixed / mobile collection centers for special waste streams
- establishment of collection and treatment points for the material recovery and / or backfilling of non-hazardous waste from construction activities;
- arrangement of sites for the temporary storage of hazardous waste from construction activities, with a view to their subsequent treatment, recycling / recovery and / or disposal;
- intensify the authorities' control;

- ensuring storage for inert waste.

In March 2020, the European Commission adopted a New Action Plan for the Circular Economy, which is part of the new European agenda for sustainable development - the Green Pact. This document proposes immediate actions to help Europe to become a sustainable society with a competitive economy based on resource efficiency and overcoming the problems of environmental degradation and climate change.. The new Circular Economy Action Plan aims to prepare the European economy for a green future, to improve competitiveness, protect the environment and provide new consumer rights [10]. It focuses on production in the with the aim of making the best possible use of own resources. In order to achieve the aim of the 3 strategic objectives have been formulated, namely [10]:

- Objective I
  - increase the recycling rate of packaging waste;
- Objective II
  - sustainable packaging;
- Objective III
  - decouple the growth in the quantities of packaging waste from economic growth.

References

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