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LIFE GREENADAPT - Nature based solutions for climate change resilient waste infrastructures: A focus on landfill leachate and rainwater run-off.

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Abstract: GREEN ADAPT aims to increase the resilience of EU waste infrastructures (focused on landfills as potential source of severe pollution episodes when impacted by extreme events) against Climate Change by demonstrating blue-green infrastructures (BGI) and ecosystem-based approaches potential. GREEN ADAPT will demonstrate BGI ability to manage flush flooding and run-off caused by heavy rainfall and prevent fires and explosions caused by droughts and unusual heatwaves.

Keywords: Nature-based-solutions, landfill, leachate

Climate change is a global phenomenon from which Europe is not exempt. Waste infrastructure, such as landfills, will be vulnerable to further increases in average temperatures and rising sea-levels, frequency and intensity of extreme weather events (e.g. intense rainfall, very hot temperatures) with potential for droughts, flooding, heatwaves and greater pressure on resource availability, particularly water.

Landfill can remain operational (including the aftercare and restoration period) for 140 years or more. These facilities will potentially need to continue to operate under the changing climate conditions that will be experienced over the course of the 21st century, and beyond. Not only will climate change impacts need to be considered at the outset when designing new infrastructure, but there is likely a legacy (particularly of landfill sites) that may need enhanced resilience to deal with the future climate, and particularly extreme weather.

Landfills are particularly sensitive to climate change impacts, especially to heatwaves, floodings and droughts since they are usually open-aired and exposed to those factors. Recent estimates suggesting that there are at least 500,000 operational and closed landfills in the EU28 [1]. Most of them (~90% with an estimated total volume of 30–50 Gm3 of waste) are ‘non-sanitary’ and feature none or little protection technologies to limit the environmental impact on water, soil, climate and health [2].

One of the adverse effects introduced by climate severe changes is the increase of the leachate infiltrated into the soil and groundwater due to increased rainfall and run-off.

In the case study selected for GREENDAPT project (XILOGA’s landfill: Non-hazardous waste located in Galicia (NW Spain) leachate reaches around 20,000 m3/year of aqueous effluent generated by rainwater percolation through waste biochemical processes in cells and the inherent water content of water in residues.

Landfill leachate is generally a coloured stream with high concentrations of COD, BOD5, ammonia, heavy metals, etc. Its composition depends on waste nature, landfill age and climate (precipitation, seasonal weather variation, amount of infiltrating water). Optimal leachate treatment, to fully reduce the negative impact on the

environment, is still a challenge due its changing nature. Variations in leachates, both over time and from site to site, means that the most appropriate treatment should be simple, universal and adaptable. Conventional landfill leachate treatments (chemical oxidation, adsorption, stripping) require high construction, maintenance and operation costs. In contrast, treatment wetlands poses the capacity to adaptation while remaining affordable, sustainable and environmentally friendly as landfill leachate treatment.[3].

The project will include an innovative combination of improved treatment wetlands to enhance the water storage and performance of biodegradable organic compound and heavy metals removal from landfill leachate. These efforts include the implementation of a pre-treatment consisting in a Floating Treatment Wetland (FTW) followed by an innovative combination of Aerated Vertical flow TW [4] with geopolymers (GPs-ATW) used as filter media for landfill leachate and a system combining TW with microbial electrochemical technology (Electroactive biofilm-based treatment wetland, EAB TW) for stormwater run-off. The demo plant will be able to treat approximately 20.000 m^3 per year of landfill leachate and 1.300 m^3 per year of rainwater harvested (Figure 1).

The main expected results at the end of the project are an increased landfill life span of 50%, 1.065 m^3/year of polluted water spill overs avoided, 21.300 m^3/year of water available to natural watercourses, Freshwater consumption saving of 2.130 m^3/year and 116.702 tCO^2eq/year avoided.

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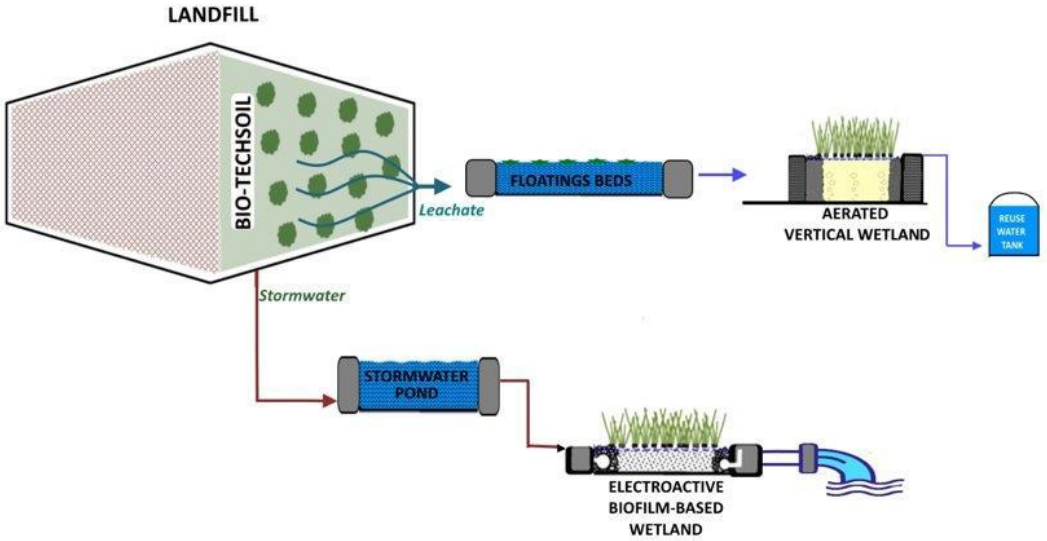

Figure 1: Diagram of the demo plant to treat landfill leacheate and stormwater run-off