



## **Insights into evapotranspiration in a temperate maritime climate as determined from large scale willow plantation lysimeters**

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Sealed basin willow evapotranspiration (ET) systems have started to be introduced as a treatment method for domestic wastewater effluent from single houses in Ireland in areas where effluent infiltration is problematic due to low permeability subsoil. The concept is that the high ET rates from the willow trees result in much lower rates of effluent hydraulic loading to the soil. A series of full-scale trials at 10 single houses have been across the country and monitored over a minimum of four years in order to assess the performance of such systems under Irish climatic conditions - i.e. a maritime temperate climate with reasonably consistent rainfall throughout the year. The results of these trials have been used to inform the national guidelines for the design of the full-scale systems, but these effectively large-scale lysimeters have also revealed interesting relationships on the relative importance of different meteorological parameters on ET in such a climate.

A sensitivity analysis was first carried out to determine the relative impact of the different meteorological parameters (temperature, relative humidity, wind speed, solar radiation and net radiation) on the calculated daily reference ET rates, according to the Penman Monteith daily reference ET equation. Continuous monitoring of rainfall, effluent flows and water level in the sealed systems (and soil porosity) over a four year period enabled water balance calculations to reveal the varying daily actual ET rates from the systems. These actual ET rates were then also compared statistically against the different meteorological parameters across several years of system operation. The results showed that, somewhat surprisingly that wind speed did not appear to be a major factor with respect to ET rates; rather net radiation was found to influence ET rates the most significantly followed by air temperature. In addition, ET was also shown to be dependent on water availability (as expected) with the highest mean daily rates during the growing seasons when rainfall levels were high compared to relatively warm, drier summers. The Irish maritime climate, with its typical high relative humidity levels throughout the year, resulted in muted evapotranspiration performance of the systems compared to studies in other countries. There was also a high degree of variance in ET rates between the willow systems, which could be attributed to different effluent loadings, different soil porosities, and different rates of development of the willow trees. On average it was determined that the actual annual ET from the systems was approximately 2.2 times (the crop coefficient) the reference value.