

Heathrow Airport Limited (HAL)

Aerated horizontal subsurface flow reed bed (HSSF)

AIRPORT RUNOFF



Project

Mayfield Farm Upgrades

Location

Hounslow, London, UK

Project type

Re-engineering and upgrade to aerated wetland technology with Forced Bed Aeration (FBA™)

Wastewater type

Industrial (de-icer contaminated storm runoff), event driven, high flow, high strength, low temperature

Treatment process

Floating reed beds, aerated lagoon, 12 saturated horizontal flow aerated wetlands

Need

Large volumes of chemical de-icers are applied to aircraft and runway surfaces every year at airports to ensure safe winter operating conditions. Aviation de-icer formulations have very high oxygen demands which can lead to oxygen depletion of receiving watercourses, if discharged without pre-treatment. In the context of wastewater treatment, one commercial aircraft can require a de-icer volume equivalent to the strength of domestic wastewater generated by 10,000 people in one day.

At Heathrow Airport, storm runoff from the 290ha Southern catchment area, containing de-icing stands, taxiways and a section of runway, is conveyed to Mayfield Farm treatment system and treated prior to discharging to a Nature Reserve. Increasing passenger numbers and aircraft movements, led to an exponential growth in the volume of de-icing chemicals used at the airport resulting in the original passive horizontal subsurface flow (HSSF) reed bed system receiving pollutant loads well in excess of its design capability. Treatment in the passive HSSF beds was oxygen limited due to higher oxygen demands in the influent than could be passively transferred into the reed beds. Furthermore, de-icer contaminated runoff is nutrient limited resulting in suboptimal conditions for treatment biomass growth. Effluent was not achieving compliance and was being tankered off-site at great expense.

Solution

The entire system was refurbished and upgraded in 2010/11 by ARM and its partner NWC and all 12 reed beds were refurbished from the original passive HSSF configuration to aerated horizontal subsurface flow (HSSF) reed beds containing FBA™, removing treatment oxygen limitations. The depth of the reed beds were increased to optimise oxygen transfer rates and maximise pollutant removal rates, within the footprint of the existing system. The upgrade increased the design BOD load of the system tenfold from 374kg/d to 3,500kg/d.





Overview of the aerated wetland FBA™ beds shortly after planting (right), example of influent and effluent samples (above).

Time series graph (below) showing Mayfield Farm influent and final effluent BOD₅ concentrations throughout the 2017/18 winter operations period at Heathrow Airport. The period between March and April 2018 was known as the 'Beast from the East'. The average BOD₅ removal was 97% with an annual average BOD discharge concentration of 4.43mg/l across the 2017/18 winter period, despite the system receiving more than double its design concentration.

Additionally, a nutrient dosing system was installed to balance carbon, nitrogen and phosphorous ratios stoichiometrically for optimal microbial growth and biological pollutant removal. Much of the process was automated through a SCADA system and real-time water quality monitors help operators to make fast and informed decisions on how best to operate the system.

Benefits

Over its first eight years of operation, the system processed c. 3.2M m³ of de-icer contaminated storm runoff, enough to fill 1,280 Olympic sized swimming pools and has removed over 860,000 kg of de-icer associated BOD. The aerated horizontal subsurface flow (HSSF) reed bed containing FBA™ technology is now a demonstrated component of airport de-icer management systems and offers the following key benefits;

- Consistent and very high-quality final effluent
- Meets environmental permit limits
- Resilient against extreme shock loading winter storm events
- Green solution creating habitat with high biodiversity value
- Sustainable and economical compared with alternative solutions

