

## CAFRE Constructed Wetland Performance – 10 year update

by

Greg Forbes, AFBI, Hillsborough and Martin Mulholland, Cafre

The constructed wetland at Greenmount Campus, Cafre has been successfully treating farmyard dirty water since it was installed in 2004. During the 12 year period since construction, the wetland has consistently reduced the concentration of pollutants in the dirty water to very low levels. In particular, the dirty water biochemical oxygen demand (BOD) has been reduced by approximately 99% from 1,805 mg/litre to 7.7 mg/litre. Over the 12 year period, there have been no breaches of the NIEA discharge consent limit of 40 mg/litre under which the wetland is operated. Other components of the dirty water such as phosphorus, nitrogen, pH and electrical conductivity have also been reduced to very acceptable levels.

**Table 1. Greenmount constructed wetland dirty water treatment performance (10 year averages)**

Contaminant	Inlet	Outlet
Biochemical oxygen demand (BOD) (mg/litre)	1,805	7.7
Total phosphorus (mg/litre)	58.8	7.0
Ammonium nitrogen (mg/litre)	6.6	0.9

### Wetland construction

Development of the Greenmount constructed wetland began in spring 2004. The purpose of the development was to test the effectiveness of using a man-made wetland system to treat dirty water from a dairy farm to a quality sufficient for it to be discharged directly to local surface waters. Constructed wetlands have been in widespread and successful use in many other countries, generally for the treatment of municipal wastewaters and some industrial and food processing effluents. Constructed wetlands work through a combination of the activities of microbes and the root systems of aquatic plants within the pond breaking down and filtering the contaminants in the dirty water. In the basic process, contaminants can settle out, be absorbed by plants and adhere to or become trapped within roots and soils in succeeding ponds.

### Greenmount wetland

The Greenmount constructed wetland consists of five ponds ranging in size from 1,250 to 3,200 m<sup>2</sup> with a total area of 1.25 hectares. The wetland pond area was designed to be twice the footprint area of the original Greenmount dairy unit at 6,600 m<sup>2</sup>. The ponds were excavated to the depth of the local clay which was then compacted using a vibrating roller to achieve an impermeable base. This avoided the expense of a synthetic liner. Successive ponds were sited to provide a fall of at least 300mm to allow the dirty water to flow through the system by gravity. Approximately 18 m<sup>3</sup> per day of dirty water was conveyed from the Greenmount dairy centre through 150mm diameter pipe network to the wetland that, combined with rainfall on ponds, produced an average daily volume of 50 m<sup>3</sup> that passed through and was treated within the wetland. Sources of dirty water treated by the Greenmount wetland include parlour washings, winter silage clamp effluent run-off and livestock

yard run-off. The constructed wetland was designed to achieve a dirty water retention time of approximately 70 days before the treated water is discharged to the Sixmilewater river.

Daily outflow from the wetland averaged approximately 25 m<sup>3</sup> per day. The difference between volumes of inflow and outflow were found to be due to evaporation of water transpired by the aquatic plants in the wetland, a process known as evapotranspiration. In all but one year to date, there was no discharge from the Greenmount wetland during summer months from April to September.

#### **Construction costs and investment payback**

Constructed wetlands are a relatively low cost technology that offers potential costs savings and environmental benefits compared to standard concrete and steel works normally employed to contain dirty water prior to land spreading. To minimise the size and construction cost of a farm wetland, clean and dirty water should be separated where feasible. As a rule-of-thumb, to allow sufficient dirty water residence time for effective treatment, the size of a wetland should be twice the area of dirty yards and unroofed silos from which dirty water will be treated.

Constructing a 6,000 m<sup>2</sup> wetland on a farm with dirty yard and un-roofed silo areas of 3,000 m<sup>2</sup> may cost between £20,000 and £30,000. Savings in land spreading and storage costs should ensure a 4 to 5 year payback on the investment. On farms with heavy land where more than 6 weeks dirty water storage is required, the payback period for a constructed wetland will be significantly reduced.