Retention of Sediment and Nutrients at Whinton Hill, Cumbria

MOPS MITIGATIONOPTIONS FORPHOSPHORUS&SEDIMENT

Research

Three field wetlands created in the Whinton Hill catchment (Figure 1) were surveyed annually for annual accumulation of sediment (Figures 2 and 3) and nutrients - phosphorus (P), nitrogen (N) and carbon (C). Daily water samples collected at Shelduck wetland (April 2011-October 2012) allowed the effectiveness of the wetlands for reducing diffuse pollution to be determined (Figure 4).

Results

Over three years, the three field wetlands at this site trapped a total of :

70 tonnes of sediment (Figure 2), including

100 kg of P, 300 kg of N, 4000 kg of C.

Most of the sediment came from gully erosion (Figure 3) following a burst field drain in 2010 and 2011, which did not occur in the hydrological year 2012.

Field wetland location was important to maximize interception of surface runoff. Local ground profiling could be used to direct runoff into wetlands.

Mean water pollutant concentrations at Shelduck field wetland were reduced by 50% for suspended sediment, 60% for total P and 35% for total N (Figure 4).

Dye tracing tests indicated that water residence time in the wetlands was 7-20 times longer than in the equivalent length of ditch.

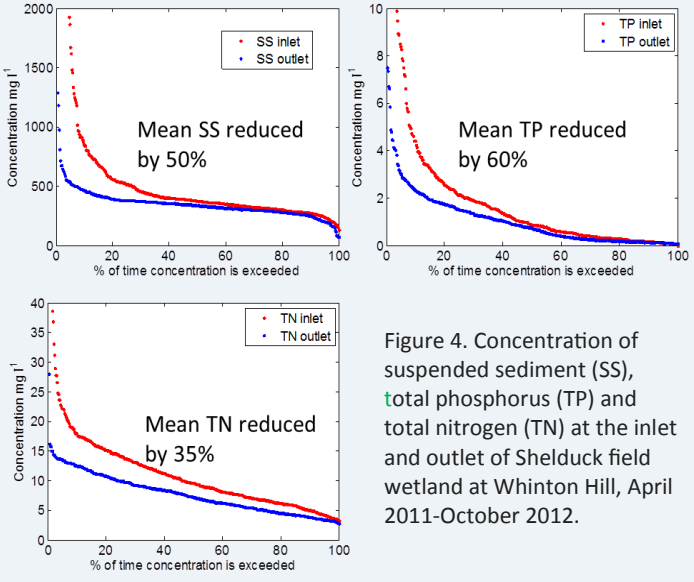

Figure 4. Concentration of suspended sediment (SS), total phosphorus (TP) and total nitrogen (TN) at the inlet and outlet of Shelduck field wetland at Whinton Hill, April 2011-October 2012.

Site Plan

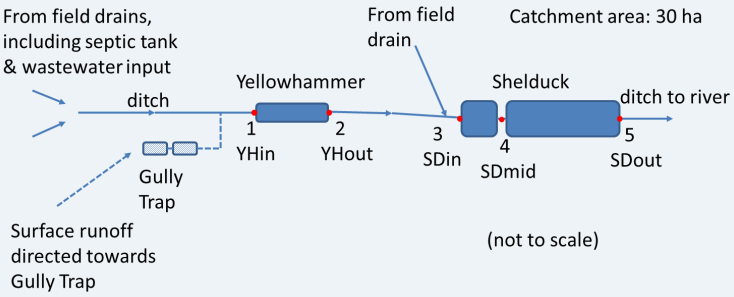

Figure 1. Flow pathways and sampling points at Whinton Hill.

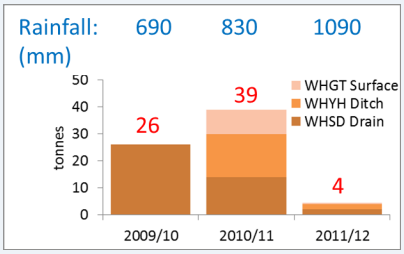

Figure 2 (above). Annual rainfall and mass of sediment trapped in each of the field wetlands at Whinton Hill, for the hydrological years 2010-2012 (1 October—30 September).

Figure 3. Gully erosion in 2010 (top right) resulted in the complete filling of Gully Trap wetland (bottom right) which was later dredged out.

Key Messages

- All three field wetlands had a positive impact, with net accumulation of sediment and nutrients in each wetland on an annual basis.
- The water quality improved as water moved through the wetland/ditch system, with lower concentrations of sediment and nutrients at the wetland outlets than the inlets, particularly when inlet concentrations were high .
- Field wetlands can store water for an order of magnitude longer than the adjacent/receiving ditch or stream under the same flow conditions, thus providing an opportunity for sediment and nutrients to settle out or be taken up by plants and micro-organisms.

LANCASTER UNIVERSITY

Further Information

This work was carried out by Lancaster University for the MOPS2 project, funded by the UK Department for Environment, Food and Rural Affairs (Defra) under contract WQ0127. To find out more, or if you have comments or queries, please view our website: mops2.diffusepollution.info or email us at: mops@lancaster.ac.uk.