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INCA Modelling of the Lee System: strategies for the reduction of nitrogen loads

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Abstract. The Integrated Nitrogen Catchment model (INCA) was applied successfully to simulate nitrogen concentrations in the River Lee, a northern tributary of the River Thames for 1995-1999. Leaching from urban and agricultural areas was found to control nitrogen dynamics in reaches unaffected by effluent discharges and abstractions; the occurrence of minimal flows resulted in an upward trend in nitrate concentration. Sewage treatment works (STW) discharging into the River Lee raised nitrate concentrations substantially, a problem which was compounded by abstractions in the Lower Lee. The average concentration of nitrate (NO_3^-) for the simulation period 1995-96 was 7.87 mg N l^{-1} . Ammonium (NH_4^+) concentrations were simulated less successfully. However, concentrations of ammonium rarely rose to levels which would be of environmental concern. Scenarios were run through INCA to assess strategies for the reduction of nitrate concentrations in the catchment. The conversion of arable land to ungrazed vegetation or to woodland would reduce nitrate concentrations substantially, whilst inclusion of riparian buffer strips would be unsuccessful in reducing nitrate loading. A 50% reduction in nitrate loading from Luton STW would result in a fall of up to 5 mg N l^{-1} in the reach directly affected (concentrations fell from maxima of 13 to 8 mg N l^{-1} , nearly a 40 % reduction), whilst a 20% reduction in abstractions would reduce maximum peaks in concentration in the lower Lee by up to 4 mg l^{-1} (from 17 to 13 mg N l^{-1} , nearly a 25 % reduction),.

Keywords: modelling, water quality, nitrogen, nitrate, ammonium, INCA, River Lee, River Thames, land-use.

[Final Revised Paper](#) (PDF, 865 KB)

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