

Managed aquifer recharge (MAR) to enhance groundwater resources for irrigation in a coastal agricultural catchment in the Crag aquifer, Suffolk

Research Summary 4: MAR scheme regulation

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Background

Water resources in East Anglia are under pressure due to population growth, demand for irrigated crops and climate change. It is predicted that the dry year annual average spray irrigation demand will increase by 59-220 x 10³ m³/day by 2050 from a baseline of 190 x 10³ m³/day¹. Matching growth with enhanced environmental protection requires innovative solutions. Managed aquifer recharge (MAR) offers the possibility of storing excess surface winter high flows underground for later abstraction during periods of peak demand. The Crag aquifer at Bucklesham in Suffolk (Fig. 1) was selected for a demonstration MAR scheme (Figs 1, 2) with the purpose of supplying additional irrigation water during periods of high summer demand. The outputs of the study enable the scheme to sufficiently inform a roadmap for similar MAR initiatives in the UK.

1. Water Resources East (2022). *Draft regional water resources plan for eastern England*. Water Resources East (WRE) Ltd, Norwich, 91 pp.

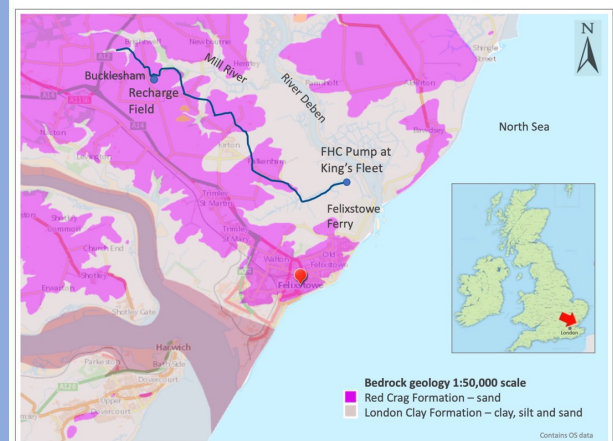


Fig. 1 Location map showing surface geology and the King's Fleet pumping station (FHC Pump) at Felixstowe Ferry and the MAR site at Bucklesham. The blue line shows the dual-pipeline to transfer water inland to farm reservoirs and the MAR site.

Design of the MAR scheme

Water is sourced from the King's Fleet at Felixstowe Ferry (Fig. 1), where the East Suffolk Internal Drainage Board pumps more than 1 x 10⁶ m³ of water each year into the River Deben. Following construction, water is transferred 14 km inland to participating farms where it is stored in reservoirs ready for irrigation and also to supply the MAR scheme at Bucklesham (Figs 1, 2).

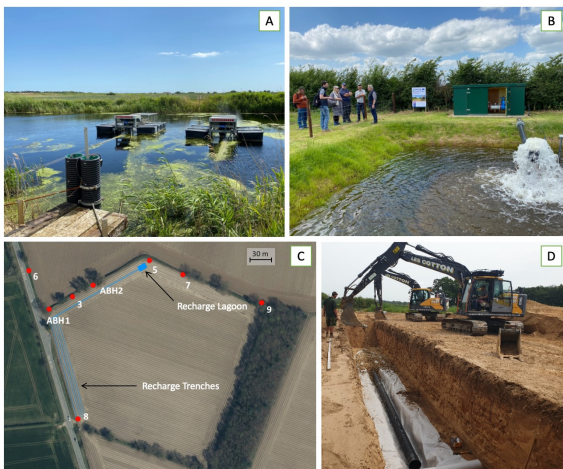


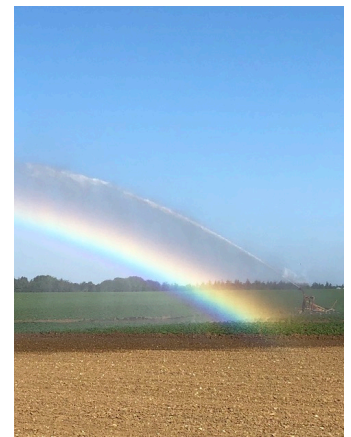
Fig. 2 A: Surface water abstraction location in the King's Fleet showing the eel-friendly, Riverscreen source-water pumps. B: Recharge lagoon at the Bucklesham MAR site in operation. C: Abstraction borehole (ABH1, ABH2) and observation borehole location plan, including the position of the recharge lagoon and layout of infiltration trenches. D: Recharge distribution trench under construction.

Further details

More information about the project is available at <https://www.fresh4cs.eu>. For specific enquires, contact Prof. Kevin Hiscock (email: k.hiscock@uea.ac.uk).

Regulatory aspects

For the approval of MAR schemes in England, the Environment Agency (EA) requires: (i) an abstraction licence or a groundwater investigation consent for the abstraction of water from an aquifer or surface water; and (ii) an environmental permit or exemption for the discharge of any water to surface water or groundwater. Data collection followed by discussion with the EA indicated that the primary regulatory concern was the potential impact of the MAR scheme on chloride concentrations within the receiving Crag aquifer.



For permitting purposes an 'absolute threshold' for chloride of 250 mg L⁻¹ based on the Drinking Water Standard, and a 'relative threshold' limiting chloride levels in the aquifer to an increase of no more than 10% from base levels were set by the EA. Additional regulatory concerns related to other potential contaminants and potential water resource impacts on nearby water features (streams, licensed abstractions and protected rights). The risks of other contaminants were considered low in the case of the Suffolk MAR scheme.

Summary

Water resource impacts were considered to be a low risk with any effects on the nearest water feature, the spring-fed lakes at Bucklesham Hall, likely to be below detection thresholds. The MAR trial showed that the risk of threshold exceedance for chloride can be minimized by: (i) setting a limit to the chloride levels in the source water; and (ii) introducing relatively small volumes of water into the aquifer and ensuring that a high proportion of this is re-abtracted. The EA would likely include limits and operational requirements to reflect these measures in future discharge consent/abstraction licence determined for this and similar MAR schemes.