



## Demonstration Test Catchments Project – Summary Paper

### Background

Nearly three-quarters of the UK land surface is in agricultural production. The influence of farming on water resources and supported ecosystems has been thrown more into focus with new legislation and policy initiatives at both European and National levels. Diffuse pollution of aquatic systems is a significant barrier to continued improvements to our lakes and rivers, while groundwater quality continues to deteriorate. New concepts, such as ecosystem services, new legislation such as the Water Framework Directive and new challenges such as a changing climate, demand more integrated and holistic approaches to environmental management with better collaboration within and between all the main stakeholders.

Integrated Catchment Management (ICM) and Integrated Water Resource Management (IWRM) are terms for emerging environmental management approaches that recognise the river catchment as the appropriate organising unit for understanding and managing our environment, in a context that includes social, economic and political considerations. The process requires the interaction between the broad communities of stakeholders, regulators and scientists.

### Policy Drivers and Questions

The European Water Framework Directive has as its main objectives no deterioration and the achievement of good ecological status in surface waters and a good status for groundwater by 2015. It is envisaged that in England this will be achieved through existing schemes and initiatives, particularly: Cross compliance; the England Catchment Sensitive Farming Delivery Initiative (ECSFDI), and the Agri-environment schemes. It is the intention to also implement Regulatory Water Protection Zones where there is clear evidence that existing voluntary mechanisms are not sufficient by themselves to achieve the required environmental objectives.

However, the implementation of such measures will need to take place in the context of reducing greenhouse gas emissions and maintaining food security for the country.

The project takes as its starting point the problem rather than potential solutions; thus “where agricultural activity is affecting water quality and its ecosystem, how can this be reduced so that good ecological status and good groundwater status as defined by the WFD can be achieved”

### Overall Objectives

The Demonstration Test Catchments (DTC) project will provide a research platform from which an integrated assessment of the effectiveness of potential mitigation measures for

reducing diffuse pollution from agriculture can be developed. It will consider the impacts and effects on both ecosystems and sustainable production.

The project will produce evidence to test the hypothesis that we can cost-effectively reduce the impact of agriculturally derived diffuse pollution on ecology and the delivery of ecosystem services through the implementation of multiple on-farm measures.

The outcomes will be delivered by linking currently disparate research on interrelated impacts of agriculture on the environment, developing communities of practice with wider stakeholder groups and using existing data, information and knowledge more effectively to provide a more robust evidence base.

Initially, the focus will be diffuse water pollution and water use in agriculture. Biodiversity, air quality, soil quality and greenhouse gas emission tradeoffs will be considered where there is an interface with water quality. However, in the longer term the framework will encourage other research strands from additional funders to be joined - e.g. on climate change, flood risk etc.

### **Specific Objectives**

***Evidence for the success of measures*** - The DTC project aims to test the efficacy of both novel and existing measures for the mitigation of agriculturally derived pollutants from multiple and diffuse sources. The measures tested will be those that can be integrated into farming practice without disproportionately impacting food production (i.e. not requiring large areas of land to be taken out of production). The evidence base for existing measures will be drawn together from work already being undertaken within the Demonstration Catchments and from work being undertaken elsewhere within the UK and in Europe.

***Understanding the implications of scale*** - The effect of implementing measures on the farm or in the field, which are needed to achieve improvements at larger spatial scales need to be better understood. Key questions to answer will be what works well where, why and how much is needed? In addition we need to understand better the intrinsic delay in the system, particularly where pollutant transport is via long pathways, and the recovery of ecosystems once water quality is improved.

***Understanding the complexity of the interacting factors*** - River catchments are highly complex systems. We must understand their workings better from both natural sciences and the socio-economic viewpoints in order that we can manage the land to maximise the ecosystem services provided. There are multiple interactions between the sometimes-competing environmental, social and economic factors that we seldom consider holistically. Which are the linkages that affect the system most and where and how should we intervene to achieve the most benefit at least cost?

***Developing an approach for use everywhere*** - All river catchments are different but have similar problems. The DTC project must develop an evidence-based approach so that the results can be applied to other catchments. Although the detailed way in which measures are applied will differ between catchments, the approach to designing the solutions should be similar. This will make the process more transparent to interested stakeholders. We wish to develop an approach that uses data, information and knowledge appropriately. Measures selected for testing will not initially be prescribed; rather they will be applied as appropriate

to local pressures. However, the ultimate aim is to provide more robust evidence to support an improved diffuse pollution “user manual”

### **The Project**

The aims and objectives outlined above will be achieved through an approach that brings together the bio-physical sciences, social science and economics. If land use management decisions are to be undertaken with any degree of confidence, a more systemic process for understanding water flow, pollutant flux and pathway transformation within and between environmental compartments in river basins will need to be adopted. This should be underpinned by an integrated conceptual modelling approach to the key processes that determine the way in which river basins function which in turn should be linked to the collection of data and scientific knowledge. As a result, decision-making to remedy existing and potential environmental pressures and impacts, will be based on the best scientific understanding and perception of the environment.

There are huge uncertainties because of the complexity of the interacting systems and the gaps in our understanding. We wish to fill those gaps using monitoring data, scientific research and local knowledge, but transforming it through a linked monitoring/modelling approach into information, knowledge and ultimately understanding.

It is essential when developing a collaborative approach that all parties have the same concept of the environment and the issues. The development of a conceptual model for each catchment will therefore be a pre-requisite. New research should aim to test and improve the current conceptual models.

Traditional monitoring schemes are largely inadequate to provide the data required to understand the system (flow pathways and biogeochemical transformations) or predict the consequences of management interventions sufficiently well. They need to take into account the inherent high spatial and temporal variability in diffuse pollution. The DTC project will therefore invest in new infrastructure in support of monitoring regimes, linked to a modelling approach, to allow sufficient understanding to be developed.

Data collected from a monitoring array should cover groundwater, surface water, flow and ecology and is needed for four broad objectives:

- 1) Identifying the status quo (characterisation or source identification)
- 2) Understanding the system (flow pathways and biogeochemical transformations)
- 3) Predicting the consequences of management options and;
- 4) Verifying the success/failure of interventions to the system (source control or pathway modification) once an option is chosen and in place.

To meet these requirements it will need to be appropriately distributed across the catchment and be able to allow us to understand the problems of the different geographical scales (i.e. from field to farm to catchment) as well as the temporal scales where a significant component of the pollutant flux is carried by the groundwater (e.g. nitrate in Chalk aquifer fed rivers). A nested approach for catchments and the monitoring therein may be appropriate. The temporal variability of run-off and recharge must be understood and monitoring systems will need to be sufficiently comprehensive and adaptable to measure fluxes across the catchment, rather than water quality at single points. The data must be

adequately compared against controls to rule out the effects of external factors such as a changing climate as well as being compatible with field-scale monitoring to test individual measures.

### The Beneficiaries

The outcomes of the DTC research platform will benefit the whole community engaged on land and water management. Although the project is led nationally by policy makers (Defra and the Environment Agency), it will encompass the interests of all other relevant sectors in a collaborative approach. In particular the farming community (including land owners, farmers and their advisors) and those involved more broadly in managing the countryside, various sector stakeholders (e.g. Water Companies, Environmental NGOs ) and the research community (universities and research institutes) will come together in each of the catchments using the DTC project as a focus. An aim is to develop communities of practice, which develop approaches that fit the discrete geographical and local circumstances, but will also be able to learn from each other and serve as examples to communities in other catchments.

### The Catchments

Three pilot catchments have been selected as case studies for this project from the nine catchments currently undergoing enhanced monitoring under the England Catchment Sensitive Farming Delivery Initiative. They are: the River Wensum in Norfolk, the River Eden in Cumbria and the River Avon in Hampshire. They have been selected for their variable geographical, geological, pedological, climatic features and agricultural land use. They are all ECSFDI priority catchments.

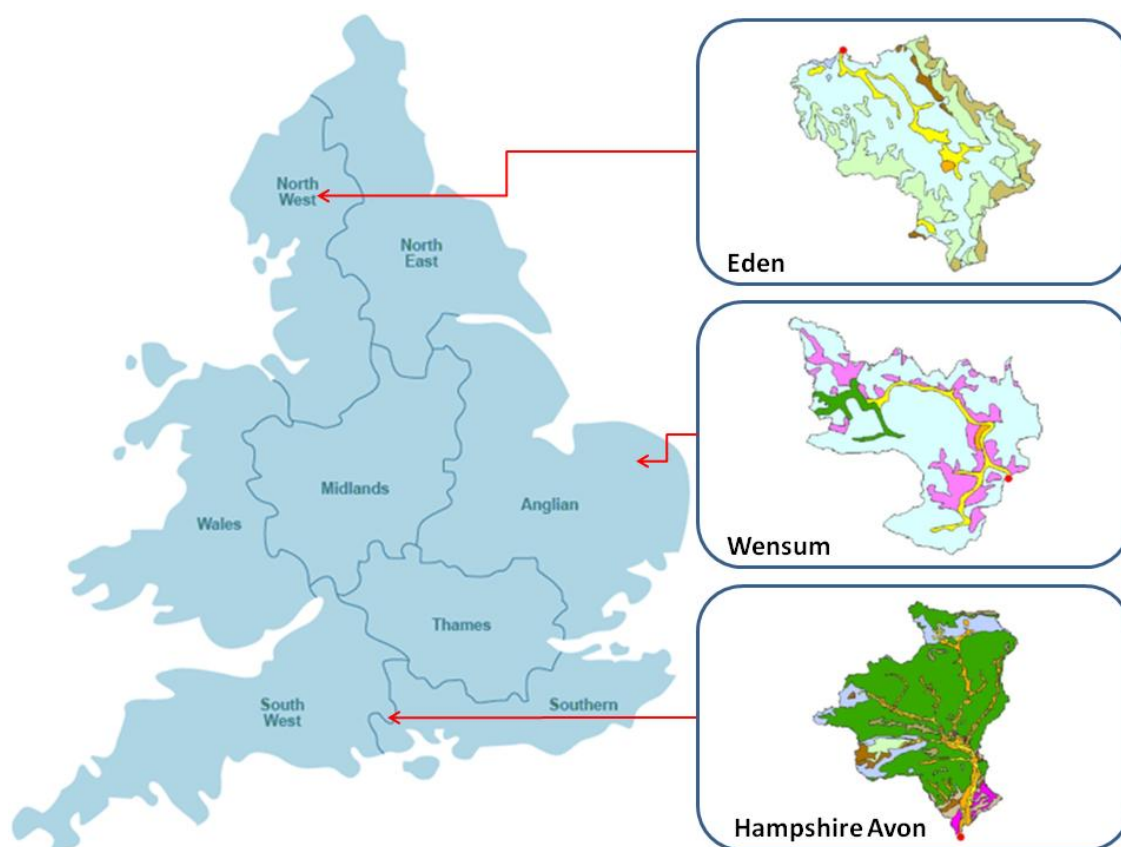


Figure 1: Location of Demonstration Test Catchments: Colours indicate variation in geology. (Source, EA)

## The Programme and Research Consortia

New R&D consortia will oversee and co-ordinate the research activities in each catchment. The consortia will not be exclusive and there will be free exchange between the demonstration catchments. We will encourage the interchange of research approaches, experimentation and results being carried out in other catchments.

Individual research projects will be commissioned to test the effect of measures, both individually and in combination. The rapid transfer of new approaches or existing measures whose success is confirmed by monitoring is a key objective of the project. It is intended to actively demonstrate successful measures to policy-makers, regulators, farmers and other groups to encourage rapid acceptance and take-up.

The research consortia will be established in each catchment by December 2009 and working to a broad specification will by Spring 2010:

- Identify sub-catchments to work in
- Capture information on pollution sources (agricultural and non-agricultural) and existing farming practices
- Design a monitoring/modelling approach (compatible with standards set for a national data repository)
- Implement monitoring strategy

There are a number of key criteria that will define the selection of the sub-catchments:

- Farmers must be already engaged in participatory approaches or their engagement is anticipated;
- Need to work in the real world – can't control for everything.
- Need to be able to apply findings to other parts of the country – though all catchments are unique

## Contacts

### **Defra Project Manager:**

Dr Dan McGonigle,  
Address: Farming and Food Science,  
Area 4E LMB, 17 Smith Square,  
London, SW1P 3JR  
Phone: 0207 238 1521  
Fax: 0207 238 1540  
Email: [daniel.mcgonigle@defra.gsi.gov.uk](mailto:daniel.mcgonigle@defra.gsi.gov.uk)

### **EA Project Manager:**

Dr Sean Burke,  
Evidence Directorate  
Phone: 07776 498542,  
Email: [sean.burke@environment-agency.gov.uk](mailto:sean.burke@environment-agency.gov.uk)

### **Project Officer:**

Dr Luke Spadavecchia,  
Farming and Food Science (as above)  
Email: [Luke.Spadavecchia@defra.gsi.gov.uk](mailto:Luke.Spadavecchia@defra.gsi.gov.uk)  
General enquiries: [dtc@defra.gsi.gov.uk](mailto:dtc@defra.gsi.gov.uk)

### **DTC Secretariat:**

Prof Bob Harris,  
Phone: 07714 063880,  
Email: [robert.harris@defra.gsi.gov.uk](mailto:robert.harris@defra.gsi.gov.uk)