

The Broads is a unique recreational and natural resource. Providing safe inland navigation over 125 miles of lock free waterways, it is home to approx 13,000 recreational vessels, both motor and sail, with up to 1000 vessel movements per day. Boats provide an excellent way to explore this internationally recognised wetland, with large areas of the waterways designated under the Birds and Habitats Directives for the ecology and wildlife it supports.

The Broads Authority, as the navigation authority, has adopted a strategic catchment approach to managing sediment. This approach provides long-term combined benefits to water quality, ecosystems and navigation, it also reduces the burden on toll payers for maintenance of the navigation. The Strategy, for the first time, provides an overview of the challenge of managing the Broads waterways and the opportunity to target resources effectively.

The overall goal for sediment management is to achieve a balance of inputs with outputs, whilst dealing with the backlog of sediment that has accumulated more rapidly over the last six decades. In addition to this build up, rising dredging costs since the early 1980s have resulted in a decrease in the volume of material routinely removed. Accumulated sediment can result in boats running aground in some areas and broads failing to achieve water quality improvements required to meet Government's public service agreement targets for SSSI condition. It is these areas that need priority dredging works in the short to medium term. However, to ensure that long-term sediment removal requirements are less, actions to minimise sediment inputs, particularly from banks, headwaters and algal input are required.

The backlog has been identified by comprehensive assessment of the sediment within the rivers and broads, using information from hydrographic survey, desk study of sediment inputs and sediment quality survey. These data combined with boating and lake restoration needs enable the Broads Authority to take a proactive and evidence-based approach to sediment management.

The analysis of hydrographic survey information alongside the waterway specifications and lake restoration requirements has identified:

- 1.7million cubic metres for removal
- 57% of this removal requirement is from the northern rivers
- 16% and 27% from the southern rivers and isolated water bodies respectively
- at current removal costs, £27.5 million would be required to achieve total compliance across the Broads, thus the Strategy and Action Plan sets out the short-term removal priorities alongside the long-term sustainable approach;
- the costs for disposal of this material will be in the region of a further £10 million.

The Strategy provides a combined assessment of dredging with flood management activities. This allows the cumulative impact of these schemes to be judged to ensure that there is no adverse impact on people, property and wildlife.

This Strategy recognises the long response time of waterways to changes in catchment management and anticipates the gradual delivery of a reduction in sediment inputs. The Action Plan, however, details the steps that can be taken over the next 5-10 years to remove sediment and put in place effective sediment management.

To address the historic build up of sediment in the Broads will be a considerable challenge. The Authority and stakeholders will need to continue to work together throughout the implementation of the Action Plan, to prioritise works within limited resources, and to find solutions where there might be conflicting needs.

## Foreword

*John Packman*

*Chief Executive*

It is difficult to overestimate the importance of this document, and the evidence-based approach it encapsulates, for the long-term management of the Broads. The Broads are not natural waterbodies and they require intervention and management to enhance their value to people and wildlife. It is a complex system and this is the first time the Authority has gained, with the benefit of research from Cranfield University, an understanding of how much sediment comes into the system and where it comes from.

The preparation of the Strategy has included the first comprehensive hydrographic survey of the river and broads. The comparison of this information with a set of specifications developed with users has provided a complete picture of what would be required to reach an ideal state in terms of navigable water. Until now the Authority and its predecessors have had to take a reactive stance in their management. Now, with the benefit of this study the Authority can plan its management of mud, not just through a dredging and disposal plan but also actions to reduce sediment input.

Managing the Broads has always been a big challenge and the historical record shows that dredging has been an issue for the last 500 years. The impact of climate change will make this at least as big, if not a bigger challenge, for the next 500 years. Using science and evidence the Authority and those who come after us will be able to manage that rate of change for the benefit of people and nature.

I would like to thank Trudi Wakelin in particular who, as the Authority's Director of Waterways, has led the whole project from start to finish. Andrea Kelly's support has been crucial together with other members of the Waterways Team in what has been a hugely ambitious endeavour.

The Steering Group, ably chaired by David Adler, has been invaluable in guiding the project and their advice, time and support for our work is greatly appreciated.

Thanks also are due to Defra, and in particular Alun Michael MP, for providing the additional National Park Grant that made this research possible. ■

# 1 Introduction

**‘The Sediment Management Strategy provides a new framework for local dredging operations to care for the navigation and improve the condition of the water bodies within the Broads. It makes us think both where this sediment has come from and how we can work in partnership for the long-term sustainable management of the Broads’**

*David Adler, Chairman, Sediment Management Strategy Steering Group.*

The waterways in Broadland are home to some of the shallowest lakes in Europe, and are subject to filling in by vegetation (Moss, 2001). For centuries people have managed the waterbodies, with records going back to 1543 where there was ‘a gret comunicacion’ in the city court about the ‘ffeyeng’ of the river. Fying out is a dialect word meaning cleaning or ‘sorting out’ (Malster, 2003). Many waterbodies were lost to shallowing and land drainage practices in the late 1800s (George, 1992). There are also many records in the 1930s, 1950s and 1960s of the problems of going aground in the rivers and broads (Malster, 2003).

The Broads Authority and its contractors carry out maintenance dredging<sup>1</sup> on a routine basis with two main objectives: securing a reasonable navigation depth<sup>2</sup> for users, and restoring degraded or shallowing waterbodies to improve the aquatic habitat water quality.

The central aim of sediment management is to maintain and improve the waterways for nature and people alike. Over the last six decades there has been an increased rate of sedimentation as result of bank erosion, agricultural practice and nutrient enrichment. In addition, the rising cost of dredging and consequent decrease in sediment removed have resulted in an increasing need to minimise sediment entering watercourses, as well as removing that already accumulated.

Accumulated sediment has an obvious impact on navigation and recreation as well as the achievement of lake restoration goals, such as clear water and ecosystem recovery. Sediment removal needs prioritising in the short to medium term, whilst developing actions to minimise sediment inputs.

The aim of the Sediment Management Strategy is to provide, for the first time, an overview of the challenges of managing the Broads waterways to be able to target resources effectively. The Strategy achieves this by compiling a comprehensive assessment of the sediment within the rivers and broads (using information from a hydrographic survey, a desk based study of sediment inputs, sediment quality data and information from stakeholder consultations on user requirements) to enable the Broads Authority to take a proactive, rather than a reactive, approach to the sediment management. This work provides a synthesis of our knowledge of the sediment budget, and a new insight to managing Broadland for people and wildlife.

In taking this holistic approach it has also been necessary to work closely with partners and interested parties to ensure that all issues have been addressed. Broads users have had continuing input through the Steering Group and committees of the Broads Authority to discuss and agree the way forward, developing a consensus approach.

Whilst this strategy focuses on the Broads area, there is recognition that sediment management fits into a wider decision making process. Catchment-

<sup>1</sup> Maintenance dredging involves removal of soft accumulated sediments to restore the original water depth. Deepening (ie by the removal of the hard bed, such as peat or gravel) is not carried out in the Broads.

<sup>2</sup> Reasonable navigation depth has been defined through a process of consultation with users to derive the waterway specifications.

## Why do we need a Sediment Management Strategy?

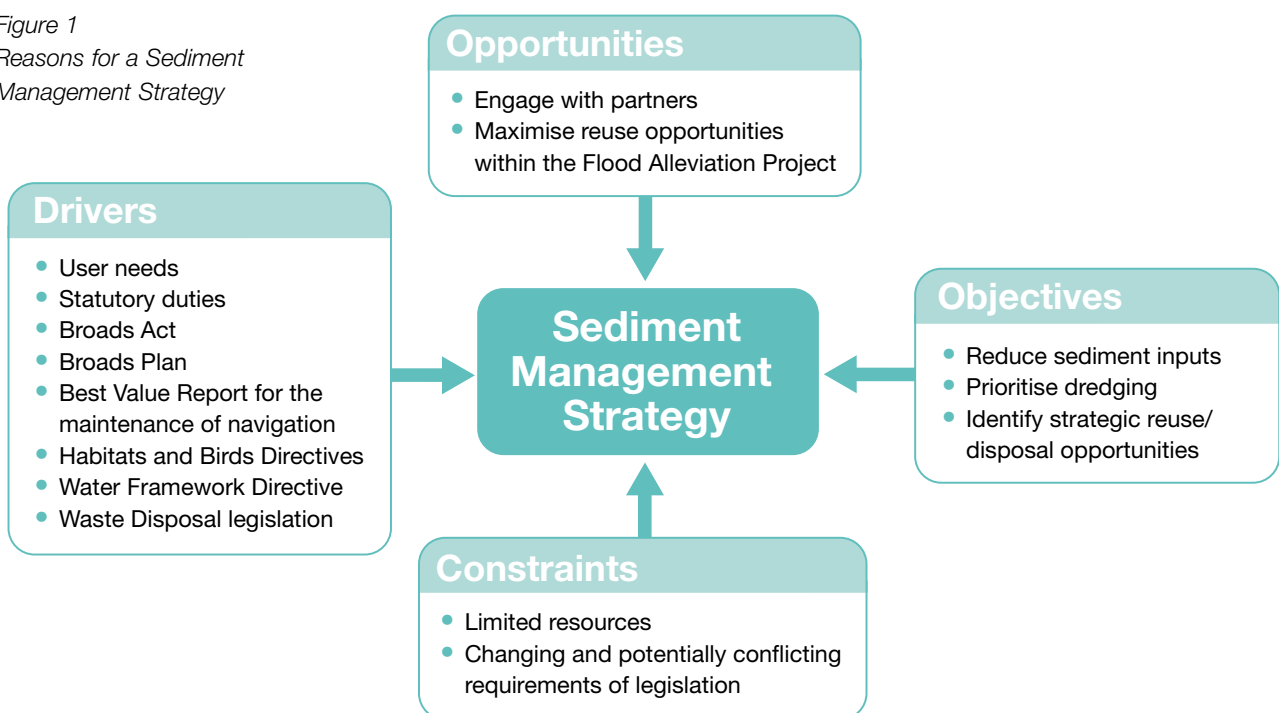
scale sediment issues provide a framework for integrated working to deliver goals for farming, conservation, recreation and economies. In addition, this strategic review will inform other catchment-scale initiatives, such as Water Framework Directive Programme of Measures, and Catchment Sensitive Farming. It also provides a clear remit and justification for the Authority's involvement in such schemes. This long-term and sustainable approach towards sediment management is similarly important for integration of waterway maintenance activities into developing legislation.

The Broads Plan 2004 (the statutory management plan for the Broads area as required by the 1988 Norfolk & Suffolk Broads Act) provides evidence of the need to work at a catchment scale to address some of the challenges facing the Broads, and to develop consensus for the future. This Sediment Management Strategy works at this catchment scale and builds on the Best Value Review of Navigation, (undertaken in the late 1990s as part of local government performance improvement requirement) which recommended that:

'the Authority continue working towards a Dredging Disposal Strategy to:

- i) Update and prioritise future dredging using joint survey data from the Broadland Flood Alleviation Project (BFAP)
- ii) Construct a sediment budget for the Broads with the Environment Agency (EA)
- iii) Identify alternative management strategies for reducing sediment inputs
- iv) Identify the volumes of silt requiring disposal to land sites versus reuse eg in flood bank strengthening, in order to produce a phased plan for network of disposal sites
- v) Engage with partners to develop opportunities for reuse and sustainable disposal options.'

Figure 1  
Reasons for a Sediment Management Strategy



Adoption of a strategic approach, which considers issues from source to sink, both provides a framework for cost-effective resource targeting and facilitates the preparation of a clear proposal for increased resources. In addition, this strategic review of sediment issues creates an opportunity to inform catchment-scale initiatives, such as the Water Framework Directive River Basin Management Plan, and Catchment Sensitive Farming. It is also hoped that by adopting and promoting a long-term and sustainable approach towards sediment management, Government will enable easy integration of essential waterway maintenance activities into future developing legislation.

Ongoing dredging, particularly in combination with dredging by Great Yarmouth Port Authority, land drainage, flood management works across the Broads and water abstraction within the catchment, has the ability to affect both water levels and saline intrusion within the river system. Such changes could adversely impact Natura 2000<sup>3</sup> protected sites. Potential impacts on these protected sites will be assessed as the Strategy and the Action Plan is evaluated through appropriate assessment.

In addition, during the last 20 years dredging disposal has become a regulated activity under new Waste Management legislation to provide enhanced environmental protection. This has led to increased cost and complexity for sediment disposal and the Sediment Management Strategy provides a framework to accommodate this developing legislation.

<sup>3</sup> Natura 2000 network of sites aims to preserve biodiversity by maintaining or restoring natural habitats of European importance.

**Sediment Management Strategy Steering Group**

Development of the Strategy has been steered by a group of stakeholders, practitioners and academics, working together for a period of 2 years. This Group has prepared objectives, supervised research projects to fill knowledge gaps, and worked with officers of the Authority in the production of the Strategy document. (See Terms of Reference, Appendix 2)

**The aims of the strategy**

**Aim**

To provide a framework for the sustainable long-term management of sediment within the Broads to protect both inland navigation and the internationally important wetland.

**Objectives**

- Identify sources and volume of sediment entering the Broads
- Reduce sediment load to the waterways through partnership working
- Balance sediment inputs with future planned dredging (following removal of the current sediment backlog)
- Define waterway specifications, and hence the dredging requirement and having done so evaluate and minimise its environmental impact
- Maximise beneficial reuse of sediment
- Target and prioritise expenditure
- Adopt a risk-based approach to planning works
- Influence wider legislation and policy for sustainable and integrated management on a catchment scale.