Integrating ecosystem services within a 50-year Vision for wetlands

Wetland Vision Technical Document: Overview and reporting of project philosophy and approach

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This report was developed specifically as an annex for the Wetland Vision Technical Document. The contents do not necessarily reflect the views of any of the Wetland Vision Project partners.
INTEGRATING ECOSYSTEM SERVICES WITHIN A 50-YEAR VISION FOR WETLANDS

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EXECUTIVE SUMMARY

Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fibre and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth. The degradation and loss of wetlands was identified within the Millennium Ecosystem Assessment (MA) process as being more rapid than that for other ecosystems.

The England Wetland Vision partnership consists of English Heritage, the Environment Agency, Natural England, the Royal Society for the Protection of Birds (RSPB) and The Wildlife Trusts. The objective of the England Wetland Vision is to articulate a spatial vision for freshwater wetlands and provide support, through the production of guidance material, to local wetland visions. The Partnership has recognised that the Vision would be strengthened by a more explicit inclusion of ecosystem services. This report sets out to provide material for broadening the England Wetland Vision to demonstrate the benefits of, and the approach to, describing ecosystem services.

Ecosystem services are defined as the benefits people obtain from ecosystems. These benefits are indispensable for both the natural environment and human well-being. The report provides examples of the following ecosystem services:

- provisioning services such as food and water;
- regulating services such as regulation of floods, drought, land degradation, and disease;
- supporting services such as soil formation and nutrient cycling; and
- cultural services such as recreational, spiritual, religious, and other nonmaterial benefits

The national Wetland Vision has captured many local visions. These local visions vary in scale, complexity and focus. Using freely available and published evidence a review was conducted of the following six local visions:

- Great Fen project
- Rainham Marshes
- River Quaggy
- Little Ouse Headwaters Project
- Lincolnshire coastal grazing marsh project
- Peatlands for People

The review focussed on assessing the language and terminology employed to articulate ecosystem services; the principal focus of each of the local visions; and the range of planned and serendipitous ecosystem services provided by each local vision. All of the local visions delivered both biodiversity benefits and wider ecosystem services. In all cases the total number of ecosystem services delivered was greater than the planned or articulated number. Based on this review a conceptual framework has been proposed which seeks to adopt as its overriding principle the desire to maximise opportunities for biodiversity whilst optimising the delivery of ecosystem services for the benefit of society. This very much embraces the philosophy of the ecosystem approach where conservation and sustainable use are promoted in an equitable way.

Recommendations are provided on how the England Wetland Vision could embrace ecosystem services more fully. The recommendations encompass philosophical and technical approaches, including how to understand better how datasets could be interrogated and manipulated to define ecosystem services and how language can be used to convey the concept to a wide audiences. The recommendations are prioritised into immediate and longer-term actions.

1 http://www.millenniumassessment.org/en/Index.aspx
2 http://www.wetlandvision.org.uk/
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1 INTRODUCTION

1.1 The Millennium Ecosystem Assessment

The Millennium Ecosystem Assessment (MA)\(^3\) was an international work programme that focused on ecosystem services (the benefits people and society obtain from ecosystems), how changes in ecosystem services have affected human well-being, how ecosystem changes may affect people in future decades, and response options that might be adopted at local, national, or global scales to improve ecosystem management and thereby contribute to human well-being and poverty alleviation.

The MA was called for by the United Nations Secretary-General Kofi Annan in 2000. Initiated in 2001, the objective of the MA was to assess the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being. The MA has involved the work of more than 1,360 experts worldwide. Their findings, contained in five technical volumes and six synthesis reports, provide a state-of-the-art scientific appraisal of the condition and trends in the world’s ecosystems and the services they provide (such as clean water, food, forest products, flood control, and natural resources) and the options to restore, conserve or enhance the sustainable use of ecosystems.

1.1.1 What are the main findings of the MA?

Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fibre and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth. The degradation and loss of wetlands was identified within the MA process as being more rapid than that for other ecosystems.

The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people. These problems, unless addressed, will diminish substantially the benefits that future generations obtain from ecosystems. The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals\(^4\).

The challenge of reversing the degradation of ecosystems while meeting increasing demands for services can be partially met under some scenarios considered by the MA, but will involve significant changes in policies, institutions and practices that are not currently under way. Many options exist to conserve or enhance specific ecosystem services in ways that reduce negative trade-offs or that provide positive synergies with other ecosystem services.

The bottom line of the MA findings is that human actions are depleting Earth’s natural capital, putting such strain on the environment that the ability of the planet’s ecosystems to sustain future generations can no longer be taken for granted. At the same time, the assessment shows that with appropriate actions it is possible to reverse the degradation of many ecosystem services over the next 50 years, but the changes in policy and practice required are substantial and not currently underway.

1.1.2 Key wetland messages within the MA

In addition to the main MA report, five synthesis reports integrated the general findings that are significant to five main subject areas. All of these synthesis reports carried the general title “Ecosystems and Human Well-being”. The synthesis reports cover Biodiversity (prepared for the Convention on Biological Diversity

\(^3\) http://www.millenniumassessment.org/en/Index.aspx

\(^4\) http://www.un.org/millenniumgoals/
The Wetlands and Water synthesis report includes a Key Messages section and a Summary for Decision-Makers as well as chapters on the distribution of wetlands and their species; wetland services; drivers of loss and change to wetland ecosystems; human well-being; scenarios for the future of wetlands; and responses for the wise use of wetlands (Millennium Ecosystem Assessment, 2005a).

In parallel to the Key Messages prefaced to the wetlands synthesis report, the Ramsar Scientific and Technical Review Panel (STRP), at its February 2005 meeting, endorsed 14 key messages for the reader to take away from the document, and these were presented to the 9th Meeting of the Conference of the Parties to the Convention on Wetlands (COP9) in November 2005. The key messages are:

1. A cross-sectoral focus is urgently needed from policy- and decision-makers that emphasizes securing wetland ecosystems and their services in the context of achieving sustainable development and improving human well-being.

2. Management of wetlands and water resources is most successfully addressed through integrated management at the river (or lake or aquifer) basin scale that is linked to coastal zone management for coastal and near-shore wetlands and that takes into account water allocations for the ecosystems.

3. Wetlands deliver a wide range of critical and important services (e.g. fish and fibre, water supply, water purification, coastal protection, recreational opportunities, and increasingly, tourism) vital for human well-being. Maintaining the natural functioning of wetlands will enable them to continue to deliver these services.

4. The principal supply of renewable fresh water for humans comes from an array of wetland types, including lakes, rivers, swamps and groundwater aquifers. Up to three billion people are dependent on groundwater as a source of drinking water, but such abstractions increasingly exceed their recharge from surface wetlands.

5. The services delivered by wetlands have been arguably valued at US$14 trillion annually. Economic valuation now provides a powerful tool for placing wetlands on the agenda of conservation and development decision-makers.

6. Wetlands encompass a significant proportion of the area of the planet; the global estimate is 1280 million hectares (equivalent to approximately 9% of land surface) and is recognized as an under-estimate.

7. The degradation and loss of wetlands is more rapid than that for other ecosystems. Similarly, the status of both freshwater and, to a lesser extent, coastal species is deteriorating faster than that of species in other ecosystems. Wetland-dependent biodiversity in many parts of the world is in continuing and accelerating decline.

8. Wetland loss and degradation has primarily been driven by land conversion and infrastructure development, water abstraction, eutrophication and pollution and over-exploitation. Losses tend to be more rapid where populations are increasing most and where demands for increased economic development are greatest. There are a number of broad, interrelated economic reasons, including perverse subsidies, why wetlands continue to be lost and degraded.

9. Global climate change is expected to further exacerbate the loss and degradation of wetland biodiversity including species that cannot relocate and migratory species that rely on a number of wetlands at different stages of their life cycle.

10. The continuing loss and degradation of wetlands are leading to reduction in the delivery of wetland ecosystem services, yet at the same time demand for these same services is projected to increase.

11. Current use of two wetland ecosystem services - freshwater and capture fisheries dependent on natural reproduction - in some regions is now in excess of levels that can be sustained even at current demands, much less future ones.
12. The projected continued loss and degradation of wetlands will result in further reduction in human well-being, especially for poorer people in less developed countries where technological solutions are not as readily available.

13. Progress towards achievement of the Millennium Development Goals depends on maintaining or enhancing wetland ecosystem services.

14. The priority when making choices about wetland management decisions is to ensure that the ecosystem services of the wetland are maintained (and, where appropriate, restored). This can be achieved by application of the wise use principle and guidelines of the Ramsar Convention.

1.1.3 The UK response to the MA

The Department for Environment, Food and Rural Affairs (Defra) recognise that our natural environment is vital to our health, economy and wellbeing providing a range of benefits including:

- Clean air, water and food for our basic survival;
- The resources (e.g. food, raw materials) we need for a strong economy; and
- A place for recreation, exercise and interaction with nature.

Defra acknowledge that the sustainable use of natural resources also plays a fundamental role in alleviating poverty in developing countries. The goal of sustainable development is to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life for future generations. In 'Securing the future – delivering UK sustainable development strategy' the UK Government sets out a framework for the pursuance of this goal. Key within this strategy is the need for an integrated policy framework to ensure natural resource protection is achieved within environmental limits.

In response to delivering on sustainable development goals, Defra have developed an Ecosystems Approach Project to develop, with stakeholders, a more strategic approach to policy and decision making on the natural environment in England. This work draws on the MA, acknowledging its role in providing not simply an evidence base for policy making, but also a new conceptual framework for decision making across sectors.

Defra have recognised that today’s biggest environmental issues tend to be more diffuse in nature and cross-cutting, and require more holistic and integrated solutions. This has provided the impetus for an ‘ecosystem approach’ which aims to enable more efficient and effective delivery of natural environment outcomes.

The ecosystem approach was adopted by the CBD as the primary framework for achieving sustainable development, based on maintaining fully functioning ecosystems (Laffoley et al, 2004). It was endorsed at the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002 and is being applied across the European Union as an approach through which to deliver on several environmental directives, strategies and agreements (Apitz et al, 2006). Various definitions have been applied to this concept including:

*The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way, and which recognises that people with their cultural and varied social needs, are an integral part of ecosystems* (Maltby, 2000).

One of the key principles, and priority targets, of the ecosystem approach is the conservation of ecosystem structure and functioning, in order to maintain ecosystem services. Defra acknowledge that the application of this approach will involve conserving, managing and enhancing the natural environment, whilst balancing environmental, economic and social considerations to achieve sustainable development. Potential benefits of this approach are:

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5 http://www.defra.gov.uk/wildlife-countryside/natres/index.htm
the ability for the Defra family to deliver natural environment outcomes more effectively and
efficiently; and
it will help to ensure that the value of the natural environment is mainstreamed across government.
Central to this will be development of tools and methodologies for valuation.

Defra, in the strategic framework prepared by the UK Biodiversity Standing Committee, have further acknowledged that a key underlying principle for the conservation of biodiversity is the ecosystem approach (Defra, 2007). Therefore the implementation of environmental legislation and the protection, conservation and enhancements of wetland ecosystems, and the important biodiversity, they support should embrace the delivery of an ecosystem approach at the core of which is the need to identify and maintain ecosystem services.

1.2 Integrating ecosystem services within a wetland vision

The England Wetland Vision brings together two of the largest conservation-focussed environmental non-governmental organisations in England with three of the most influencing statutory bodies that have duties towards the protection and enhancement of the environment. The partnership consists of English Heritage, the Environment Agency, Natural England, the Royal Society for the Protection of Birds (RSPB) and The Wildlife Trusts\(^\text{10}\). The objective of the England Wetland Vision is to articulate a spatial vision for freshwater wetlands and provide support, through the production of guidance material, to local wetland visions. The Partnership has recognised that the Vision would be strengthened by a more explicit inclusion of ecosystem services. This report sets out to provide material for broadening the England Wetland Vision to demonstrate the benefits of, and the approach to, describing ecosystem services, through the following specific objectives:

1. Define wetland ecosystem services and the benefits they deliver based on the outputs of the Millennium Ecosystem Assessment (MA).

2. Identify English case studies that have articulated a long-term wetland vision (of any scale, with wetlands featuring to any extent) in terms of the ecosystem services that the new or improved wetlands are proposed to provide.

3. Detail the nature of the services to be provided and the evidence (and particularly the data and information) used to justify how new wetlands would be able to provide those services.

4. Describe the kind of language used in such studies, its relation to the MA terminology and the broader legislation/agreements called upon.

5. Describe how biodiversity values and priorities have been balanced and incorporated in such projects and the extent to which biodiversity targets were either the catalyst for developing the vision or were a serendipitous by-product.

6. Identify the availability and utility of datasets used in studies described above and their potential application within the England Wetland Vision project.

7. Propose a ‘must have’ terminology for developing a more all encompassing Vision in time for the final launch and describe how the incorporation of ecosystem services could add ‘value’ to a wetland project.

8. Provide recommendations on the approach (both philosophical and technical) taken to date with the 50-yr Wetland Vision project, on what are the options for modifying the vision:
   a) Within the remaining period of 6-months;
   b) Beyond 6-months; and
   c) For providing advice for local development.

\(^{10}\) http://www.wetlandvision.org.uk/
2 WETLAND ECOSYSTEM SERVICES

2.1 Introduction

Wetland ecosystems have long been recognised as providing a range of benefits for people and society (Maltby, 1986, Dugan, 1990, Turner and Jones, 1990, Davis, 1993). The Ramsar Convention on Wetlands\footnote{http://www.ramsar.org/} has promoted the wise use of wetlands as a means of maintaining their ecological character and the ecosystem processes and structure which underpin the delivery of ecosystem services. Increasingly the valuation of ecosystem services is seen as important in making more informed decisions regarding the use and management of wetlands and their benefit to society (Barbier et al., 1997, Emerton and Bos, 2004, de Groot et al., 2006). Because of the many services and multiple values of wetlands, many different stakeholders are involved in wetland use, this can lead to conflicting interests and the over-exploitation of some services (e.g., fisheries or waste disposal) at the expense of others (e.g., biodiversity conservation or nutrient removal (Hansson et al., 2005)). However, despite the fact that the concept that wetlands provide a range of benefits is clear, there are still considerable challenges in developing this approach. This is particularly evident in the economic valuation of ecosystem services (Hartje et al., 2003).

Ecosystem services are defined by the MA as:

The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious, and other nonmaterial benefits (Millennium Ecosystem Assessment, 2005a).

The MA categorises ecosystem services into four broad areas: provisioning, regulating, cultural and supporting (Millennium Ecosystem Assessment, 2005a). Each service possesses sub-categories. For instance regulating includes climate regulation, water regulation, water purification and waste treatment, erosion regulation and natural hazard regulation (Table 1).

Ecosystem services, which are indispensable for both the natural environment and for human well-being, result from the interactions and processes within the ecosystem (de Groot et al., 2006). Wetlands are composed of a number of biophysical structures such as soils, water, plant and animal species. Within wetlands the interactions among and within the biophysical structures result in ecosystem processes such as denitrification, decomposition or primary production. The interactions among and within these different components allow the wetland to perform certain functions (de Groot, 1992; Maltby et al., 1996; McInnes et al., 1998). The degree to which a wetland delivers ecosystem services depends on its functional properties (e.g. biotic and abiotic components) and relationship between and among ecological components and processes (Figure 1).

However, it is important to understand the distinction between the different components of the ‘ecosystem services paradigm’ (\textit{sensu} Haines-Young et al., 2006). It is also paramount to understand the societal and spatial context. Figure 1 indicates that a wetland may have the capacity, i.e. it possesses the appropriate biophysical structure and supports the necessary processes which combine to produce a function, however it does not always follow that society perceives a benefit (value) for the delivery of the service, i.e. water purification and waste treatment. People and society will value function differently in different places at different times (Haines-Young and Potschin, 2007). Therefore in defining what constitutes an ecosystem services it is important that an understanding of the societal, spatial and temporal is considered.
Table 1. Ecosystem services provided by or derived from wetlands (Millennium Ecosystem Assessment, 2005a).

<table>
<thead>
<tr>
<th>SERVICES</th>
<th>COMMENTS AND EXAMPLES</th>
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<tbody>
<tr>
<td><strong>Provisioning</strong></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>production of fish, wild game, fruits, and grains</td>
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<tr>
<td>Fresh water</td>
<td>storage and retention of water for domestic, industrial, and agricultural use</td>
</tr>
<tr>
<td>Fibre and fuel</td>
<td>production of logs, fuelwood, peat, fodder</td>
</tr>
<tr>
<td>Biochemical</td>
<td>extraction of medicines and other materials from biota</td>
</tr>
<tr>
<td>Genetic materials</td>
<td>genes for resistance to plant pathogens, ornamental species, and so on</td>
</tr>
<tr>
<td><strong>Regulating</strong></td>
<td></td>
</tr>
<tr>
<td>Climate regulation</td>
<td>source of and sink for greenhouse gases; influence temperature, precipitation, and other climatic processes</td>
</tr>
<tr>
<td>Water regulation (hydrological flows)</td>
<td>groundwater recharge/discharge</td>
</tr>
<tr>
<td>Water purification and waste treatment</td>
<td>retention, recovery, and removal of excess nutrients and other pollutants</td>
</tr>
<tr>
<td>Erosion regulation</td>
<td>retention of soils and sediments</td>
</tr>
<tr>
<td>Natural hazard regulation</td>
<td>flood control, storm protection</td>
</tr>
<tr>
<td>Pollination</td>
<td>habitat for pollinators</td>
</tr>
<tr>
<td><strong>Cultural</strong></td>
<td></td>
</tr>
<tr>
<td>Spiritual and inspirational</td>
<td>source of inspiration; many religions attach spiritual and religious values to aspects of wetland ecosystems</td>
</tr>
<tr>
<td>Recreational</td>
<td>opportunities for recreational activities</td>
</tr>
<tr>
<td>Aesthetic</td>
<td>many people find beauty or aesthetic value in aspects of wetland ecosystems</td>
</tr>
<tr>
<td>Educational</td>
<td>opportunities for formal and informal education and training</td>
</tr>
<tr>
<td><strong>Supporting</strong></td>
<td></td>
</tr>
<tr>
<td>Soil formation</td>
<td>sediment retention and accumulation of organic matter</td>
</tr>
<tr>
<td>Nutrient cycling</td>
<td>storage, recycling, processing, and acquisition of nutrients</td>
</tr>
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2.2 Ecosystem service benefits

Wetland ecosystems, including *inter alia* rivers, lakes, ponds, marshes, fens, grazing marsh, mudflats, provide many services which contribute to human well-being and poverty alleviation. Biodiversity also plays an important role in ecosystem functions that provide provisioning, regulating, cultural and supporting services. Drawing heavily on the work of the MA, the following section outlines some examples of the ecosystem service benefits provided by wetlands.

2.2.1 Wetland ecosystem services

Both inland and coastal wetlands influence significantly the nature of the hydrological cycle and hence the supply of water for people and the many uses they make of water, such as for irrigation, energy, and transport (Bullock and Acreman, 2003). Changes in hydrology, in turn, affect wetlands.

- Wetlands deliver a wide array of hydrological services, for instance, swamps, lakes, and marshes assist with flood mitigation, promote groundwater recharge, and regulate river flows, but the nature and value of these services differs across wetland types.

- Flooding is a natural phenomenon that is important for maintaining the ecological functioning of wetlands (for example, by serving as a means for the natural transport of dissolved or suspended materials and nutrients into wetlands) and in particular for sustaining the delivery of many of the services they provide to millions of people, particularly to those whose livelihoods depend on floodplains for flood-recession agriculture and pasturage and for fish production.

- Many wetlands diminish the destructive nature of flooding, and the loss of these wetlands increases the risks of floods occurring. Wetlands, such as floodplains, lakes, and reservoirs, are the main providers of flood attenuation potential in inland water systems. Nearly 2 billion people live in areas of high flood risk, a risk that will be increased if wetlands are lost or degraded. Coastal wetlands, including coastal barrier islands, coastal river floodplains, and coastal vegetation, all play an important role in reducing the impacts of floodwaters produced by coastal storm events.

- Physical and economic water scarcity and limited or reduced access to water are major challenges facing human society and are key factors limiting economic development in many countries. Water scarcity and declining access to fresh water are a globally significant and accelerating problem for
one to two billion people worldwide, hindering growth in food production and harming human health and economic development.

- The continued degradation of water quality will increase the prevalence of disease, especially for vulnerable people in developing countries, where technological fixes and alternatives are not readily available. The burden of disease from inadequate water, sanitation, and hygiene totals 1.7 million deaths and results in the loss of at least 54 million healthy life years annually. Although largely eliminated in wealthier nations such as the UK, water-related diseases (malarial and diarrhoeal diseases, for instance) are among the most common causes of illness and death in developing countries, affecting particularly the poor. Some waterborne chemical and microbiological pollutants also harm human health, sometimes, in the case of chemical pollutants, through biomagnification through the food chain. Water quality degradation also affects people indirectly by degrading the resource base on which they depend. Present institutional structures tend to promote a narrow, sectoral approach to intervention for individual diseases, providing little opportunity to consider broader approaches to ecosystem management as a tool for enhancing human health. Actions to overcome intersectoral divides would help promote the use of ecosystem assessments or eco-health approaches to address human health concerns.

Two of the most important ecosystem services provided by wetlands are the provision of food and the supply and availability of fresh water. Some people, particularly those living near wetlands, are highly dependent on these services and are harmed directly by their degradation.

- Inland fisheries are of particular importance in developing countries, and they are sometimes the primary source of animal protein to which rural communities have access. For example, people in Cambodia obtain about 60–80% of their total animal protein from the fishery in Tonle Sap and associated floodplains. Wetland-related fisheries also make important contributions to local and national economies. Capture fisheries in coastal waters alone contribute US$34 billion to gross world product annually.

- The principal supply of renewable fresh water for human use comes from an array of inland wetlands, including lakes, rivers, swamps, and shallow groundwater aquifers. Groundwater, often recharged through wetlands, plays an important role in water supply, with an estimated 1.5–3 billion people dependent on it as a source of drinking water. Rivers have been substantially modified around the world to increase the water available for human consumption. Recent estimates place the volume of water trapped behind (documented) dams at 6,000 to 7,000 cubic kilometres.

Wetlands provide significant cultural, aesthetic, educational and spiritual benefits, as well as a vast array of opportunities for recreation and tourism. In developing countries recreational and ‘green’ tourism opportunities associated with wetlands are receiving increasing attention as a low-impact, non-consumptive development option and an opportunity to attract financial investment and to generate significant income (Gössling, 2000). Similarly, tourism is seen as an important incentive for conservation and a key funder of protected areas (Langholz, 1996). Even within the UK green tourism initiatives are being promoted as way to access wetlands and to support local enterprise12.

- Recreational fishing can generate considerable income: 35 to 45 million people take part in recreational fishing (inland and saltwater) in the United States, spending a total of US$24 to 37 billion each year on their hobby (Feather et al, 1999).

- Much of the economic value of coral reefs, with net benefits estimated at nearly US$30 billion each year, is generated from nature-based tourism, including scuba diving and snorkelling.

- A study undertaken in the Djoudj National Bird Park, located in the Senegal River Delta, Senegal, focusing on the willingness to pay indicated that the visitor admission price could be increased from approximately £2.10 per person to about £7.00 (based on an open-ended question approach) to in excess of £18.00 (based on close-ended question approach). This demonstrated that the total annual revenue for 2002 could have been in the region of £83,000 to £150,000 compared to an actual revenue of slightly more than £30,000 (Oumou et al, 2006).

12 http://www.green-business.co.uk/GreenBusiness_Introduction.asp
Of increasing concern is the role of wetlands in mitigating or contributing to climate change. A recent expert meeting co-convened by the CBD and Ramsar concluded that the release of carbon resulting from wetland degradation will offset the gains made by the world community to reduce greenhouse gas emissions\(^\text{13}\). Wetlands are critically important for both mitigation (reducing the rate of CO\(_2\) increases in the atmosphere) and adaptation (dealing with the severe impacts of climate change).

- One of the most important roles of wetlands may be in the regulation of global climate change through sequestering and releasing a major proportion of fixed carbon in the biosphere. For example, although covering only an estimated 3 to 4% of the world’s land area, peatlands are estimated to hold 540 gigatons of carbon, representing about 1.5% of the total estimated global carbon storage and about 25 to 30% of that contained in terrestrial vegetation and soils.

- Sea level rise and increases in storm surges associated with climate change will result in the erosion of shores and habitat, increased salinity of estuaries and freshwater aquifers, altered tidal ranges in rivers and bays, changes in sediment and nutrient transport, and increased coastal flooding and, in turn, could increase the vulnerability of some coastal populations. Wetlands, such as mangroves and floodplains, can play a critical role in the physical buffering of climate change impacts.

### 2.2.2 Ecosystem services and biodiversity

The Millennium Ecosystem Assessment (2005b) recognises that biodiversity forms the foundation of the vast array of ecosystem services that critically contribute to human well-being. Despite there being limited empirical studies that link changes in biodiversity with changes in ecosystem service provision, and consequently to human well-being, it is possible to summarise some of the key principles.

- Changes in biotic interactions among species, predation, parasitism, competition, and facilitation, can lead to disproportionately large, irreversible, and often negative alterations of ecosystem processes.

- Many changes in ecosystem services are brought about by the removal or introduction of organisms in ecosystems that disrupt biotic interactions or ecosystem processes. Because the network of interactions among species and the network of linkages among ecosystem processes are complex, the impacts of either the removal of existing species or the introduction of new species are difficult to anticipate.

- As in terrestrial and aquatic communities, the loss of individual species involved in key interactions in marine ecosystems can also influence ecosystem processes and the provisioning of ecological services. For example, coral reefs and the ecosystem services they provide are directly dependent on the maintenance of some key interactions between animals and algae. As one of the most species-rich communities on Earth, coral reefs are responsible for maintaining a vast storehouse of genetic and biological diversity. Substantial ecosystem services are provided by coral reefs, such as habitat construction, nurseries, and spawning grounds for fish; nutrient cycling and carbon and nitrogen fixing in nutrient-poor environments; and wave buffering and sediment stabilization.

- Even if losses of biodiversity have small short-term impacts on ecosystem function, such losses may reduce the capacity of ecosystems for adjustment to changing environments (that is, ecosystem stability or resilience, resistance, and biological insurance) (high certainty). The loss of multiple components of biodiversity, especially functional and ecosystem diversity at the landscape level, will lead to lowered ecosystem stability.

One of the highest profile examples of enhancing and conserving biodiversity in order to improve the provision of ecosystem services comes from the USA. Before it became overwhelmed by agricultural and sewage runoff, the watershed of the Catskill Mountains provided New York City with water ranked among the best in the USA (Ashendorff et al., 1997). When the water fell below acceptable quality standards, the City investigated the cost of installing an artificial filtration plant. The estimated price tag for this new facility was estimated at being between six to eight billion dollars, a high price to pay for a supply that was once

considered free. New York City decided instead to invest a fraction of that cost (US$660 million) in restoring the natural capital it had in the Catskill’s watershed. In 1997, the City raised an Environmental Bond Issue and is currently using the funds to purchase land and halt development in the watershed, to compensate property owners for development restrictions on their land, and to subsidize the improvement of septic systems.

It can be demonstrated that the inclusion of ecosystem services in conservation planning has great potential to provide opportunities for biodiversity protection (Chan et al., 2006). It is possible to examine whether different objectives for biodiversity conservation conflict with or reinforce each other by considering the two principal approaches that seem, initially, to differ most fundamentally in objective.

- **Objective One:** focused on biodiversity conservation for its own sake, independent of human needs or desires, and to focus on a species for species sake.
- **Objective Two:** focused on safeguarding ecosystem services for the benefit of human well-being: for the provision of ecosystem services and enhancing human well-being.

How much are these two objectives likely to coincide? The degree of concordance will depend on complex, and at present little-understood, interactions between biodiversity and resultant ecosystem services. Many ecosystem services may be unaffected by small losses of biodiversity, but they may deteriorate rapidly when, for instance, most of the elements of a functional group are gone. For instance, local or functional extinction, or the reduction of a population to the point that they no longer contribute to ecosystem functioning, can have severe impacts on ecosystem services (Millennium Ecosystem Assessment, 2005b). The coincidence of the two strategies is likely to increase as (i) an increasing number of services is considered; (ii) functional redundancy is valued as a buffer against random natural events (such as drought) and ongoing anthropogenic change; and (iii) the relative weight placed on biodiversity-intensive services, such as aesthetics, increases (Balvanera et al., 2001).

Whilst the relative merit of alternative conservation objectives is as much a matter of societal choice as of scientific debate a well-integrated scientific framework for assessing their merits is essential to decision-making, especially when these objectives may diverge. In an editorial to Science, this necessity has been expounded clearly by Balvanera et al (2001): *above all, it must be remembered that biodiversity is in serious jeopardy for a reason: namely, that the opportunity costs of conservation are perceived to be too high. The best hope for biodiversity is to create and align diverse incentives for conservation wherever possible and to integrate these into the larger policy-making arena. The England Wetland Vision offers such a policy-application arena where the incorporation of ecosystem services should not be viewed as an ‘either – or’ option, but as an opportunity to maximise the convergence between these, initially, parallel objectives.*


3 CASE STUDIES

3.1 Context

In many areas of England partnerships have formed to identify long-term conservation priorities and the spatial context for wetland restoration or enhancement projects (Hume, 2007). The England Wetland Vision will provide a national framework and further support for the delivery of these local visions. The national Wetland Vision recognises the successful delivery of local visions as a major delivery mechanism and will assist with their cultivation, evolution and delivery.

The local visions captured by the England Wetland Vision project vary in scale, complexity and detail. Some represent aspirational visions in the truest sense where large-scale landscape restoration is proposed. Others are of a local scale and more akin to individual projects. For instance, the economic and regenerative potential of the natural environment in the North West of England is a vision which captures the potential to generate significant economic and regenerative outcomes as well as implementing benefits for the natural environment, including elements of wetland restoration and enhancement, across an extensive area including Cumbria, Lancashire, Cheshire and the urban conurbations of Merseyside and Manchester (Environmental Resources Management, 2003). Whereas the Little Ouse Headwaters Project on the border between Norfolk and Suffolk covers an area of less than 100 hectares and has very site specific objectives.

3.2 Selection of local visions

Information has been collated from several of the local visions to assess whether they have embraced the delivery of ecosystem services as well as biodiversity benefits. The review was conducted on information already held by the England Wetland Vision partnership and did not involve new research or data searches.

Evidence was sought from existing publications and information freely available on the local wetland visions as to the presence or absence of the articulation of ecosystem services. This often involved an interpretation of language and an inference on proposed outcomes. Data and information sources used in the development of local wetland visions were similarly inferred or directly identified from the freely available information sources. It is suggested that for many of the local wetland vision a considerable body of work will have been conducted during their genesis and evolution. This body of work may not be subsequently captured or presented in the information available and utilised during this review. Therefore, it must be borne in mind that the definition of the ecosystem services delivered by the case studies represents the interpretation of the author and that it is not based on detailed analysis of empirical data or interviews with project personnel.

In finalising the local vision selected for review the following criteria were applied:

- Information existed on the local vision;
- The local vision was known to embrace more than just biodiversity objectives;
- Diversity in the range of wetland habitats represented; and
- The local visions represented all of the Partners.

Based on the review and the application of the above criteria, the following local wetland visions were selected for assessment:

- Great Fen project
- Rainham Marshes
- River Quaggy
- Little Ouse Headwaters Project
- The Lincolnshire coastal grazing marsh project
- Peatlands for People

14 http://www.wavcott.org.uk/lohp/home.htm
3.3 Brief descriptions of case studies

Information provided and readily accessible on the local visions varied greatly in terms of quantity, language and technical detail. Each local vision had a primary focus of enhancing biodiversity, however the wider benefits (ecosystem services) varied greatly in terms of their profile, diversity and emphasis. Table 2 provides outline descriptions of the six case studies.

Table 2. Brief description of local vision case studies.

<table>
<thead>
<tr>
<th>CASE STUDY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Fen project</td>
<td>The Great Fen Project is a partnership between one of Natural England’s founding bodies, English Nature, The Wildlife Trusts, Huntingdonshire District Council and the Environment Agency. It will restore over 3,700 hectares of fenland from arable land between Huntingdon and Peterborough. This will safeguard isolated and diminishing fen species and their unique and valuable habitat, which is so rare throughout the world. The project will connect Woodwalton Fen National Nature Reserve with Holme Fen National Nature Reserve. Neither of these important sites are sustainable at their present size, due to intensive arable cultivation around them and uncontrollable water levels. The Great Fen Project will halt the deterioration of both reserves and improve the whole area so much for wildlife that new species will breed there.</td>
</tr>
<tr>
<td>Rainham Marshes</td>
<td>The RSPB Rainham Marshes is a wetland reserve managed primarily for breeding and wintering waterbirds and water voles. Its location on the edge of London provides a great opportunity to introduce people to the importance of wetlands and the fascinating wildlife that they support. The reserve also features an innovative visitor centre which incorporates best practice in sustainable building design and acts as an environmental and education centre. With the Thames Gateway and the Olympics set to dominate the area it is seen as important that an area is secured to provide a high quality natural environment. The area provides a healthy and accessible environment crucial to the quality of life.</td>
</tr>
<tr>
<td>River Quaggy</td>
<td>Running from Bromley to Lewisham in south London, the Quaggy River has suffered considerable flooding problems over the years – caused primarily by development on the natural floodplain. The entire section of the river running through Sutcliffe Park was hidden underground. Managing flood risk in this way used to be seen as good practice. However it meant valuable floodplain was lost, together with vital natural habitats. The main focus of the project was to return the ‘culverted’ river back to its natural state. In the process, the opportunity was taken to turn the bare, uninteresting park into a popular green space. Some of the benefits of the scheme include an underground ‘culverted’ river restored to its natural state; green space created for the local community; new habitats created for wildlife; risk of flooding reduced. A flood storage area was constructed that can hold up to 85,000m³ of flood water – equating to approximately 35 Olympic-size swimming pools. It now protects 600 homes and businesses from flooding. Restoration has played a huge role in this project. Boardwalks, bridges and footpaths have been installed, avenues of trees and wildflower meadows planted, and an outdoor classroom created. There are new seating areas throughout the park, some of which have been purchased from MENCAP Riverwood, a voluntary group supporting the employment of people with learning disabilities. These unique pieces of furniture were recycled from timber found in the River Thames.</td>
</tr>
<tr>
<td>Little Ouse Headwaters Project</td>
<td>The course of the Little Ouse has been straightened to allowed the drying-out and conversion to arable agriculture of much of the surrounding wetland. Small areas of fenland, which had belonged to local parishes since the time of the Enclosure Acts, survived, but their wildlife interest continued to decline. The ending of traditional management practices, the lowering of water tables and reduction in water quality, and the inability of many species to recolonise such small, isolated patches of land, all contributed to a loss of biodiversity. Today, despite these losses, pockets of land around the headwaters of the Little Ouse and Waveney still retain wildlife that is recognised as being of international importance.</td>
</tr>
</tbody>
</table>
importance. The area encompassed by this project includes two Sites of Special Scientific Interest which are part of the Waveney and Little Ouse Valley Fens Special Area of Conservation (SAC). A further four sites retain wildlife of interest in a county context, whilst others contribute to the characteristic landscape of the valley. The eastern boundary of the project area adjoins Redgrave and Lopham Fen which is a National Nature Reserve and internationally important wetland (a RAMSAR site).

In 2002, residents from the Parishes of Redgrave, South Lopham, Blo’ Norton, Hinderclay and Thelnetham established the Little Ouse Headwaters Project (LOHP) as a Charitable Trust which aims to enhance the value of the river valley within these parishes. The Trust works closely with, and supports, other local charities. Its trustees include representatives from the five Parish Councils in the project area together with other local residents with particular knowledge and interests relevant to the project. Our long-term aims are:

To recreate and maintain a continuous corridor of wildlife habitat along the headwaters of the Little Ouse by:
- improving the wildlife diversity
- where appropriate, restoring natural river features
- improving water quality

To facilitate rural regeneration and land-use diversification;

To improve recreation, amenity and education value for the community; and

To improve landscape quality and safeguard against flooding

This will be achieved through the re-creation of some of the valley’s fens, meadows, and river meanders, as well as the maintenance and enhancement of the existing wetland, woodland and heathland. We believe that the project will benefit the local economy by increasing the area’s potential for low impact eco-tourism, and by the employment of local contractors for practical management work.

The Lincolnshire coastal grazing marsh project

The Lincolnshire Coastal Grazing Marsh projects aims to ensure that there will once again be extensive grassland landscapes rich in wildlife, intersected by a distinctive pattern of water courses. Within this landscape pastoral farming thrives and local communities have a high quality of life. The area is attractive to local people and visitors, with year-round opportunities to experience the natural and historic environment through improved access, helping to develop and sustain a vibrant rural economy.

The aims are:

To reverse the decline in biodiversity in the grazing marsh;

To ensure that any landscape and land-use change enhances and protects archaeological and historical features and contributes positively to overall landscape character;

To encourage retention and re-establishment of viable pastoral farms;

To stimulate local economic activity through the marketing of locally produced high quality products and services; and

To improve the local environment for the benefit of all through enhanced access and recreation opportunities.

To achieve these aims it will be necessary to:
- halt the decline in pastoral farming;
- return arable land to pasture; and
- raise water tables to provide permanently wet ditches and promote seasonally flooded grasslands

Peatlands for People

One of Natural England’s founding bodies, English Nature, the Royal Society for the Protection of Birds, Cumbria Wildlife Trust, Environment Agency and Solway Coast AONB Unit are working together in the “Peatlands for People” project to restore the natural wealth of Cumbria’s raised peatbogs and link them to the region’s culture, economy and quality of life”.

The lowland peatlands of the South Solway are a vestige of our once wild and natural landscape. For thousands of years, the organic remains of mosses and other plants have been slowly accumulating into domes of thick peat. These waterlogged lands and pools of open water, and the barriers they provided to human change, encouraged a distinctive wildlife to flourish and preserved the secrets of the past in their deep peat. The Peatlands for People Vision is to restore these natural wetlands so that they are once more an active part of the region’s natural and cultural landscape. It may take many years before we see the wildlife potential fully restored across all this peatland. However, in just a few years, real wildlife benefits can be achieved through restoration. Our vision is over the next ten years to put in place all the measures needed to achieve this, and for these sites to benefit once more the quality of life of local communities and the public.

3.4 Local visions and ecosystem services

The language and terminology used to articulate ecosystem services varied greatly among the six case studies. In all cases no empirical data was provided or used to quantify the presence, absence or magnitude of ecosystem service delivery. Therefore the evidence used to identify the provision of ecosystem services focused on the interpretation of language and the deciphering of narrative.

A summary of the types of terms and the uses of language is provided in Table 3. In some cases the interpretation of the presence of an ecosystem service is relatively straightforward and clear, in others it is a matter of inference and assumption. Furthermore, some ecosystem services are more clearly articulated than others.

3.4.1 Provisioning services

The provision of food is explicit for the Great Fen project through the assertion that ‘there will be opportunities for organic meat and dairy products’. However, this was not always clear and hence the provision of food was inferred for the statement within the Lincolnshire coastal grazing marsh project that asserted that ‘within this landscape pastoral farming thrives’. Similarly the provision of fibre and fuel was explicit for the Great Fen project through the statement that a ‘return of traditional cropping such as reeds for thatching or hay for power generation’, yet remained more ambiguous for the Lincolnshire coastal grazing marsh project.

Three of the provisioning services were not represented in the information reviewed for the six local visions, namely: provision of freshwater, biochemical or genetic materials. This does not necessarily that these ecosystem services were not proposed or that they will/do not occur but rather that there is no implicit or explicit reference to them in the information reviewed.

3.4.2 Regulating services

Both natural hazard regulation and water purification and waste treatment were explicit in some of the case study literature. For example, natural hazard regulation was clearly articulated for the River Quaggy project in the statement that ‘the scheme reduces flood risk to 600 homes and businesses’. Equally, the Little Ouse Headwaters Project is unequivocal that one of the aims of the vision is ‘improving water quality’. These two ecosystem services were the most clearly expressed out of all the services considered.

Pollination was not explicit in any of the case study literature. However, it was inferred through statements such as, in the case of the River Quaggy, ‘it is a habitat for a huge variety of plants and animals, and features wildflower meadows, wetland areas, reed beds, lakes and ponds’.

Three of the regulating services were not articulated in any of the case studies, namely climate regulation, erosion regulation and water regulation (specifically groundwater recharge and discharge).
Table 3. Terminology used in the local vision case studies for describing ecosystem services. (1 Great Fen project, 2 Rainham Marshes, 3 River Quaggy, 4 Little Ouse Headwaters Project, 5 the Lincolnshire coastal grazing marsh project, 6 Peatlands for People).

<table>
<thead>
<tr>
<th>SERVICES</th>
<th>TERMINOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Provisioning</strong></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>• .. will be grazed by large herbivores such as wild horses and highland cattle. 1</td>
</tr>
<tr>
<td></td>
<td>• .. there will be opportunities for organic meat and dairy products. 1</td>
</tr>
<tr>
<td></td>
<td>• Farmers to continue livestock farming .. 5</td>
</tr>
<tr>
<td>Fresh water</td>
<td>None</td>
</tr>
<tr>
<td>Fibre and fuel</td>
<td>• .. return of traditional cropping such as reeds for thatching or hay for power generation. 1</td>
</tr>
<tr>
<td></td>
<td>• To stimulate local economic activity through marketing of locally produced high quality products and services. 5</td>
</tr>
<tr>
<td>Biochemical</td>
<td>• None</td>
</tr>
<tr>
<td>Genetic materials</td>
<td>• None</td>
</tr>
<tr>
<td><strong>Regulating</strong></td>
<td></td>
</tr>
<tr>
<td>Climate regulation</td>
<td>• None</td>
</tr>
<tr>
<td>Water regulation</td>
<td>• None</td>
</tr>
<tr>
<td>(hydrological flows)</td>
<td></td>
</tr>
<tr>
<td>Water purification and</td>
<td>• .. added reed beds where storm water joins the river to act as a filter to improve water quality. 3</td>
</tr>
<tr>
<td>waste treatment</td>
<td>• .. improving water quality. 4</td>
</tr>
<tr>
<td>Erosion regulation</td>
<td>• None</td>
</tr>
<tr>
<td>Natural hazard regulation</td>
<td>Improved capacity for the storage of winter water could reduce flood risk in the area. 1</td>
</tr>
<tr>
<td></td>
<td>• .. to provide space for floodwater.. 3</td>
</tr>
<tr>
<td>Pollination</td>
<td>• The park has quickly become an important area of natural beauty .. 3</td>
</tr>
<tr>
<td></td>
<td>• To ensure that any landscape and land-use change enhances and protects archaeological and historical features.. 5</td>
</tr>
<tr>
<td></td>
<td>• And link them to the region’s culture, economy and quality of life. 6</td>
</tr>
<tr>
<td></td>
<td>• Pathways and facilities will be suitable for people with disabilities, and there will be opportunities to explore on horseback, cycle or boat.</td>
</tr>
<tr>
<td></td>
<td>• .. turning it into a valuable resources for local communities. 3</td>
</tr>
<tr>
<td></td>
<td>• The park has quickly become an important area natural beauty and a recreational a site for the local community. 3</td>
</tr>
<tr>
<td></td>
<td>• To improve recreation, amenity and education value for the community. 4</td>
</tr>
<tr>
<td></td>
<td>• To improve the local environment for the benefit of all through enhanced access and recreation opportunities. 5</td>
</tr>
<tr>
<td>Aesthetic</td>
<td>• .. making (the river) more attractive for local people to use.. 3</td>
</tr>
<tr>
<td></td>
<td>• .. and for these sites to benefit once more the quality of life of local communities and the public. 6</td>
</tr>
<tr>
<td>Educational</td>
<td>• .. will create a landscape for learning. 1</td>
</tr>
<tr>
<td></td>
<td>• Schools and Universities have visited to learn about ecology, flooding and wildlife. 3</td>
</tr>
<tr>
<td></td>
<td>• To improve recreation, amenity and education value for the community. 4</td>
</tr>
<tr>
<td><strong>Supporting</strong></td>
<td></td>
</tr>
<tr>
<td>Soil formation</td>
<td>• .. aims to restore the necessary conditions to recreate active bog habitat. 6</td>
</tr>
<tr>
<td>Nutrient cycling</td>
<td>• None</td>
</tr>
</tbody>
</table>
3.4.3 Cultural services

More information was provided on cultural services than the other services. These were most clearly and explicated articulated. The language used within the local vision case studies possessed a much greater empathy with these ecosystem services than the other types. This was particularly true for recreational and educational services. Statements such as ‘to improve the local environment for the benefit of all through enhanced access and recreation opportunities’ (the Lincolnshire coastal grazing marsh project) or ‘the park has quickly become an important area natural beauty and a recreational a site for the local community’ (River Quaggy) are clear and concise. The same is true for educational services, for instance statements such as ‘will create a landscape for learning’ (Great Fen project) or ‘schools and Universities have visited to learn about ecology, flooding and wildlife’ (River Quaggy) are unambiguous. Often cultural services were expressed collectively through statements such as ‘to improve recreation, amenity and education value for the community’ (Little Ouse Headwaters Project).

Spiritual and inspirational services were slightly more ambiguous and inferred, but were still identifiable through statements such as ‘link them (the peatlands) to the region’s culture, economy and quality of life’. Similarly aesthetic services were expressed in less precise terms such as ‘making (the river) more attractive for local people to use’ (River Quaggy) and ‘these sites to benefit once more the quality of life of local communities and the public’ (Peatlands for People).

3.4.4 Supporting services

The two supporting services, soil formation and nutrient cycling were generally not referred to, or even implied, in any of the local vision case studies. The one exception was in the statement ‘aims to restore the necessary conditions to recreate active bog habitat’ where the restoration of active peat forming conditions is implied within the Peatlands for People project. Despite the paucity of evidence for supporting services, it does not necessarily mean that they will/are not present, just that there is no or very limited evidence for them. In the case of both it is highly likely that they will be occurring in all of the case studies. Increases in the degree of waterlogging or inundation will promote organic matter accumulation and improve soil formation. The passage of water containing nutrients through the restored or created wetland areas will result in changes in the rates of the cycling of nitrogen and phosphorus. These situations are common for the majority of the local vision case studies.

3.5 Biodiversity or ecosystem services?

Each local vision case study possesses a different emphasis or objective. None of the case studies adopt a one-dimensional biodiversity focus. However, each strives to achieve a unique balance between biodiversity objectives and the delivery of wider societal benefits. The headline objectives for each local vision case study have been distilled from the information reviewed. It is clear that the local visions are driven by a variety of catalysts not all of which are biodiversity-centric (Table 4). For instance the River Quaggy has at its core the need to reduce urban flood risk. Similarly the Lincolnshire coastal grazing marsh project makes a very clear statement of intent regarding its aspirations for people, wildlife and the historic environment.

Table 4. Interpretation of the catalysts for local visions (based on literature reviewed).

<table>
<thead>
<tr>
<th>Project</th>
<th>Catalyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Fen project</td>
<td>Safeguard isolated and diminishing fen species and their unique and valuable habitat</td>
</tr>
<tr>
<td>Rainham Marshes</td>
<td>Primarily a wetland reserve for breeding and wintering waterbirds and water voles</td>
</tr>
<tr>
<td>River Quaggy</td>
<td>Reducing flooding and restoring the river</td>
</tr>
<tr>
<td>Little Ouse Headwaters Project</td>
<td>To recreate a continuous corridor of wildlife habitat along the headwaters</td>
</tr>
<tr>
<td>Lincolnshire coastal grazing marsh project</td>
<td>To improve opportunities for wildlife, heritage and people through protecting and restoring grazing land and particularly wet grassland</td>
</tr>
<tr>
<td>Peatlands for People</td>
<td>Restore the natural wealth of raised peatbogs and link them to the region’s culture, economy and quality of life</td>
</tr>
</tbody>
</table>
Table 5. Planned (P) and serendipitous (S) ecosystem services associated with the local vision case studies (blanks indicate either no evidence or unlikely that the service would be provided).

<table>
<thead>
<tr>
<th></th>
<th>Great Fen project</th>
<th>Rainham Marshes</th>
<th>River Quaggy</th>
<th>Little Ouse Headwaters Project</th>
<th>The Lincolnshire coastal grazing marsh project</th>
<th>Peatlands for People</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Provisioning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Fresh water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibre and fuel</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>Biochemical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genetic materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Regulating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate regulation</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water regulation (hydrological flows)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water purification and waste treatment</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Erosion regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural hazard regulation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pollination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cultural</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiritual and inspirational</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Recreational</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aesthetic</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supporting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil formation</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutrient cycling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>11</td>
</tr>
</tbody>
</table>


However, several of the local visions have as a primary catalyst the desire to deliver on biodiversity objectives, with other benefits being secondary or, could be described more crudely as, serendipitous or opportunistic. For instance Rainham Marshes is primarily a wetland wildlife reserve but opportunities have arisen to develop a state of the art environmental education centre on the back of the wildlife reserve. The great Fen Project recognises the primary need to safeguard threatened fen species and habitats, but also recognises that there are major benefits to be gained for local community from this goal.

The case studies demonstrate that the philosophical position regarding ‘either – or’ (i.e. biodiversity or ecosystem services, but not both) is effectively redundant. All the projects, whether driven by biodiversity objectives or focussed on wider societal drivers, can, and do, accommodate a breadth of benefits without demonstrably compromising biodiversity objectives.

### 3.6 Planned or serendipitous ecosystem services

Using an interpretation of the language, as discussed above, in combination with a theoretical understanding of how the wetland systems may respond to the environmental changes defined within the objectives of the visions, it has been possible to define whether the resultant ecosystem services are planned, serendipitous or unlikely to occur. Table 5 provides a summary for the six local visions. The relative bias of planned versus serendipitous ecosystem services is illustrated in Figure 2. It must be stressed that this is a subjective assessment based on the available information provided via the England Wetland Vision and that interpretation of more detailed information, or ground truthing of results, may generate different results. It should also be noted that ecosystem services are recorded by presence (actual as defined from the literature or inferred based on an understanding of the type of wetland and the overall functioning of the system) or absence. No evaluation is made of the relative importance to society of any one ecosystem service over another or the economic benefit associated with the ecosystem service. This assessment is provided as an illustration of the concept rather than a definitive evaluation of the total benefit the local vision provides.

The Little Ouse Headwaters Project and the Lincolnshire coastal grazing marsh project both demonstrate a strong bias towards planned ecosystem services and also both local visions record the highest number of planned ecosystem services (eleven and ten respectively) (Table 5, Figure 2). This position reflects the interpreted catalyst for the Lincolnshire coastal grazing marsh project but does not reflect the primary catalyst of creating a continuous corridor of wildlife habitat for the Little Ouse Headwaters Project. This indicates that the Little Ouse Headwaters Project provides more ecosystem services on closer inspection than the headline catalyst suggests. A review of the information provided indicates that this is actually the case. It was not a surprise to discover this as the Little Ouse Headwaters Project was the 2006 winner of the Chartered Institute of Water and Environmental Management (CIWEM)/RSPB Living Wetlands Award, an award which recognises multifunctional projects which demonstrate the sustainable use of wetlands. It is clear that both of these local visions have taken a holistic approach to delivering on multiple objectives, however, despite this it was possible to identify ancillary, serendipitous benefits which were not explicit in the original goals and objectives.

The River Quaggy Project, despite having a very clear ecosystem service catalyst in terms of natural hazard regulation (flood risk management) still incorporated seven other planned ecosystem services into the scheme design. The only serendipitous ecosystem services provided by the scheme were both the supporting services: soil formation and nutrient cycling. It is suggested that these were expected to occur but, as supporting services to the delivery of other ecosystem services, were explicit in the information reviewed.

The vision for the Great Fen project, despite being catalysed by clear biodiversity objectives, still manages to incorporate eight planned ecosystem services (the same number as the River Quaggy project). However, on closer inspection the Great Fen project also delivers on five other serendipitous ecosystem services including one provisioning service (fresh water), three regulating services (water regulation – groundwater recharge, water purification and pollination) and one supporting service (nutrient cycling). It is possible that these ecosystem services were planned but not explicit within the information reviewed.

Both the Rainham Marshes and the Peatlands for People local visions generated more serendipitous ecosystem services than planned (six and four, and six and five respectively). This could be simply as a result of the fact that these two local visions were supported by the least amount of information to review, and subsequently this might have resulted in an inherent bias in the results. Peatlands for People represented the
only local vision focussed on the restoration of active mire processes. Given the timescales necessary to achieve such an end, it could be that the information provided emphasised this and the cultural services in lieu of other shorter term benefits.

Figure 2. Planned versus serendipitous ecosystem services (GF Great Fen Project, RM Rainham Marshes, RQ River Quaggy, LO Little Ouse Headwaters Project, LI Lincolnshire coastal grazing marsh project, PP Peatlands for People).

Irrespective of the main catalyst behind each of the local visions, there is a clear bias towards the provision of planned cultural services over and above provisioning, regulating or supporting services across all six visions. The reasons for this are unclear. However it may be that the emphasis is required to satisfy funding bodies, and subsequently remains in all future publicity information, or that there is a greater immediacy with these more overtly 'social' services than other ecosystem services, especially those of a biogeochemical or hydrological nature, which resonates with a variety of audiences. It could simply be that the provision of spiritual, inspirational, recreational, aesthetic and educational objectives are considered more important than other ecosystem services.
4 INCORPORATING ECOSYSTEM SERVICES INTO A WETLAND VISION

4.1 Introduction

Currently the level of professional and public understanding of the concept of, and language associated with, ecosystem services is low (Define, 2007). Many existing wetland vision initiatives revolve around the delivery of biodiversity targets, such as Biodiversity Action Plan (BAP) objectives (Hume, 2007). However, the UK Government, through Defra (Defra, 2007), is embracing the global shift towards implementing an ecosystems approach for the conservation and management of natural resources (Hartje et al, 2003). Therefore, for the England Wetland Vision to reflect this move a framework must be created which is comprehensible to a variety of audiences, both technical and lay, and implementable within existing financial drivers and legislative contexts.

4.2 Conceptual framework

Biodiversity needs all the help it can get to abate species loss and habitat degradation (Balvanera et al, 2001). Therefore the starting point in the integration of ecosystem services within a wetland vision must be the principle that it is not a case of either – or. A symbiotic relationship exists between the delivery of biodiversity targets and the provision of ecosystem services. Mutual benefits within wetlands are are well documented (Millennium Ecosystem Assessment, 2005a).

However, in England the conservation and enhancement of wetlands is still wedded to protected sites and BAP targets. The local vision cases studies demonstrate that whilst it is possible to restore an undesignated wetland area for the benefit of regulating flooding (e.g. River Quaggy) it is also possible for internationally important wetland sites to deliver on a range of ecosystem services (e.g. Little Ouse Headwaters Project). The overriding parallel between these two different visions, which is taken from herein as the philosophy underpinning the conceptual framework for incorporating ecosystem services into a wetland vision, is:

the desire to maximise opportunities for biodiversity whilst optimising the delivery of ecosystem services for the benefit of society.

The international, national and local statutory habitat designations for the six local vision case studies are provided in Table 5. This demonstrates that the case studies represent a diversity of wetlands, from those holding no statutory designations to sites which are protected under European legislation and are considered of international importance. If the philosophy advocated above is extended to a finite conclusion, then the intention should be to improve the quality of a site to the point where it moves towards holding an international designation or supporting features of interest commensurate with such a state. Whilst in practical terms this may, more often than not, remain purely aspirational the principle should be pursued. Therefore, the aspiration for the River Quaggy should be that, in time, it is either designated as locally or nationally important, or should support features of comparative quality. This aspiration should be sought without compromising existing delivery of ecosystem services, and ideally should seek to enhance the delivery of societal benefits over time.

To illustrate the conceptual framework a crude habitat index has been generated for the six case studies (Appendix 1). This is not intended to be robust, but is used to demonstrate the conceptual approach and to facilitate definition of the relative importance of the sites based on biodiversity-related site designations. The habitat index has been plotted against the number of ecosystem services articulated for each of local vision case studies (Figure 3). Figure 3 distinguishes between the total, planned and serendipitous ecosystem services for each of the local visions.

| Table 5. | International, national and local habitat designations held by local vision case studies (SPA: Special Protection Area, cSAC: candidate Special Area of Conservation, Ramsar: Wetland of International Importance, SSSI: Site of Special Scientific Interest, NNR: National nature reserve, LNR: Local nature reserve). |
In simple terms the local visions with a low habitat index are considered relatively less important in terms of biodiversity than those with a high habitat index. Similarly the case studies with a low number of ecosystem services are considered to providing less overall benefit to society than those with a high number. It must be emphasised that this may not be the case, and the application of environmental economics would be one method of translating this concept into a common currency in order to provide a more robust evaluation (de Groot et al., 2006).

**Figure 3.** Total, planned and serendipitous ecosystem services plotted against habitat conservation status index ( ■ Total number of ecosystem services, ● total number of planned ecosystem services, ○ total number of serendipitous ecosystem services. GF Great Fen Project, RM Rainham Marshes, RQ River Quaggy, LO Little Ouse Headwaters Project, LI Lincolnshire coastal grazing marsh project, PP Peatlands for People).
Adoption of the philosophy espoused above results in a desire to ‘move’ any wetland vision towards the top right of the graph shown in Figure 3. This is illustrated conceptually in Figure 4. This conceptual framework should be applicable to any wetland vision. There should be potential to ‘retrofit’ ecosystem services objectives to existing visions without compromising biodiversity delivery. In many cases several ecosystem services may already be being delivered but without explicit comprehension or publicity. However, of more importance within the context of a 50 year vision for the English landscape, every wetland opportunity should embrace this conceptual framework and examine the potential to deliver a range of ecosystem services. The alignment of biodiversity objectives with wider societal benefits may generate a range of advantages including increased potential for funding, greater public appreciation of the multifunctional role of wetlands and the need for their protection, and enhanced awareness for the need to protect and manage wetlands appropriately in order to benefit both people and wildlife.
5 RECOMMENDATIONS

5.1 Introduction

Wetlands are fundamentally important to human well-being (Millennium Ecosystem Assessment, 2005a). The maintenance and improvement of the biodiversity they support underpins this principle. This report has demonstrated how the MA approach has advocated this philosophy (Section 1) and provided examples of the wider societal benefits provided by wetlands (Section 2). Through the use of local wetland vision case studies it has been possible to demonstrate the articulation of ecosystem services within an English context and assess the language and emphasis applied (Section 3). A conceptual framework for future wetland visions has been described which would seek to maximise opportunities for biodiversity whilst optimising the delivery of ecosystem services for the benefit of society (Section 4). To integrate this philosophy more fully within the 50 year England Wetland Vision the following recommendations are made.

5.2 Philosophical

The England Wetland Vision is a partnership between organisations each with a different raison d’être. Undoubtedly synergies are obvious among the partners, but whilst each pursues its own ‘corporate’ goals tensions will inevitably exist. However, the pursuance of wetlands to deliver a range of ecosystem services should not be viewed as antithetical to the achievement of biodiversity aspirations. The two objectives are convergent and should be viewed as mutually supportive. A repositioning of the focus of the England Wetland Vision, to embrace ecosystem services, could potentially assist in each of the partners finding the outputs more accessible and applicable. This may particularly be the case with Natural England, who entered the Vision in the form of one of its founding organisations, English Nature, but who now have a much wider responsibility within the English landscape including inter alia access and recreation.

The local wetland vision case studies have demonstrated a convergent of philosophies to positive effect, especially in the case of the Little Ouse Headwaters Project and the Lincolnshire coastal grazing marsh project. It is essential that this view is embraced widely to ensure that opportunities for both wildlife and society are not missed, leaving both in a poorer state. This may be increasingly relevant in a landscape where water availability will dictate habitat feasibility and the delivery of biodiversity targets and the need to consider multifunctional objectives for wetland restoration and creation becomes paramount (Mitchell et al, 2007).

5.3 Technical

5.3.1 Datasets

The understanding and application of the ecosystem approach remains nascent within England. This is in part a result of a perceived shift to a ‘new paradigm’ for nature conservation (Haines-Young et al, 2006) and also because of an inherent resistance to change. The England Wetland Vision is steered predominantly from an ecological perspective, whilst receiving technical guidance from a wider, yet still comparatively narrow, perspective. Criteria and datasets used to assess the feasibility of implementing the vision have focussed on delivery of wetland ‘habitats’ (such as fens, reedbed or purple moor grass and rush pastures) (Hume, 2007).

At the outset of the England Wetland Vision project no single dataset existed to predict the location of possible areas for the restoration or creation of, for example, wet woodland. Using expert knowledge and professional judgement this dataset now exists. The absence of an appropriate dataset should not be used as a justification for non-pursuance of an idea. If this philosophy had been applied at the outset of the Vision, limited progress would have ever been made. Within the Wetland Vision, to date, the datasets have not been selected and interpreted to inform the visioning process of how a wetland could remove nutrients from eutrophic waters or how a wetland could provide an educational benefit. This has been because the primary focus for the outputs of this phase of the project has not been on these issues. Similarly, the expertise within the TAG and the partners has been engaged primarily in assisting in defining potential areas of ‘habitat’ rather than identifying potential areas for carbon sequestration, phosphorus removal or education provision.
Recent work undertaken in Scotland has demonstrated that national electronic datasets can be combined to generate a hydrogeomorphic classification of wetlands (SNIFFER, 2007). Through a GIS this classification can define, with varying degrees of accuracy, the likelihood of dependency of any wetland area on surface and groundwater bodies by assessing likely water sources. Through an interpretation of the surface and groundwater sources it is possible to identify potential pressures on wetlands, such as eutrophication or abstraction. Equally it is possible to make inferences on how any existing wetland areas may respond to these pressures and function to remove or cycle nutrients or to store carbon. This logic, based on a functional approach *sensu* Maltby et al. (1996), could be extended relatively simply to ‘forecast’ the potential delivery of a range of ecosystem services for different wetland areas. Work on GIS-based decision support systems which link a functional assessment knowledge-base with methods of socio-economic valuation has been conducted (Mode *et al.*, 2002). This approach allows rapid assessments of hydrological, biogeochemical and ecological wetland functions using data which can be rapidly gathered or inferred from available datasets. Similar such approaches should be investigated and integrated within the England Wetland Vision.

Similarly, individual datasets do not exist to define the educational value of an actual, or, through the Vision, potential wetland area. By engaging with the appropriate experts and combining the existing datasets, either with or without additional datasets, in a novel manner there is no reason why this cannot be achieved.

The review of the local vision case studies did not provide any significant insight into the datasets used in predicting and describing the delivery of ecosystem services. Information received remained qualitative. However, certain datasets undoubtedly would have application for defining both habitat potential and ecosystem service delivery. For instance, the following data layers are combined to explain the distribution of fens within the England Wetland Vision (Hume, 2007):

- Fenbase;
- The locations of springs;
- Base geology with which the distribution of habitat is known to have a strong correlation;
- Soil types known to contain localised pockets of groundwater;
- National Peatland Inventory; and
- Peat soils in floodplains that can support peat based valley fens.

The following factors have been used to prioritise the potential locations for increasing the distribution of this habitat type (Hume, 2007):

- Proximity buffers
- Availability of groundwater
- Known presence of existing fen type

Several of these datasets possess utility for defining or predicting ecosystem services. For instance, information on the underlying geology, availability of groundwater, soil type and the location of springs could be utilised to assist in defining the role of an area in water regulation and specifically the recharge or discharge of groundwater. Similarly the accumulation of carbon within fen peats can assist in regulating climate and mitigating CO₂ emissions. The datasets available lend themselves to identification, in qualitative terms, to the prediction of the climate regulation service. The same applies to the full range of habitats considered in the England Wetland Vision (Hume, 2007).

Of key importance to the technical understanding of the prediction of ecosystem services is not necessarily the availability of datasets but understanding and interpreting the existing datasets from a multifunctional perspective. Allied to this is the importance of awareness of other datasets which can be used in conjunction with existing datasets to inform the identification of, or benefit of, a range of ecosystem services. For instance information on river water quality could be used to interpret the role of fens in trapping contaminants or cycling nutrients and to set ecosystem service objectives within the vision for fens.

In understanding the technical concepts, such as defining the hydrological regime and evaluating the role of a potential wetland vision in regulating natural hazards such as floods, it is important that the appropriate scientific opinion is sought. Studies have shown that sweeping generalities cannot be made regarding the role of wetlands in the hydrological cycle and that a site by site, bespoke approach should be pursued (Bullock and Acreman, 2003). Similarly if assumptions are to be made on the ability of a wetland to cycle nutrients and
improve water quality an adequate understanding of wetland biogeochemistry is required (Verhoeven et al 2006, Kadlec and Knight, 1996). The key principle is to engage with a holistic, multi-disciplinary team to ensure that no opportunity is missed and all potential ecosystem services are maximised.

The engagement with the appropriate experts should extend beyond environmental disciplines such as ecology, hydrology or biochemistry and should include experts versed in the historic environment, social sciences and environmental economics. In this context biodiversity opportunities will be maintained but wider societal benefits will also be identified.

5.3.2 Language
In a recent report to Defra, research has demonstrated that the term ‘ecosystem services’ was completely unfamiliar term, even for relatively ‘warm’ audiences. It was further concluded that the term is, at present, meaningless and confusing and likely to distance people from the concept (Define, 2007). The term which possessed the highest level of understanding and comprehension was ‘benefits we get from nature’. Define (2007) recommend that certain terms are avoided due to a significant lack of comprehension. This included the following:

- Provisioning services
- Regulating services
- Supporting services

This presents the integration of the concept within the England Wetland Vision with a major issue regarding language. Obviously the choice of language will depend on the audience to be engaged. However it should be noted that even for relatively warm audiences with an understanding of the environment, the use of some of the terms associated with ecosystem services requires careful consideration. A further complication is the work of the MA, the major conventions such as the CBD and Ramsar, and latterly the UK Government through Defra have adopted a consistent nomenclature to describe ecosystem services. These terms are described in Table 1. Whilst this might provide a common language within wetland ‘academic’ circles it may further ostracise a variety of audiences and complicate the implementation of a more multifunctional approach to a wetland vision.

5.4 Recommendations
Recommendations are provided across two timescales: (1) over the next six months and referred to as ‘immediate’; and (2) beyond six months and referred to as ‘longer term’.

5.4.1 Immediate recommendations
The following recommendations should be adopted within the next six months if ecosystem services are to be integrated into the Wetland Vision:

1. It is recommended that the England Wetland Vision Partnership agree a standard philosophy to the approach of implementing the vision. If this is to include the delivery of multifunctional benefits to society through the integration of ecosystem services then this should be clear in both published information and subsequent delivery on the ground.
2. Key within this should be the advocacy of a convergent approach rather than a habitat target-based approach defined in area. Therefore targets could be set on carbon storage, water quality improvements or homes protected from flood risk.
3. A standard, accessible nomenclature should be developed in order to communicate the concept of ecosystem services. This should be achieved through engagement and consultation with key audiences and be consistent with the terminology presented in Table 1.

5.4.2 Longer term recommendations
If the immediate recommendations are embraced, the following longer term recommendations will need to be implemented to convert aspiration into reality:
1. The philosophy of the vision should be to encourage any stakeholder engaged in wetland visions to, metaphorically, keep their eyes open for opportunities to secure multifunctional benefits. This will require a programme of education and the production of guidelines and supporting documents to facilitate this process as seems appropriate to assume that the cognisance of the audiences will be low.

2. As part of encouraging stakeholders to adopt a multifunctional approach, a round of consultation will be necessary to ensure maximum understanding and buy in within future wetland projects.

3. Any engagement with stakeholders needs to ensure that the use of language is appropriate. Key to this is the adoption of a common parlance and consistent nomenclature.

4. A series of case studies and demonstration sites should be worked up in detail. These should indicate that the identification of benefit need not necessitate economic evaluations or detailed process studies. Case studies should demonstrate how ecosystem services have been identified and delivered and describe the associated benefits to society. Case studies should also be drawn from different wetland habitats to demonstrate that ecosystem services apply across all wetland types.

5. The integration within the 50-year vision should also involve engagement with key experts to ensure a robust technical approach is advocated. Similarly these experts should also assist in the identification and integration of relevant datasets which can assist in informing the integration of ecosystem service benefits within local visions.

6. The UK Government is beginning to embrace the ‘ecosystem approach’. It is essential that the 50-year vision integrates with these initiatives and is not seen to stand outside of this process. Therefore the England Wetland Vision needs to integrate itself more closely with these initiatives to ‘mainstream’ it with current Defra, and wider, thinking.

### 5.5 Concluding remarks

There is no denying that wetlands need our help more now than at any other time. A 50-year vision for wetlands provides an unique opportunity to reduce wetland loss and degradation and to build a landscape which delivers both enhanced biodiversity and improved human well-being. The two concepts are not mutually exclusive and a true vision should be framed around the convergence of these concepts and delivery of a sustainable landscape where wetlands are key delivers of multifunctional benefits.
6 REFERENCES


7 ACKNOWLEDGEMENTS

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Please note that the views expressed in this report are that of the author’s and do not necessarily represent or reflect the views of the Wildfowl & Wetlands Trust or of the England Wetland Vision Partnership.
8 APPENDIX 1 – HABITAT INDEX

The habitat index represented a simplistic method of demonstrating the relative value of each of the local visions based on biodiversity related designations. Information on the designated status of each site was collating using MAGIC\textsuperscript{15}. The habitat designations are shown in the following table.

<table>
<thead>
<tr>
<th>Project</th>
<th>SPA</th>
<th>cSAC</th>
<th>Ramsar</th>
<th>SSSI</th>
<th>NNR</th>
<th>LNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Fen project</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Rainham Marshes</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>River Quaggy</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Little Ouse Headwaters Project</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Lincolnshire coastal grazing marsh project</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Peatlands for People</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
</tr>
</tbody>
</table>

Each habitat designation was assigned a score based on the following:

Score 4 Internationally important
SPA  
cSAC / SAC
Ramsar

Score 2 Nationally important
SSSI
NNR

Score 1 Locally important
LNR

Therefore the maximum score obtainable was 17.

<table>
<thead>
<tr>
<th>Project</th>
<th>SPA</th>
<th>cSAC</th>
<th>Ramsar</th>
<th>SSSI</th>
<th>NNR</th>
<th>LNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Fen project (8)</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Rainham Marshes (2)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>River Quaggy (0)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Little Ouse Headwaters Project (12)</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Lincolnshire coastal grazing marsh project</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Peatlands for People (16)</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

These scores were ‘normalised’ on a scale of 0 to 1.0 to generate an index. The index for each local vision was calculated as:

Great Fen project 0.47
Rainham Marshes 0.12
River Quaggy 0.00
Little Ouse Headwaters Project 0.71
Lincolnshire coastal grazing marsh project 0.76
Peatlands for People 0.94

\textsuperscript{15} \texttt{http://www.magic.gov.uk/website/magic/}