CREATING GREEN INFRASTRUCTURE FOR IRELAND

ENHANCING NATURAL CAPITAL FOR HUMAN WELLBEING

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Comhar
Sustainable Development Council

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Foreword

In March 2010, the European Council committed to a new vision for biodiversity and a target "to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as possible, and stepping up the European contribution to averting global biodiversity loss". A European Commission Communication on Biodiversity, published in January 2010, acknowledges the importance of Green Infrastructure in the biodiversity agenda. Comhar Sustainable Development Council (SDC), together with similar councils participating on the network of European Environment and Sustainable Development Councils (EEAC) has made the case that Green Infrastructure, and the protection and enhancement of ecosystem goods and services, should be viewed as critical infrastructure, in the same way as transport and energy networks and as vital to sustainable development.

The protection and development of Green Infrastructure has also been identified by Comhar SDC as one of the priority areas in its proposals for a Green New Deal for Ireland. Comhar SDC is convinced that there is a need to proactively develop Green Infrastructure and ecological connectivity and address fragmentation, and that this will have the dual function of enhancing biodiversity and improving resilience and adaptation to climate change.

Integration of the Green Infrastructure approach can be smart and strategic and offer potential ways of effectively integrating biodiversity into spatial planning and sectoral considerations. This is a real challenge for biodiversity policy and its implementation, and we need to find more effective ways of doing this to make progress in halting biodiversity loss.

In 2009, Comhar SDC commissioned a consortia led by Compass Informatics Limited, in partnership with Mary Tubridy & Associates, Keith Simpson & Associates and Cunnane Stratton Reynolds, to undertake the research on Green Infrastructure to contribute to the evidence base for policy and decision making in this area.

The Biodiversity Forum, the advisory body to Government on biodiversity which operates under the auspices of Comhar SDC, together with the Northern Ireland Biodiversity Group hosted a conference on 'Biodiversity and Planning: Building Connectivity for Sustainability'. The initial research findings were presented at the conference which was attended by a wide range of stakeholders including Government, Local Government, nature conservation, tourism, agriculture, forestry, planning, landscape architects and ecologists. There was widespread support and interest in Green Infrastructure. The research findings and the related policy recommendations in this report have been shaped by the feedback at the Conference and other stakeholder inputs since then.

This work has been led, on behalf of Comhar SDC, by Dr. Cathy Maguire with support of Ms. Niamh Kirwan. We are deeply grateful to them, and Professor Ken Whelan, Chair of the Biodiversity Forum, for managing the stakeholder engagement on the project and steering it to completion.

The detailed recommendations, which have been endorsed by the Biodiversity Forum and Comhar SDC, identify the opportunities for strengthening the policy and legislative framework in Ireland. The report and recommendations acknowledge that there are major challenges ahead of us to protect and enhance biodiversity and ecosystem goods and services, not least in the context of climate change. The report makes the case that despite many detailed safeguards, planning has failed biodiversity to date and the importance of biodiversity for our wellbeing is still not properly valued in policy and decision making.

Comhar SDC hopes that this report and the related policy recommendations will be a proactive contribution to the development of Green Infrastructure in Ireland, and in particular ecological connectivity, which will both enhance biodiversity and human wellbeing, and improve resilience and adaptation to climate change.

Noel Casserly
Director
Comhar SDC

Executive Summary

The study sets out a broad definition of Green Infrastructure and explores and proposes an approach and a set of principles that should be followed in Green Infrastructure planning. The promotion and development of the 'Green Infrastructure' concept, which can be defined as *'an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations'*[1], can assist in halting the loss of biodiversity and decline in ecosystem services. Biodiversity continues to decline because its value is not reflected in decision making by business and Government. Green Infrastructure seeks to address this problem by providing a spatial evidence base which highlights the value of biodiversity and ecosystem services to the economy and society. Green Infrastructure planning therefore allows for the integration of the value of biodiversity into business decisions in sectors such as agriculture and water supply, and also local and central Government decisions. Ecosystem services supplied by Green Infrastructure include *provisioning*, such as the production of food and water; *regulating*, such as the control of climate and disease; *supporting*, such as nutrient cycles and crop pollination; and *cultural*, such as spiritual and recreational benefits.

The study sets out how Green Infrastructure might be identified and mapped via three case studies for sample areas covering different general landscape and context types. These demonstrated the flexibility of the planning approach in different environments. They included an urban area, a peri-urban area and a more regional rural area. The case studies recognised that formal Green Infrastructure and other planning approaches are underway in these areas, and that this work is illustrative only. The pilot studies raise some interesting issues still to be discussed and resolved including; the integration of Green Infrastructure planning with traditional planning, the need for national objectives, the introduction of strategic land use planning in areas which have not been subject to detailed spatial planning, the recognition of ecosystem services in local plans and the collection of appropriate information on local features of Green Infrastructure.

The report describes a planning process to support the implementation of the Green Infrastructure approach. This allows for flexibility based on the nature of Green Infrastructure, local stakeholder needs and specific local objectives. It sets out the various stages involved in the preparation of a Green Infrastructure plan following best practice models. The planning process should follow a typical rational planning methodology including: (a) a process planning stage, (b) analysis, (c) plan and strategy formulation, and (d) implementation, with feedback between the stages.

Awareness of the intrinsic value of Green Infrastructure and stakeholder involvement are essential elements of successful planning. These will have to be accommodated at all stages to build community cohesion and support sustainable development. Green Infrastructure mapping provides the strategic framework which can then be built on by adding stakeholder knowledge of local opportunities and priorities.

There is a need to proactively develop Green Infrastructure, and in particular ecological connectivity, which will both enhance biodiversity and human wellbeing, and improve resilience and adaptation to climate change. As Green Infrastructure emphasises management and not just protection of the environment, it has particular potential to assist in meeting the requirements of a range of European Directives (Habitats, Birds, Water Framework and Floods). It provides a path through the increasingly complicated legislative framework while focusing on the resource itself and how different demands and requirements can be reconciled though integrated cost effective actions. This need to go beyond

1 Benedict, M.A. and McMahon, E.T. (2002) Green Infrastructure: Smart conservation for the 21st Century. Renewable Resources Journal 20(3): 12-17.

protection of biodiversity on special sites and take a proactive and outward looking approach to connect sites in the wider countryside is recognised in Article 3 of the Birds Directive and Article 10 of the Habitats Directive. Objectives 2 and 3 of the EU Communication on 'Halting biodiversity loss by 2010 and beyond: sustaining ecosystem services for human wellbeing' stress the need 'to conserve and restore biodiversity and ecosystem services in the wider EU countryside and marine environment.'

The preliminary national map has commenced the process of designing a national Green Infrastructure framework map. It provided a framework for the illustrative case studies and a national overview of Green Infrastructure. These maps are relatively easy to prepare to support Green Infrastructure planning studies and can be easily revised as data improves and comments are received from potential users.

A SWOT analysis of Green Infrastructure was carried out identifying and summarising the strengths, weaknesses, opportunities, and threats of the approach. The analysis serves to highlight what needs to be done to make the Green Infrastructure approach central to spatial planning, including the obstacles to achieving that. It is believed that Green Infrastructure and Spatial Planning Policy are more compatible with current plan making processes which are focused on urban areas, and with some modifications current plan making can accommodate the Green Infrastructure concept in these locations. More innovative mechanisms are required to extend this approach to rural areas and here we can draw on practices in countries such as the Netherlands.

Further work is needed to refine and implement a Green Infrastructure planning approach. Research is necessary to assess the value and functions of Green Infrastructure and to allow for the development of practical how-to guides for national, regional and local Green Infrastructure. This will require local authorities, the Spatial Planning Unit of the Department of Environment, Heritage and Local Government, and a sample regional authority. Training and awareness will be necessary and training should be case based, developed in consultation with existing networks of professionals, and have a particular focus on consensus development and multi-functionality. Plugging of data gaps and the more streamlined integration of data will be necessary to ensure the successful adoption of any Green Infrastructure approach.

The baseline analysis presented here, has assessed the potential of the Green Infrastructure approaches in Ireland; investigated and illustrated potential planning and implementation methodologies and tools; and raised awareness of the approach through its outcomes and related workshops and conference. This was a preliminary study which generated considerable interest among the participants of the workshops which were held to inform its development. Many of the issues raised during the workshops have informed the contents of this report. Those which are outside the scope of the study have been identified as areas for further work.

A range of recommendations are set out to support the proper and appropriate use of the Green Infrastructure approach in an Irish context. The recommendations in this report have been prioritised into different phases in recognition of the process that will need to be undertaken to develop and implement a Green Infrastructure approach in Ireland. The recommendations below relate to the initial actions that are necessary to create Green Infrastructure for Ireland and should be undertaken during 2010-11.

Phase 1 – Creating Green Infrastructure for Ireland (2010-11)

Green Infrastructure approach:

- The approach recommended by Comhar SDC and the Biodiversity Forum to implement Green Infrastructure should be adopted by Government. The planning process should follow a typical rational planning methodology including: (a) a process planning stage, (b) analysis, (c) plan and strategy formulation, and (d) implementation, with feedback between the stages and stakeholder participation incorporated throughout the process. This allows for flexibility based on the nature of Green Infrastructure, local stakeholder needs and specific local objectives.
- A pilot study should be undertaken to develop a Green Infrastructure Strategy following the recommended planning process and incorporating a fuller area assessment, data analysis, stakeholder participation, and prescription of detailed actions. This should be facilitated by Comhar SDC in partnership with selected Local Authorities.

Governance and co-ordination:

- Government should identify the Department of the Environment, Heritage and Local Government (DOEHLG) as the lead Department and assign appropriate resource to co-ordinate the implementation of Green Infrastructure and provide a support and advisory service. The DOEHLG should act as a champion of the Green Infrastructure approach.
- Comhar SDC, the Heritage Council and other key stakeholders should work with the lead Department to provide training and awareness raising on Green Infrastructure amongst the public, planning professionals and local authorities.

National GI framework and guidance:

- National Green Infrastructure objectives should be developed and published to inform national and regional planning guidance, county and local development plans. This should be led by the DOEHLG.
- Guidance on Green Infrastructure should be developed to support local initiatives and build on best practices. Practical how-to guides should be developed for national, regional and local Green Infrastructure. This should be led by the DOEHLG and carried out in partnership with key stakeholders including Comhar SDC, Heritage Council, Local Authorities, regional authorities and landowners.
- A National Habitat Map at Heritage Council Level 2 detail and field resolution should be developed building on current initiatives to provide a basis for national to local Green Infrastructure maps.
- The National Framework Green Infrastructure Map should be further developed to incorporate additional Green Infrastructure elements such as climate change adaptation and food production and used to inform spatial planning and other policy areas. The map should be regularly revised as data improves and users provide feedback. This should be led by the DOEHLG.

- Integrated Regional Framework Green Infrastructure maps should be produced to guide and inform national and regional strategies and to provide a framework for local plans and implementation. The use of a GIS system means they can be produced at River Basin District, regional and local scales. This should be led by the DOEHLG in partnership with Regional and Local Authorities.

Current policy opportunities:

- Green Infrastructure should be included in the revised National Biodiversity Plan as a key mechanism for integrating biodiversity concerns into sectoral policies and spatial planning. The National Biodiversity Plan should contain explicit reference to Green Infrastructure ideally in a section on partnership and integration processes. Resources should be allocated to allow for the implementation of the objectives of management plans for designated sites and River Basin Districts as these are almost all compatible with Green Infrastructure Planning.
- Green Infrastructure should be incorporated into the National Adaptation Plan as a mechanism of integrating biodiversity and climate change policies.
- Planning authorities should use the provisions in the Planning and Development (Amendment) Act 2010 to ensure that supplementary development contribution schemes support Green Infrastructure development.
- The recent commitment to undertake a Landscape Character Assessment should incorporate Green Infrastructure by mapping functions of the landscape and not just character. Legislation and guidelines developed to promote landscape planning should recommend that this takes place in the context of Green Infrastructure planning. The focus of Landscape Character Assessment should be extended to urban and peri-urban areas and potential linkages to support ecosystem functioning should be considered in landscape character areas. Information gathered to assist both processes should be shared. This should be led by the DOEHLG in partnership with the Heritage Council.

1. Introduction

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1.1 Introduction

Comhar Sustainable Development Council (SDC) commissioned research on Green Infrastructure to contribute to the evidence base for policy and decision making in this area as part of Comhar SDC's Green Infrastructure work programme. The advisory body to Government on biodiversity, the Biodiversity Forum operates under the auspices of Comhar SDC. In November 2009 the Biodiversity Forum and the Northern Ireland Biodiversity Group held a conference on 'Biodiversity and Planning: Building Connectivity for Sustainability'. The initial research findings were presented at the conference which was attended by a wide range of stakeholders including Government, Local Government, nature conservation, tourism, agriculture, forestry, planning, landscape architects and ecologists. There was widespread support and interest in Green Infrastructure and a second workshop was held with key stakeholders to consider the research findings in detail and ensure stakeholder input informed the approach and recommendations. This research has also informed Comhar SDC's and the Biodiversity Forum's recommendations to Government on the development of Green Infrastructure in Ireland.

1.2 Motivation and Definition

Development has been a major driver of habitat degradation and biodiversity loss in Ireland. There is a clear need for spatial planning to take greater consideration of both biodiversity and climate change adaptation issues. Existing tools such as Strategic Environmental Assessment and Environmental Impact Assessment aim to prevent impacts and ensure effective mitigation measures are included in development plans. However, the use of these tools alone is essentially a reactive approach. There is a need to proactively develop Green Infrastructures and ecological connectivity and address fragmentation, which will have the dual function of enhancing biodiversity and improving resilience and adaptation to climate change.

Green Infrastructure and its ecosystem goods and services should be viewed as critical infrastructure for Ireland in the same way as our transport and energy networks are seen as vital to sustainable development. The development of Green Infrastructure has been identified by Comhar SDC as one of the priority areas in its proposals for a Green New Deal for Ireland[2].

Green Infrastructure strategies set out a positive vision of the future provision of Green Infrastructure and how it contributes to enhancement of biodiversity and human wellbeing. Green Infrastructure mapping and strategy development can play an important role in gaining political and public support for biodiversity protection and enhancement.

Green Infrastructure can be broadly defined as *'an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations. Green Infrastructure is the ecological framework needed for environmental, social and economic sustainability – in short it is a nation's natural life sustaining system'*[3]. There is no standard definition of Green Infrastructure and indeed the working definition adopted by the project was as follows:

2 Comhar Sustainable Development Council (2009) Towards a Green New Deal for Ireland. http://www.comharsdc.ie/_files/2009_TowardsAGreenNewDealComhar_rpt.pdf

3 Benedict, M.A. and McMahon, E.T. (2002) Green Infrastructure: Smart conservation for the 21st Century. Renewable Resources Journal 20(3): 12-17.

'Green Infrastructure is a strategically planned and managed network featuring areas with high quality biodiversity (uplands, wetlands, peatlands, rivers and coast), farmed and wooded lands and other green spaces that conserve ecosystem values which provide essential services to society.'

In addition to variations in definition, there are differences in the type of work being undertaken in developing Green Infrastructure in different countries. A recent European workshop organised by DG Environment brought together a wide range of initiatives to examine how Green Infrastructure could be developed in Europe focusing on the integration of the Natura 2000 network into the wider countryside[4]. The workshop offered the following definition: *'planning approaches which maintain ecological functions at the landscape scale through multi-functional spaces'*. Initiatives are taking place across Europe at a range of scales; transnational, national, regional and local with some focusing on green space in urban environments and others on the development of ecological networks. For the purposes of our approach, Green Infrastructure includes multi-functional green spaces in urban areas as well as ecological connectivity in the wider landscape.

Some work has already been undertaken in this area in Ireland and there are a number of local authorities and other stakeholders who are interested in furthering development of Green Infrastructure. The focus to date has been mainly in urban areas and at local authority level[5]. The Environmental Protection Agency also funded a study identifying the preliminary needs for the development of a national ecological network in Ireland[6]. This study highlighted the need for local area studies in the context of national or local spatial planning.

This research has sought to enable the identification of current assets and outline the functional requirements and benefits of current Green Infrastructure. In undertaking this baseline assessment the use of digital mapping and Geographical Information Systems (GIS) to collate, map and analyse information has been important. This work it is hoped will provide an evidence base for follow on work - developing strategies, assessing future needs, and identifying where improvements and new Green Infrastructure should be provided in the future.

1.3 Aim and objectives

The aim of the research was to establish the baseline situation regarding Green Infrastructure in Ireland and develop recommendations to Government on the creation of Green Infrastructure and identify the most important actions for establishment of Green Infrastructure approaches.

The research had a number of objectives including:

- Establishment of the baseline situation regarding any mapping or policy development on Green Infrastructure by local authority area.

4 See Proceedings from the Workshop "Towards a Green Infrastructure for Europe", 25-26 March 2009, Brussels (www.green-infrastructure-europe.org).

5 UCD Urban Institute Ireland, Dún Laoghaire-Rathdown County Council and Fingal County Council (2008) Green City Guidelines. Advice for the protection and enhancement of biodiversity in medium to high-density urban developments. UCD Urban Institute Ireland, Richview, Clonskeagh Drive, Dublin 14, Ireland. ISBN 978-1-905254-33-0.

6 Tubridy, M. and O'Riain, G. (2002) Preliminary study of the needs associated with the development of a National Ecological Network. ERTDI Report (2000-LS-4-4), Environmental Protection Agency, Ireland. http://www.epa.ie/downloads/pubs/research/land/EPA_ecological_network_ERTDI5_synthesis.pdf

- Selection of three local authority areas for baseline assessment of Green Infrastructure assets to act as demonstration case studies. These should include an urban, rural and mixed area.
- Collation of existing baseline data, consultation with data providers and digitisation of data to produce Green Infrastructure baseline maps for the three local authority areas.
- Identification of key data gaps and needs.
- Analysis of maps to identify opportunities for further development of Green Infrastructure in selected areas.
- Development of policy recommendations on how Green Infrastructure could be developed tailored for national and local government. This should also include identification of key partners and stakeholders.
- Presentation of the initial research findings to stakeholders and ensuring stakeholder input into recommendations.

1.4 Outputs

The main output of the research project is this report, however, other important outputs include a collation of spatial data organised and categorised into Green Infrastructure themes; use of that data to create a National Green Infrastructure framework map, and a series of illustrative maps of potential Green Infrastructure for the case study areas. In addition a series of presentations were made at the November 2009 national conference on Green Infrastructure[7], and two project workshops.

1.5 Overview of Report Structure

The report firstly provides a background to Green Infrastructure, then progresses to discussing the national infrastructure map and case studies, and based on this background understanding, it proceeds to set out a way forward in terms of potential in existing legislation, planning and associated initiatives. Lastly the recommendations are drawn together and presented.

7 Biodiversity Forum/Northern Ireland Biodiversity Group Joint Conference *'Biodiversity and Planning: Developing Connectivity for Sustainability'*. Botanic Gardens, Dublin. Comhar SDC.

2. **Green Infrastructure** – where are we now?

2. Green Infrastructure – where are we now?

2.1 Introduction

A review of various legislation, policies and examples of best practice relevant to Green Infrastructure was undertaken. These are summarised in this chapter but dealt with individually and in more detail in Appendix 1 in order to inform the assessment of the appropriateness of Green Infrastructure as an approach, the methodologies applied to date, and to consider opportunities within current legislation and initiatives. In providing this summary we do not seek to provide a fully argued assessment of Green Infrastructure as this is dealt with in many other publications, rather this chapter seeks to give a sense of the widespread adoption of Green Infrastructure and related approaches and the opportunities available to Ireland.

In addition, a telephone survey was carried out among a sample of local authorities (urban and rural) to explore the relationship between biodiversity, local spatial planning and interest in Green Infrastructure (further information is presented in Appendix 2). Consultations were also held at a project workshop that was attended by representatives of selected local authorities and large landowners, and the Green Infrastructure conference hosted by Comhar SDC[8] provided an additional opportunity to present and discuss ideas around Green Infrastructure.

2.2 Development of Green Infrastructure planning

2.2.1 Global context

Green Infrastructure planning is being actively promoted by the EC and Irish government. It has its roots in planning and conservation efforts in Europe and America and increasing appreciation of the services provided by ecosystems. Ecosystem services benefit human well-being and health, and provide other direct benefits, such as flood control, water purification and regulation, carbon capture, food production, raw materials, and emotional, recreational and spiritual values. Green Infrastructure planning identifies the key areas which provide these ecosystem services and seeks to inform decision making on trade offs and compromises which need to be made to get the best outcome for human wellbeing from these multifunctional landscapes.

While not enshrined in legislation internationally or nationally, the Green Infrastructure approach supports global policy on biodiversity and sustainable development. Agenda 21 and associated global biodiversity policy (The Convention on Biological Diversity) emphasise the value of biodiversity to economic activity (food production, clean water and air) and the need for improved management of biodiversity by all individuals and sectors. Concern with climate change has also increased attention on Green Infrastructure.

An ongoing study on The Economics of Ecosystems and Biodiversity (TEEB) which is sponsored principally by the United Nations Environment Programme and the EU, provides evidence that investment in Green Infrastructure offers cost-effective opportunities to meet policy goals. The study shows that it is cheaper to make such investment than restoring damaged ecosystems and that the social benefits that accrue from appropriate investment are of a significantly higher magnitude than the costs.

8 Biodiversity Forum/Northern Ireland Biodiversity Group Joint Conference *'Biodiversity and Planning: Developing Connectivity for Sustainability'*. Botanic Gardens, Dublin. Comhar SDC.

The key concepts and strategies associated with Green Infrastructure planning were developed in the 1970s and 80s and have been linked to the ecological networks concept during this period. In recent decades concern with ecosystem services and climate change has promoted increased interest in the approach.

Formal Green Infrastructure planning became common in the USA and has been promoted by, amongst others, an environmental non-governmental organisation The Conservation Fund which has produced supporting training manuals and runs training courses in conjunction with the Forest Service (www.conservationfund.org).

Plans from the US highlight the value of ecosystem services provided by wetlands as sources of clean water, for flood attenuation, and improving water quality. The plans also provide a mechanism to manage sprawl, identify 'greenways' (non motorised transport routes) and suggest management initiatives at landscape scale (both urban and rural areas) to protect and enhance networks (cores and corridors). Resultant Green Infrastructure plans highlight areas of high biodiversity, farmland, woodland, provide information on the economic value of Green Infrastructure, and specify socio -economic strategies to support integration of biodiversity through spatial and sectoral planning. A case study examined in Maryland which focused on Cecil County bordering Chesapeake Bay identified the optimum network of interconnected natural areas and open space which could protect 94% of its wetlands and 75% of its forests. Research on the economic value of Green Infrastructure estimated that its contribution to the county's clean air and water, flood protection provided an estimated $1.7 billion in ecosystem services each year.[9]

2.2.2 Developments within Europe

Within Europe the network approach to environmental management was pioneered by the Netherlands to support the implementation of the EU Habitats Directive, the principal objective of which is to set up a network of protected sites in the form of Natura 2000. Article 10 of the Habitats Directive states: "Member States shall endeavour…in their land-use planning and development policies and, in particular, with a view to improving the ecological coherence of the Natura 2000 network, to encourage the management of features of the landscape which are of major importance for wild fauna and flora… Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems for marking field boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species".

By prescribing the identification and management of linear, connecting features and habitat islands, the Habitats Directive effectively requires the adoption of an ecosystem or landscape-scale approach to biodiversity management as a means to complement the protection of individual designated sites.

In 1990 the Dutch government introduced the National Ecological Network (Ecologische Hoofdstructuur) with the aim of developing a coherent network of natural areas (core areas and nature development areas) connected by ecological corridors. With this concept, the government replaced the traditional protection approach to site based conservation, with a pro-active form of protection and nature development, setting clear priorities in a wider national and international context. The ecological network approach has been examined or adopted by many countries across Europe. It has drawn attention to land outside designated areas such as less intensively managed farmland and the importance of rural development policy and making links between conservation priorities and land use and development.

9 http://www.greeninfrastructure.net/sites/greeninfrastructure.net/files/1-magreeninfrastructurecasestudy.pdf

Best practice in Europe supports strategic spatial planning which integrates biodiversity. The European Spatial Development Perspective has as its objectives the development of ecological networks and the integration of biodiversity considerations into sectoral policies such as agriculture, transport, tourism, recreation and fisheries.

International networks of planners and ecologists have voiced support for a network approach. The New Charter of Athens 2003 produced by The European Council of Spatial Planners[10] called for the preservation and development of connected networks of habitats, open space, water bodies, cultural heritage features and the surrounding rural landscape. The European Council of Spatial Planners, in a document titled 'Try it This Way: Checklist for Sustainable Development at the Local Level'[11] reiterates the importance of Green Infrastructure planning in urban areas (although without naming it as such), suggesting possible components of the urban Green Infrastructure network and stressing the importance of its connection to the urban hinterland. Networks of European ecologists have actively advocated a European ecological network to support the implementation of the Pan European Biological and Landscape Diversity Strategy promoted by the Council of Europe. Organisations such as the European Centre for Nature Conservation[12] have acted as focus points for ecological network and Green Infrastructure related programmes.

2.2.3 Current EC policy on Green Infrastructure

A 2008 conference on Green Infrastructure organised by the European Commission (www.green-infrastructure-europe.org) linked the development of ecological networks to Green Infrastructure planning and revealed a diversity of approaches throughout Europe. Currently most countries are focusing on Green Infrastructure planning for biodiversity, particularly to improve the value of the Natura 2000 network. There is increasing emphasis on managing Green Infrastructure to mitigate for climate change. Among individuals and organisations which reported at this conference there was less interest in planning for ecosystem services or integrating this initiative with other aspects of EC environmental/sustainable development policy. Key lessons and opportunities were also identified which include the following:

- The need for Green Infrastructure plans to be produced nationally and locally.
- The requirement for mechanisms to allow for integration between them.
- That plan making processes should maximise the involvement of stakeholders.
- An acceptance that the final outcome will be based on negotiations with the socio-economic partners.
- That the methodology and implementation should be easily understood.
- That research was needed on species movement to improve value of corridors.
- That Green Infrastructure planning should support improved targeting of existing supports for sustainable development e.g. agri-environmental schemes.

10 http://www.ceu-ectp.eu/index.asp?id=108
http://www.ceu-ectp.eu/images/files/Athens_Charters/charter2003.pdf

11 The European Council of Town Planners'Guide for Spatial Planning (2002), *Try it this way, sustainable development at the local level.* http://www.ceu-ectp.eu/index.asp?id=109.

12 http://www.ecnc.org/

Green Infrastructure is being promoted by the Biodiversity Unit, DG Environment of the European Commission, and the European Network of Environment and Sustainable Development Advisory Councils to support 1) the establishment of a "network" based on Natura 2000, 2) the integration of biodiversity with spatial and sectoral planning, 3) the provision of services provided by ecosystems such as clean air and water, productive soils, recreation areas and 4) to mitigate for climate change. It also explicitly recognises the role of Green Infrastructure for ecosystems in the wider countryside and marine environment outside of Natura 2000 areas[13].

It is considered that Green Infrastructure planning will be particularly important to implement the current EC Biodiversity Strategy and Biodiversity Action Plan[14] and its proposed follow-ons. While many of the Strategy objectives such as that "to re-enforce the compatibility of regional and territorial development with biodiversity", relate closely to Green Infrastructure there is also closer reference. In this regard Action 4.3.1 seeks to "develop and implement spatial and programmatic plans that support the coherence of the Natura 2000 network (in line with the requirements of the nature directives to ensure such coherence) and maintain and/or restore the ecological quality of wider landscape". The European Commission is currently developing a Green Infrastructure Strategy for Europe. However, it will be essential that the potential to facilitate spread of invasive alien species is properly considered in developing a Green Infrastructure plans to avoid unintended negative impacts on biodiversity.

2.2.4 Green Infrastructure planning in the UK

Green Infrastructure planning and development in the UK has taken place almost exclusively in urban and peri-urban areas and describes planning which has as its principal objective the provision of a network of areas for recreation. The government's advisor on architecture, CABE (Commission about the Built Environment)[15] has recently issued a policy statement titled "Grey to Green" which emphasises the potential for restoring or recreating Green Infrastructure in urban settings.

Studies have taken place in urban areas (such as East London Green Grid[16]) which have strategically mapped and considered multiple uses of Green Infrastructure such as:

- Flood risk areas.
- Ecologically sensitive areas.
- Barriers to connectivity.
- Areas of open space deficiency; quality/poor accessibility.
- Transport corridors (walk/cycle/car/bus/rail) and hubs.
- Residential and employment zones.
- Future development areas.

The Millennium Ecosystem Assessment (2005) has produced a valuable definition of ecosystem services. This grouped ecosystem services into four broad categories: *provisioning*, such as the production of food and water; *regulating*, such as the control of climate and disease; *supporting*, such as nutrient cycles and crop pollination; and *cultural*, such as spiritual and recreational benefits.

13 http://ec.europa.eu/environment/nature/ecosystems/index_en.htm

14 http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/sec_2006_621.pdf

15 http://www.cabe.org.uk

16 http://www.designforlondon.gov.uk/what-we-do/all/east-london-green-grid/

While the specific Green Infrastructure approach is effectively largely urban focused, the related ecological networks approach is being subjected to increased attention in rural areas. Building on experience gained through the Cheshire Ecological Network[17] Scottish Natural Heritage is currently undertaking research into the scientific value of the networks approach[18] while the UK government has recently started research on a national ecological network[19].

A regional Green Infrastructure study in the north west[20] is unusual as it is promoted by a community forestry initiative and highlights the importance of Green Infrastructure assets for carbon storage and sequestration, as source of fossil fuel and material substitution, food production as well as recreation.

The principal Green Infrastructure project in Scotland focuses on social inclusion and community cohesion and promotes community involvement in green space management. (www.greenspacescotland.org.uk)

Green Infrastructure planning in Wales has a broad focus and is linked to improving socio-economic conditions particularly in rural areas. The Welsh plan assesses the added socio-economic benefits for having intact watersheds and peaty areas for flood retention, freshwater supplies and carbon sequestration. Planning is based on studies carried out since the 1990s on ecological connectivity, landscape character, recreational planning and ecosystem services. The findings are now being incorporated into the Wales Spatial Plan in order to influence spatial planning decisions e.g. to direct agri-environment money into areas that are providing important ecosystem services to society and to steer development such as energy infrastructure.

2.2.5 Green Infrastructure Planning in Ireland

Within Ireland interest in Green Infrastructure has similarly developed over the last decade. A study of ecological networks, carried out to inform the National Spatial Strategy in 2002[21] referred to the map of a proposed national ecological network as a Green Infrastructure map. However the final National Spatial Strategy made no direct reference to the value of the network approach or its relevance to strategic planning.

The concept was formally introduced to Ireland in 2008 at an international conference organised by Fingal County Council held in Malahide, County Dublin[22]. It was addressed by the Minister for Environment, Heritage and Local Government and speakers came from the US, the Netherlands, the UK, and Sweden. Contributors from Ireland included Fingal County Council, the Heritage Council, the National Parks and Wildlife Service, and the Environmental Protection Agency. The large attendance at the conference confirmed interest in the concept, particularly from planners.

17 http://www.cheshire.gov.uk/SREP/NHE_ECOnet_Ecointro.htm

18 http://www.snh.org.uk, http://www.publiccontractsscotland.gov.uk

19 http://www.whitehallpages.net/modules.php?op=modload&name=News&file=article&sid=241769

20 http://www.greeninfrastructurenw.co.uk

21 Tubridy M, O Riain, G (2002). Preliminary study of the needs associated with a National Ecological Network. ERTDI Report (2000-LS-4-4), Environmental Protection Agency, Ireland. http://www.epa.ie/downloads/pubs/research/land/EPA_ecological_network_ERTDI5_synthesis.pdf

22 http://www.fingalcoco.ie/Planning/ConservationHeritage/GreenInfrastructure/

Biodiversity management and the Green Infrastructure approach

Biodiversity management in Ireland as led by the National Parks and Wildlife Service (NPWS), is principally concerned with implementing obligations arising from EU Habitats, Birds and related Directives and the national Wildlife Amendment Act (2000) which focus on particular habitats and species and also tends to focus on designated areas rather than the broader landscape. Integration of biodiversity and development is principally mediated through the planning system via the Planning Acts with local authorities being the principal actors. The Strategic Environmental Assessment process is also relevant to the Green Infrastructure approach as it requires the comprehensive collection, evaluation of environmental information, and the definition of environmental objectives.

Management initiatives at the landscape level have drawn attention to the multifunctional benefits of Green Infrastructure. These include the Water Framework Directive, the Flood Risks Directive and the European Landscape Convention. The water related directives recognise the multi-functional use of wetlands, require objective-based planning based on comprehensive baselines, co-operation between local authorities and consideration of wetland catchment management in spatial plans, and recognise the multifunctionality of 'landscape'.

The implementation of the Convention on Biological Diversity[23] by the NPWS actively supported by the Heritage Council has introduced broader objectives for biodiversity management. It has resulted in the first National Biodiversity Action Plan, improved access to information on biodiversity through the National Biodiversity Data Centre[24], research on biodiversity outside designated areas, and mechanisms for greater stakeholder involvement through local fora and Local Biodiversity Action Plans principally developed through local authorities.

The integration of biodiversity with development is a priority of the current national Biodiversity Action Plan. A recent review[25] which stated that only 7% of designated habitats are in good status, with 46% inadequate and 47% poor, suggests that existing mechanisms are not working effectively and that new approaches are needed.

An economic evaluation of biodiversity was commissioned by the NPWS in 2008[26]. This estimated that the current marginal value of biodiversity and certain ecosystems services in Ireland in terms of their contribution to productive output and human utility is over €2.6 billion per annum.

Contributions were assigned to the following sectors:

Agriculture	€1372m/annum
Forestry	€85m
Fish (catch)	€180m
Aquaculture	€50m
Water Quality	€385m
Human Welfare	€330m

23 http://www.cbd.int/

24 National Biodiversity Data Centre – http://www.biodiversityireland.ie.

25 http://www.npws.ie/en/PublicationsLiterature/ConservationStatusReport/

26 Bullock, C., Kretch, C. & Candon, E. (2008). The Economic and Social Aspects of Biodiversity Benefits and Costs of Biodiversity in Ireland. Unpublished Report to National Parks & Wildlife Service. http://www.npws.ie/en/media/NPWS/Publications/Biodiversity/Media,6432,en.pdf

This assessment does not consider all ecosystem services as defined by the Millennium Ecosystem Assessment and it excludes food production and waste assimilation. Thus the total value must be considered as being conservative.

An increasing number of practical initiatives offer guidelines or funds to support the integration of biodiversity related actions with other uses. These relate principally to rural land use planning and agriculture – for example cross compliance, REPS type payments, and the NPWS farm scheme – and generally relate to areas that contain relatively higher quality biodiversity elements of Green Infrastructure. The Rural Environment Protection Scheme (REPS), recently closed to new entrants, offered financial incentives to farmers to manage land, watercourses and buildings sustainably. Commonage Framework Plans, were developed jointly by agriculture and biodiversity specialists to provide guidelines for farmers managing vulnerable high value biodiversity areas. Research commissioned by the Heritage Council has examined concepts such as 'high value farmland', greenways, and mechanisms for integrating farming, forestry and environmental management.

It is believed that Green Infrastructure planning would complement the objectives of the Heritage Council for improved landscape management, information dissemination and build on its relationship with local authorities. Local Biodiversity Action Plans which have been prepared by local authorities have increased the profile of Green Infrastructure locally and offer an opportunity for greater stakeholder involvement in its management.

"Green" guidelines have been produced by development sectors (forestry and road development) or to guide development in particular areas (Green City Guidelines). While REPS has provided specific incentives for biodiversity friendly management on farms, certain landowners also engage voluntarily in this process. In the peatland sector, Bord na Mona is considering allocating 80% of its substantial land bank to "green uses" (Catherine Farrell, Bord na Móna, pers.comm.).

Overall many aspects of current planning practice support the development of the Green Infrastructure approach. The fundamental concepts of Green Infrastructure such as multi-functionality and connectivity are increasingly visible in local development plans, although with no recognised definition or method of Green Infrastructure planning the concept remains vague. The planning process has made developers and consultants familiar with good and bad examples of Green Infrastructure, even if not known by that name, while there is growing familiarity with partnership approaches to strategic spatial planning of natural resources such as those on coastal zone management or river basin management planning.

Recreation and the Green Infrastructure approach

The principles of connectivity and multi-functionality are particularly relevant to planning for outdoor recreation. Recreation in a rural area is likely to take place in a setting richer in Green Infrastructure. In urban areas most places dedicated to recreation are small, with less Green Infrastructure. Although users, uses, and competing functions will differ between urban and rural areas the same principles apply. In the 1870s Frederick Law Olmsted prepared a plan for a 10 mile long 'parkway' for Boston, known as the Emerald Necklace, using tree-lined esplanades and the Muddy River to link a string of urban parks to natural areas at the edge of the city. Two current national policy documents suggest that the adoption of a Green Infrastructure planning approach for recreation could result in major benefits in both the urban and rural environments.

The National Countryside Recreational Strategy which was developed by all the major stakeholders with the active involvement of the Minister of Community, Rural and Gaeltacht Affairs, supports

a multifunctional approach to the use of the countryside. The Strategy contained a number of strategic objectives including the development of 'a suitable structure to deliver a national countryside recreation service in a strategic and coordinated way'. Its implementation is focusing on the development of a network of trails including 'Greenways', and consideration is being given to improving the connectivity between routes and maximising the recreational potential of state controlled land and assets. The National Recreation Policy for Young People published in 2007 provides a strategic framework for the promotion of recreational opportunities for young people. It considered that poor planning and the poor quality of the physical environment have restricted young people's engagement in recreation activities.

An EU funded research project based in UCD[27] and which involved several European partners examined the value of greenspace using Dublin City as one of several case study areas. The focus of research in Dublin was on public attitudes. Recent research by the Economic and Social Research Institute[28] confirmed the financial benefits of greenspaces to home owners as they concluded house prices were related to proximity to green spaces and parks in Dublin city.

At a county level the Galway Recreation Needs Strategy[29] recognised that careful design of facilities can help to bring about positive environmental change, and that areas at risk of decline or under threat can be restored while allowing access for appropriate use by the community. One of its principal objectives was the development of an integrated network of areas and facilities.

Dublin South County Council[30] for its part is implementing a network of cycle routes linking parks and watercourses while Belfast[31] is undertaking an initiative to join greenspaces via greenways and cycleways with an emphasise on recreation.

At a more local level, the Liberties Regeneration Local Action Plan[32] involved fieldwork to characterise all Green Infrastructure and developed a set of actions to integrate biodiversity and open space development. Objectives included a network of parks attractive for recreation and wildlife, the development of linkages of value to biodiversity and non motorised transport and the integration of biodiversity and open space provision within developments. The biodiversity element of the Action Plan acts in parallel with sports, leisure and recreation plans along with arts, built heritage and waste management.

Local Authorities and the Green Infrastructure approach

A survey of selected staff in a sample of local authorities was undertaken to evaluate the awareness among local authorities in Ireland of the Green Infrastructure approach, to assess how biodiversity was being incorporated into the planning process, and also to find out what datasets were created or used to inform this process.

27 http://www.ucd.ie/greensp/

28 http://www.esri.ie/publications/latest_publications/view/index.xml?id=2913

29 Galway City Council (2008). Galway City Recreation and Amenity Needs Study. Galway City Council. http://www.galwaycity.ie/AllServices/Planning/Publications/#d.en.4691

30 Hannon, M (2008). The development of a green route system for South Dublin. Vol 16(1) 12-16, Spring 2008 Countryside Recreation, Countryside Recreation Network. http://www.countrysiderecreation.org.uk/journal/Spring%202008/Spring%202008.pdf

31 Montgomery, J (2008), Belfast gets it breath back. Vol 16(1) 8-11, Spring 2008 Countryside Recreation, Countryside Recreation Network. http://www.countrysiderecreation.org.uk/journal/Spring%202008/Spring%202008.pdf

32 http://www.theliberties.ie/

The survey confirmed that working relationships between biodiversity/heritage specialists and planners, engineers and local development interests support engagement with the Green Infrastructure approach to planning.

Until six years ago local development plans only referred to the value of rarer examples of Green Infrastructure such as designated sites and the protection of trees. Within the last six years a significant amount of data on local biodiversity has been generated through projects funded partly by the Heritage Council. As a result, efforts are being made to utilise this information in local spatial planning. Many counties have commissioned blanket habitat mapping (using Fossitt, 2000) to characterise Green Infrastructure in areas with potential for development (Fingal, Meath, Clare, Sligo, Kildare, Cork County), or as an aid to a comprehensive baseline (Laois). Other local authorities have surveyed particular landscape features such as fens, peatlands, eskers, parks, grasslands, coasts, hedgerows and bridges.

Perhaps more so than local datasets, the NPWS maps of designated Natura 2000 sites are the most important source of information on Green Infrastructure assets. Few local authorities have access to other NPWS data sets such as data on rare plants, or results of bat, woodland and grassland surveys.

There is less awareness and little direct use of other national digital data sets to guide spatial planning such as those provided by the EPA (CORINE landcover, water quality, river catchments, soils); the Geological Survey (soils, aquifers, bedrock geology); Ordnance Survey (1st and following editions of 1:10560 scale mapping; Digital Terrain Model providing height, slope and aspect data; aerial photography); and other organisations such as the Teagasc, Forest Service, Coillte, Department of Agriculture Fisheries and Food. These specialist data sets are principally used for Strategic Environmental Assessment or by consultants or where a staff member such as a Heritage Officer has particular expertise in Geographic Information Systems. Data from non-governmental organisations including BirdWatch Ireland (IWeBS wetlands birds survey) or Botanical Society of Britain and Ireland (flora distribution) were mentioned by just one local authority surveyed.

Various approaches are being tried to use this information to inform local plans. Information on important areas and impacts of development are being brought to the attention of planners preparing local plans. Policies are being developed to recognise sites and features outside designated areas. Particular reliance is placed on Article 10 of the Habitats Directive which emphasises the importance of corridors for wildlife. This is being used to support policies to protect hedgerows and undesignated sites of local importance. While habitat mapping around settlements in certain counties has followed the ecological network approach and identified cores and corridors these concepts are not enshrined in Development Plans.

There is general dissatisfaction with the mechanisms currently available to input information on biodiversity to spatial plans. Respondents, to whom the concept was introduced directly for the first time, considered that the concept of Green Infrastructure and mechanism of Green Infrastructure planning will be more attractive than ecological networks because of the clearer focus on benefits to people.

Current Status of the Green Infrastructure approach

Green Infrastructure is being actively promoted by Comhar SDC[33] to support sustainable development in urban and rural areas and responses to climate change. Its work programme includes an objective to further develop and implement this concept.

33 http://www.comharsdc.ie

The National Climate Change Strategy[34] emphasises the value of forestry, new green spaces and natural attenuation areas in cities, all types of natural and man made wetlands. Also the requirement for networks, space for habitat and species movement and the importance of soft coastlines and controlled retreat to withstand rising sea levels. As noted previously, it is also inherent in other policies and initiatives.

At a local authority level, Fingal County Council is taking the initiative in Green Infrastructure planning within local authorities, mainly as a result of the council's involvement in the previously mentioned conference in 2008. Importantly, Green Infrastructure principles are being incorporated in the new county development plan where the process involves drafting chapters integrating Green Infrastructure with related topics (Biodiversity, Landscape, Open Spaces, Parks and Recreation, Heritage and Water Management) complemented by a Green Infrastructure chapter which will explain the concept and process of integration.

The Draft Dublin City Development Plan incorporates many Green Infrastructure principles. Proposals include a "Green Network" extending outside the city and a new type of zoning (Z9) which includes 'green networks' as well as open space and recreation.

Draft Regional Planning Guidelines for the greater Dublin area refer to Green Infrastructure planning and contain a regional green network map. A small network of professionals is actively involved in promoting the concept, through a working group set up after the Fingal conference under the umbrella of the Urban Forum. Managed by the Irish Landscape Institute the group has representatives from the Irish Planning Institute, The Institute of Chartered Surveyors and The Institute of Ecology and Environmental Management. Its short-term objective is to develop an information booklet on Green Infrastructure.

2.3 Conclusions

Green Infrastructure planning is not enshrined formally in planning systems and practice in Ireland, although the fundamental ecological and spatial concepts which underpin Green Infrastructure, such as multi-functionality and connectivity, are increasingly visible in strategic planning. It strongly supports EC and government priorities for spatial planning and integration of biodiversity and development. Support exists for this approach among almost all individuals and sectors to whom it has been introduced.

The review suggests the following priorities for Green Infrastructure planning:

- Preparation of national guidelines setting out the Green Infrastructure approach to support local initiatives.
- Identification, quantitatively and qualitatively of the economic and social benefits of ecosystem services delivered by Green Infrastructure in monetary terms and also the social gains to health and quality of life. This information will help Local Development Plans support local responses to major issues related to quality of life, water quality and climate change.
- Collation of datasets which are available for Green Infrastructure mapping and guidance on linking landscape features and functions to potential benefits for people's wellbeing.

34 Department of Environment Heritage and Local Government (2007). National Climate Change Strategy 2007-2012. http://www.environ.ie/en/Environment/Atmosphere/ClimateChange/NationalClimateChangeStrategy/PublicationsDocuments/FileDownLoad,1861,en.pdf

3. **Mapping Ireland's Green Infrastructure** – a preliminary National Map

3. Mapping Ireland's Green Infrastructure – a preliminary National Map

3.1 Objective

A national map of Green Infrastructure is an important element in national planning of Green Infrastructure. Such a map will provide a framework that assists in planning and coordination of Green Infrastructure below the national level – at regional and county, and thereafter to local levels. It also potentially supports transnational coordination and reporting to European and global initiatives.

The preliminary national map presented here sought to commence the process of designing this national framework map including an assessment of potential methods of creating that map. It also sought to provide a framework for the illustrative case studies and to provide a national overview of Green Infrastructure.

3.2 Consideration of Scales

In planning, implementing, and managing Green Infrastructure it is important to consider the scales in terms of the national, regional and local and which is most appropriate to the process or benefit under consideration. By doing so, the role of the national framework map and also the project illustrative case studies can be more readily understood.

It is envisaged that at each level there are particular roles that fit best to that level or scale. These roles are summarised below:

National

- Facilitating trans-boundary and international linkage and allowing strategies to be put in the context of larger international concerns such as climate change and primary production.
- Providing the framework for regional and local Green Infrastructure plans.
- Informing national Natura 2000 network extension strategies.
- Supporting national policy development and informing coordination of policies and the actions of various organisations.
- Supporting progress assessment at other levels against a national framework, with an associated national action and priorities plan.
- Capable of utilising national coverage datasets and hence providing a consistently interpretable map.
- Capable of integration with the SEA process, the Water Framework Directive and with Coastal Zone Management.
- Providing an overview of natural and cultural resources with emphasis on the identification of priority elements and routes.

Regional

- Providing integration and linkages across local authorities and other organisations and ensuring consistency in approaches.
- Integration with regional planning authorities and associated guidelines.
- Develop and promote connectivity between areas which are informed by habitat scale, arresting habitat fragmentation, extension and promotion of traditional habitats such as forestry, wetlands and bogs, rights of way issues, tourism and economic benefits and competing land use issues.
- Allowing organisation level planning for large landowning entities such as forestry (Coillte) or peatlands (Bord na Móna).
- Seeking to use a wider range of data and drawing in datasets that may vary across the region but that provide additional understanding and detail to planning and mapping.
- Providing regional and district green hubs as anchor points of Green Infrastructure and create new strategic green spaces in association with major new developments and population increase.

Local

- Facilitating local authority involvement at county and sub-county levels.
- Providing engagement with a range of local organisations, and branches of national bodies e.g. NGOs, IFA etc.
- Appropriate scale for detailed implementation plans and physical implementation of those plans.
- Opportunity to utilise local data and knowledge.
- Facilitating the identification of important landscape corridors which could include hedgerows, treelines and pockets of tree cover, streams and roadside verges.

The flow of information and data should move up and down the scales but also horizontally at regional and local levels i.e. across regional and local authorities.

3.3 Approach

3.3.1 Green Infrastructure Elements

In order to illustrate the multi-functional aspects of Green Infrastructure, types of assets or 'elements' of Green Infrastructure were considered. A full list of how Green Infrastructure elements relate to social and economic benefits can be seen from looking at the 8 different functions it provides in Table 1.[35]

35 Drawing on: Towards a Green Infrastructure Strategy for South Hampshire: Advice to PUSH, July 2008.

Table 1: Green Infrastructure elements and social and economic benefits

1. Recreation & Health	■ Improves physical and mental well-being ■ Provides opportunities to exercise, play and engage in sport ■ Provides accessibility (permeability) through the landscape, especially for walking and cycling
2. Biodiversity & Natural Resources	■ Increases opportunities for sustainable land management ■ Safeguards priority habitats and species ■ Restores ecological networks ■ Conserves and improves soil quality ■ Reduces the impact of poor air quality
3. Coast, Water Resource and Flood Management	■ Improves water quality ■ Provides coastal and waterside recreation ■ Protects water resources and abstraction sites and brings them into multifunctional use
4. Sense of place – appreciation of landscapes and cultural heritage	■ Safeguards the distinctive character and openness ■ Safeguards and encourages beneficial use of local landscape resources ■ Conserves historic landscapes, archaeological assets, built heritage and cultural heritage
5. Climate Change Adaptation and Mitigation	■ Provides opportunities for renewable energy production ■ Buffers/brakes flooding (fluvial and coastal); providing space for SUDS ■ Provides shade and cooling to densely populated areas, especially those with vulnerable communities
6. Economic Development	■ Provides a setting to encourage inward investment ■ Encourages retention of entrepreneurs and graduates ■ Provides a setting and market for land-based tourism and social enterprises
7. Social Inclusion	■ Provides a setting for community engagement and informal education ■ Stimulates increase in training and skills ■ Provides an outlet for community instincts for stewardship of the environment
8. Productive Environments – Food, Fibre, Energy	■ Sustains a diverse land-based industry (farming, forestry, fisheries, tourism, renewable energy)

The study mapped Green Infrastructure elements using the following categories which combine elements of the different functions shown in Table 1:

Biodiversity: The biodiversity element is deemed to be the ecological networks approach, facilitating the development and enhancement of core, buffer and corridor areas for the purposes of biodiversity conservation.

Recreational and Quality of Life: Recognising that Green Infrastructure has more uses than just acting as a location for habitats and species, the Recreation and Quality of Life element includes uses such as recreation, health and clean air site planning, green buildings, energy and transport, that deliver benefits to people.

Water Quality and Flood Attenuation: Water courses, floodplains, coastal areas, and wetlands have fundamental roles in relation to provision and maintenance of water and water quality. They also play important and critical roles in flood attenuation by acting as conduits of water, buffers against flooding, and sponge effects for holding water to reduce rapid runoff and controlling water levels.

These three elements were included in the national map creation but also in the case studies. Other functional elements can be considered such as climate change adaptation, and food and materials production, and can reflect national or other concerns. The Green Infrastructure approach is flexible enough to allow additional or specific functional elements to be included.

3.3.2 Data Assessment and Manipulation

In support of the data analysis required by the research, a comprehensive Geographical Information System was prepared. This GIS facilitated the collation, management, analysis, and visualisation of all spatial/map and tabular/attribute data used in the mapping.

For the creation of the national framework map it was deemed to be important that datasets of national coverage would be used and consequently the appropriate datasets were sourced and added to the GIS. Thus the core datasets utilised were as follows:

- CORINE Landcover 2006 (with 1990 data used for Northern Ireland) (EPA)[36]
- Designated Sites (NPWS) –
  - Special Areas of Conservation (EU Habitats Directive)[37]
  - Special Protection Areas (EU Birds Directive)[38]
  - Natural Heritage Areas (Wildlife Act, 1976)[39]
- Watercourses (rivers, lakes) – Water Framework Directive national digital data based on Ordnance Survey 1:50,000 digital data (EPA, OSi).

The CORINE landcover classes were assessed and recategorised into the three Green Infrastructure elements, with an individual landcover class potentially being in none or all Infrastructure elements. Appendix 4 lists the landcover classes as recategorised for the project and includes the CORINE landcover classes and the extended classes used by the related MOLAND[40] project and dataset. The Biodiversity classifications were those used in the previous EcoNet study undertaken by Tubridy and Ó Riain (2002)[41]. These classes are described in Appendix 3 of this document.

The reclassified CORINE landcover map layers were the basis for the Green Infrastructure maps of Biodiversity, Water Quality and Flood Attenuation, and Recreation and Quality of Life. Other map layers such as the designated areas and water courses were then added to these base Green Infrastructure maps to represent features not included in the landcover dataset, or to provide further detail on particular important features.

The process flow diagram (Figure 1) illustrates this process with the following maps presenting the outcome in the form of preliminary National Green Infrastructure Framework maps.

36 http://www.epa.ie/whatwedo/assessment/land/corine/

37 http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

38 http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

39 http://www.npws.ie/en/WildlifePlanningtheLaw/Legislation/WildlifeAct1976/

40 http://moland.jrc.ec.europa.eu/

41 Tubridy M, O Riain, G (2002). Preliminary study of the needs associated with a National Ecological Network. ERTDI Report (2000-LS-4-4), Environmental Protection Agency, Ireland.

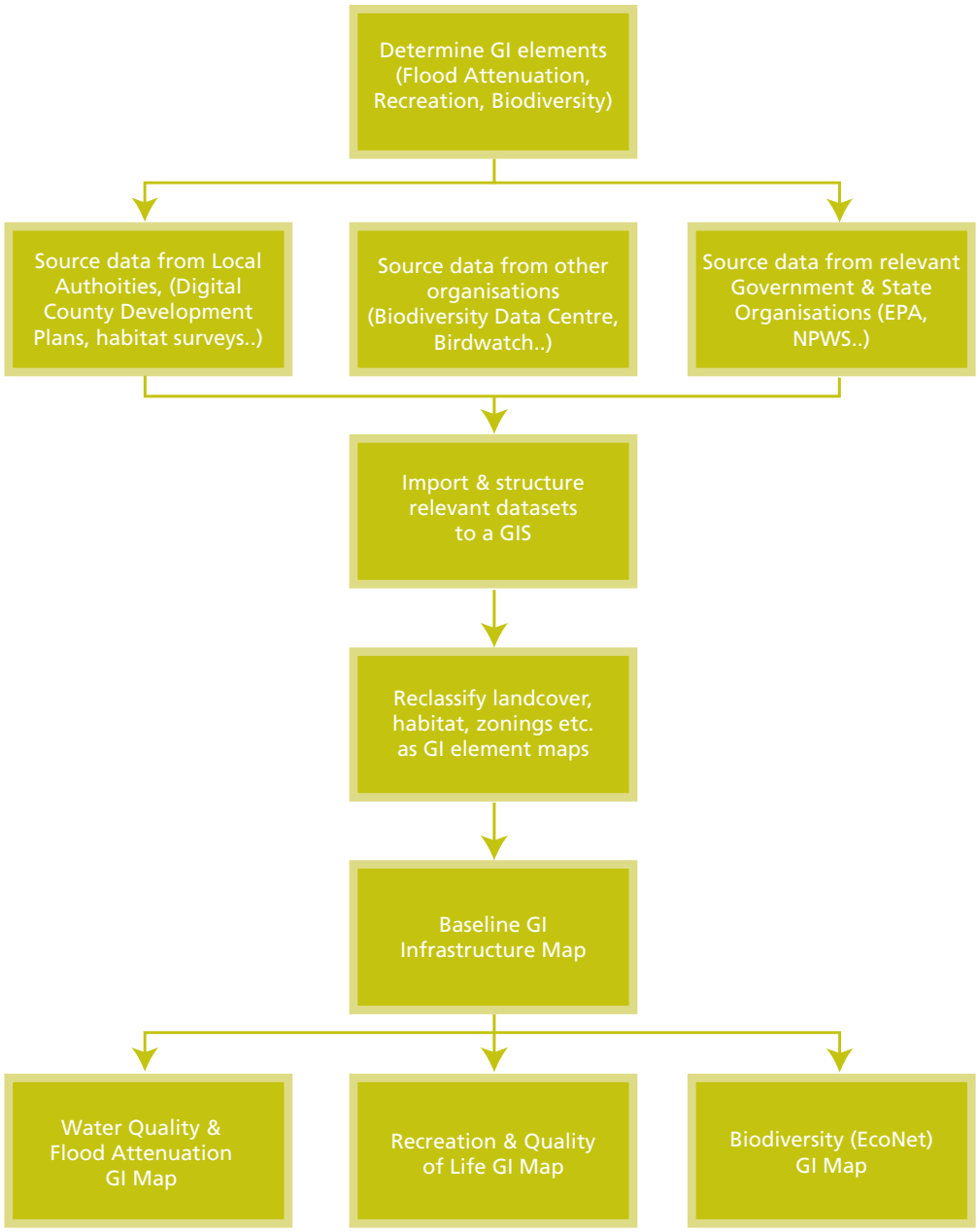

Figure 1: Development a Green Infrastructure map using GIS – a process overview.

3.4 Preliminary Maps

The process created a series of maps illustrating Green Infrastructure of each element type.

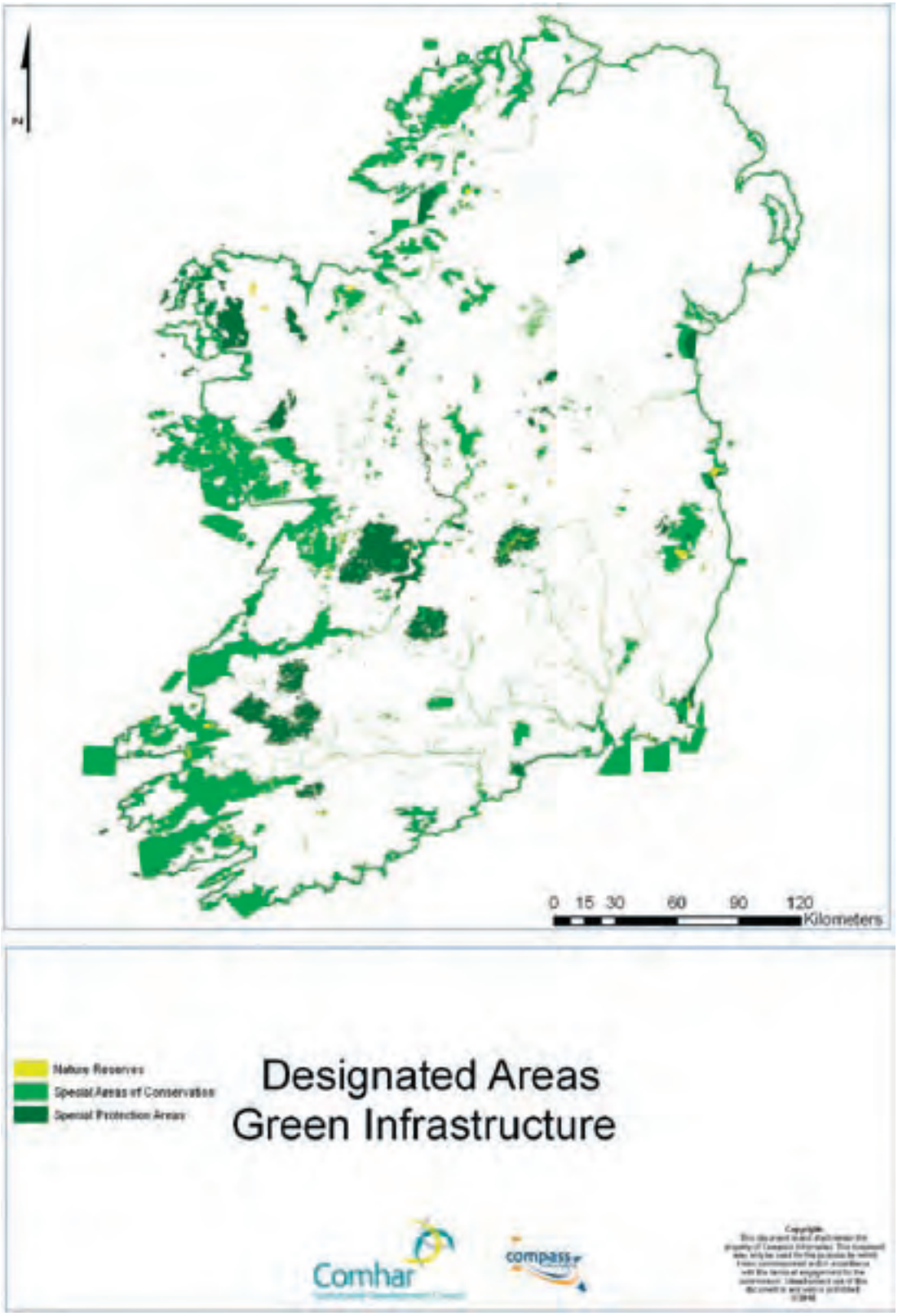

Figure 2: Preliminary National Framework Map – Core Designated Areas Network Green Infrastructure

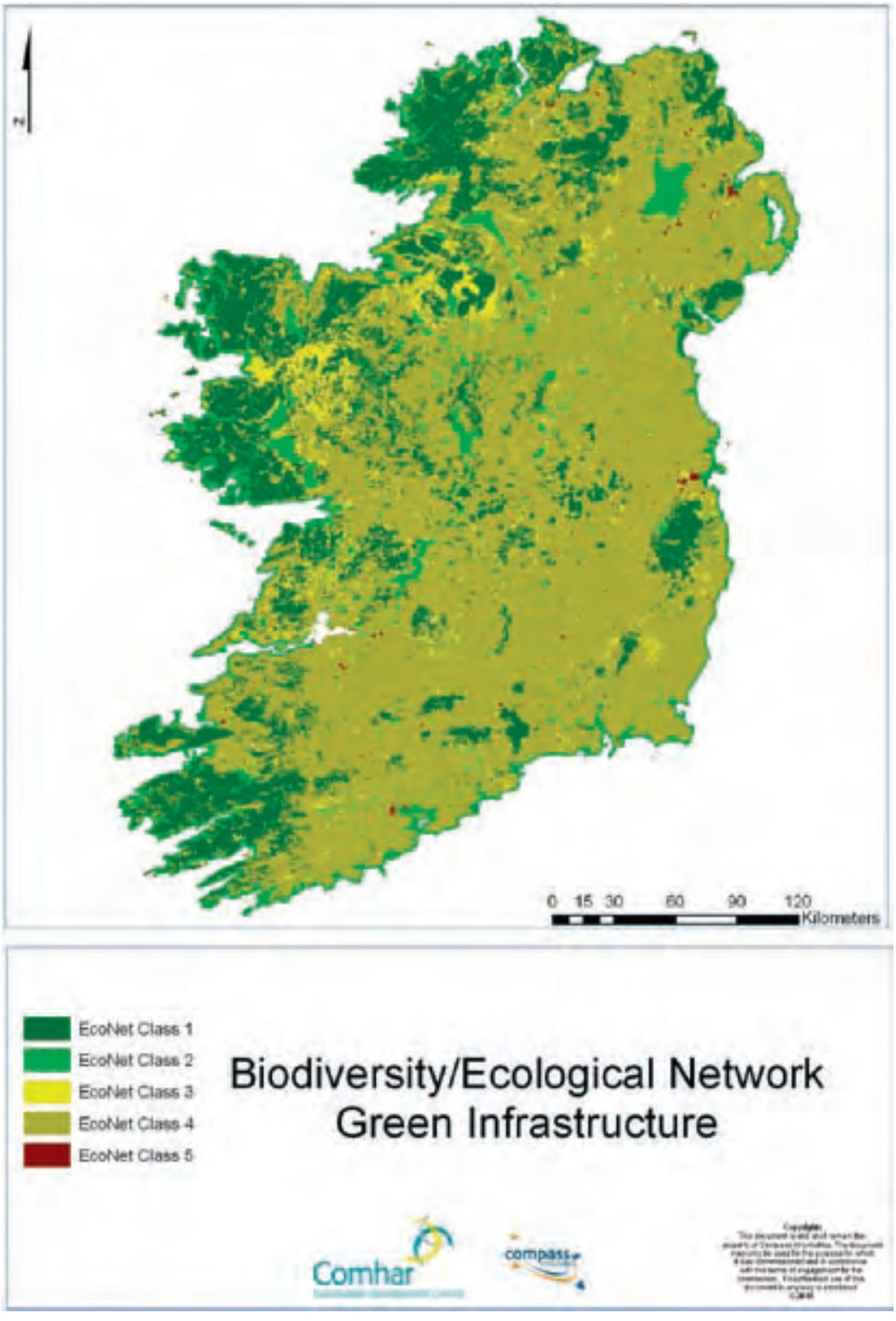

Figure 3: Preliminary National Framework Map – Biodiversity/Ecological Network Green Infrastructure

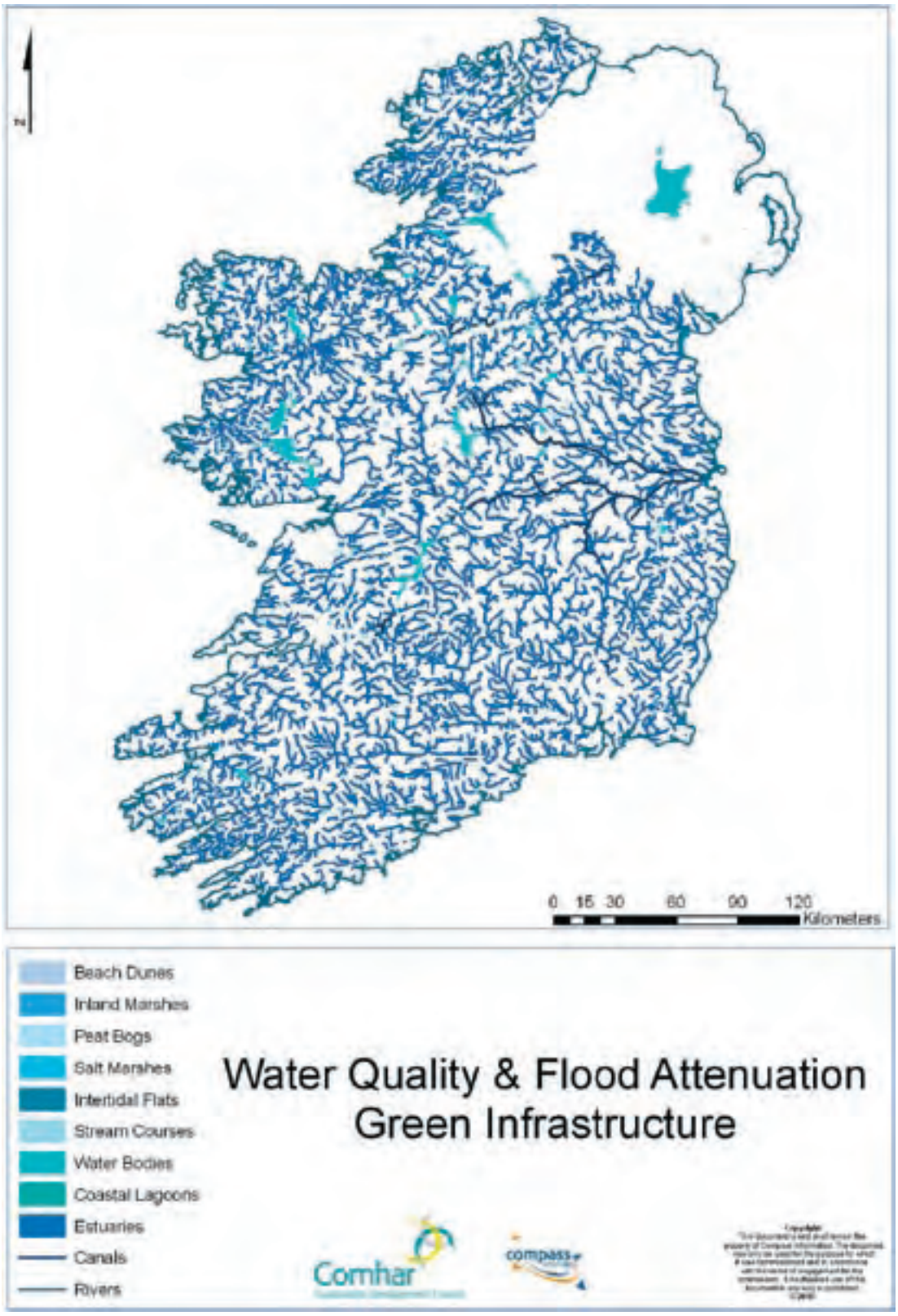

Figure 4: Preliminary National Framework Map – Water Quality & Flood Attenuation Green Infrastructure

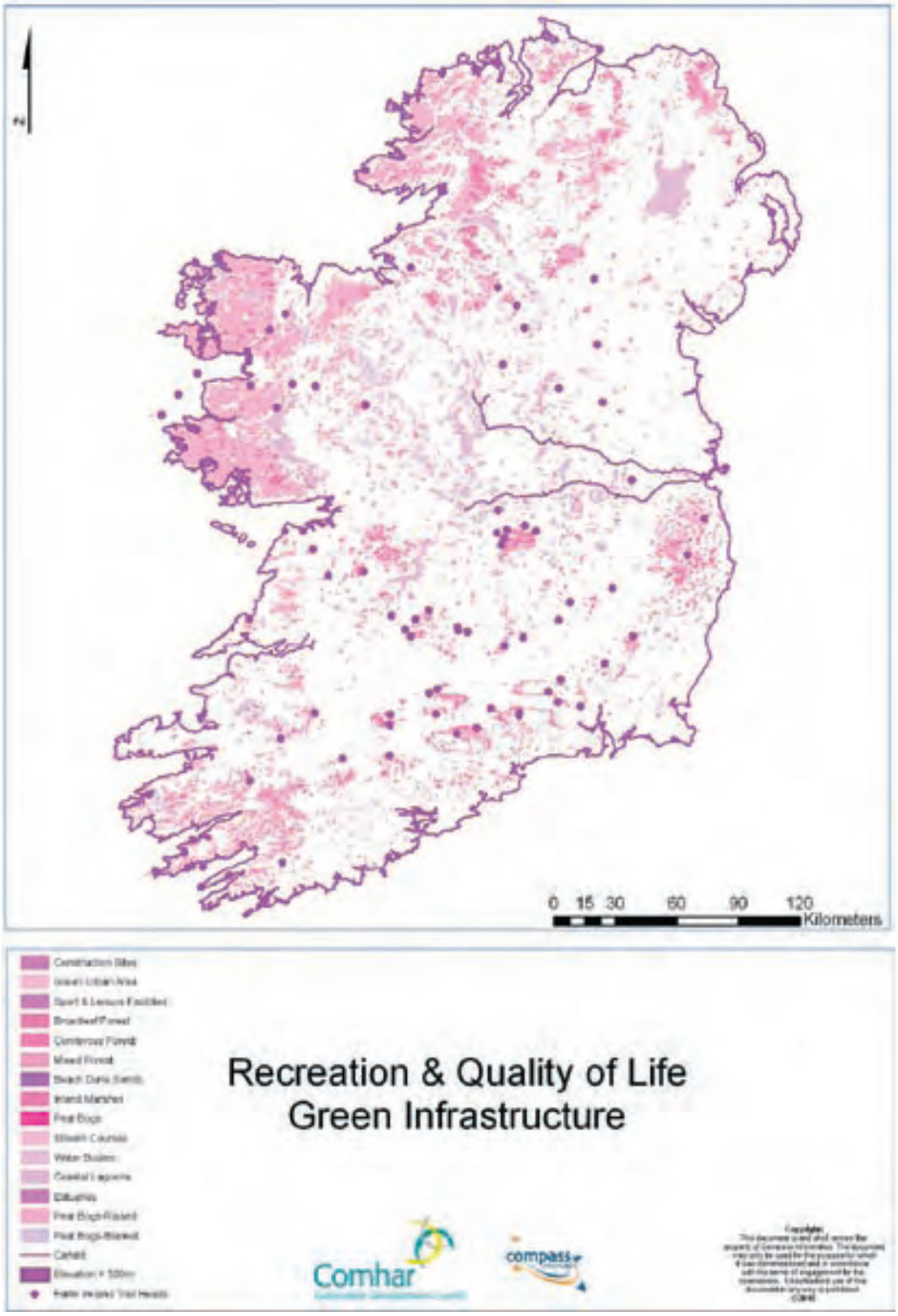

Figure 5: Preliminary National Framework Map – Recreation & Quality of Life Green Infrastructure

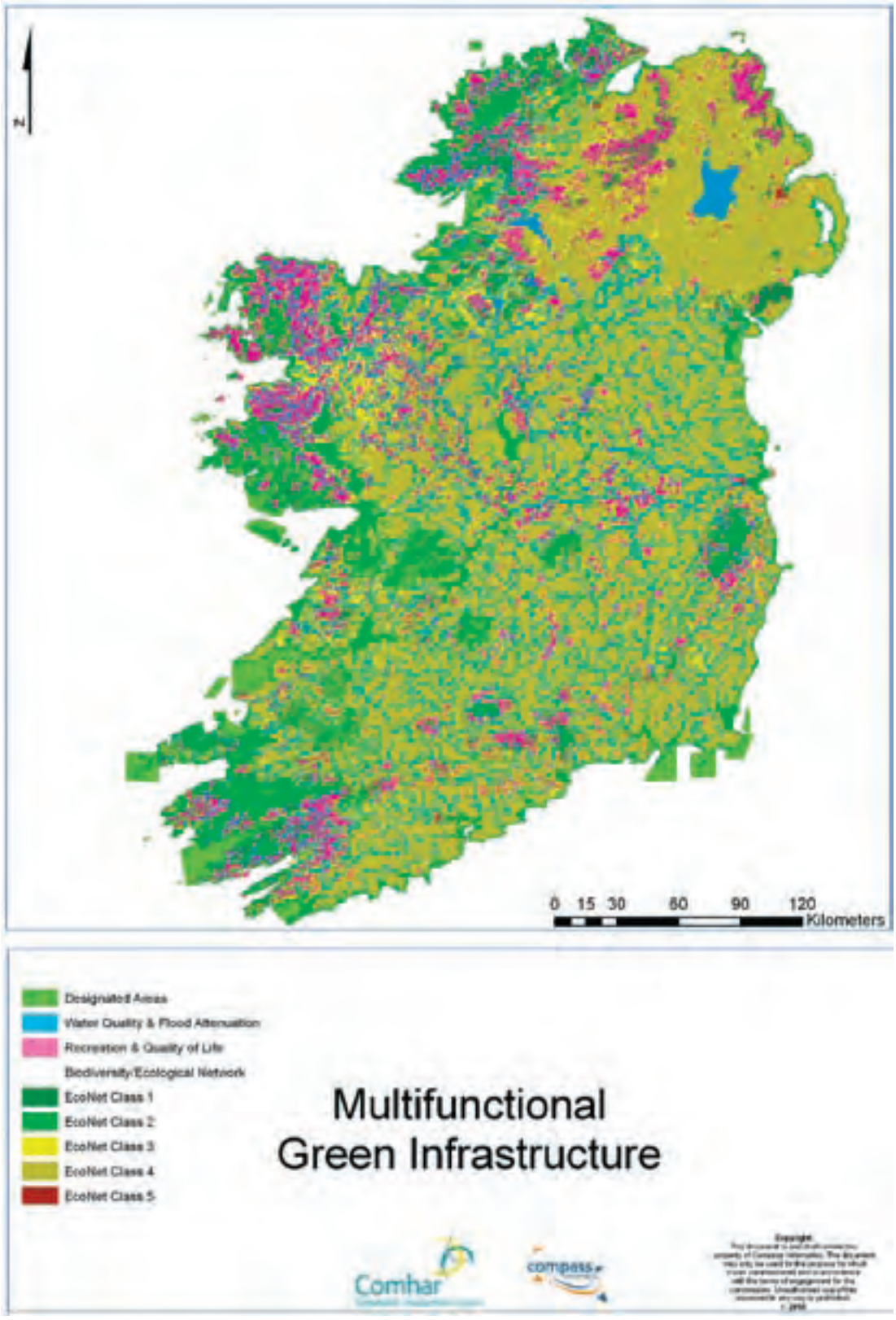

Figure 6: Preliminary National Framework Map – Multifunctional Green Infrastructure

3.5 Discussion

The preliminary national framework maps present an overview of selected types of Green Infrastructure and their spatial distribution. It is clear that there is an overlap between each – with strong Green Infrastructure across all elements along through western counties, uplands, coastal areas, and with the water network including riparian zones provides widespread opportunities for connecting features. It is clear also that there are opportunities across all Green Infrastructure elements to take the ecological network approach of core, buffer and corridors in order to develop connectivity and a more spatially integrated approach.

3.6 Conclusions

The national maps are proposed as a useful framework map, facilitating the Green Infrastructure roles as outlined in Section 3.2 above. They are also relatively easy to prepare from a selection of national datasets. These datasets can be supplemented readily by datasets representing additional features or more suitable datasets such as habitat or landuse mapping. It is recommended that the national framework map be revised in due course as data improves and as the map undergoes review by potential users.

4. Case Studies in Green Infrastructure

4. Case Studies in Green Infrastructure

4.1 Introduction

The case studies were prepared to provide illustrations of how Green Infrastructure might be identified and mapped for sample areas covering different general landscape and context types: an urban area, a peri-urban area which incorporates an urban-rural interface, and a more regional rural area. The case studies are illustrative only. Their principal value is to demonstrate that the approach is flexible enough to be useful in different areas with different types of Green Infrastructure. Thus the areas covered include an area of north Dublin city covering approximately the Dublin 3 postal area; the Broadmeadow catchment area in Fingal, north of Dublin city incorporating suburban towns and rural countryside; and an area of Offaly-Westmeath that is predominantly agricultural with large areas of exploited peatlands. The case studies recognised that formal Green Infrastructure and other planning approaches are underway in these areas, and that this work is illustrative only.

4.2 Methodology

The case studies sought to take the same broad approach as the national framework map by using baseline landcover maps and reclassifying these in Green Infrastructure element maps (See Figure 1, Chapter 3). In addition, many other datasets were identified, collated and added to the GIS. Thus local planning implementation offers the opportunity to include many local datasets reflecting data availability at the local level and reflecting local interests and concerns more accurately. These local datasets were again categorised by Green Infrastructure elements and are included accordingly in the relevant maps.

The work flow diagram below summarises at the high level the process followed in the GIS in preparation of the illustrative maps.

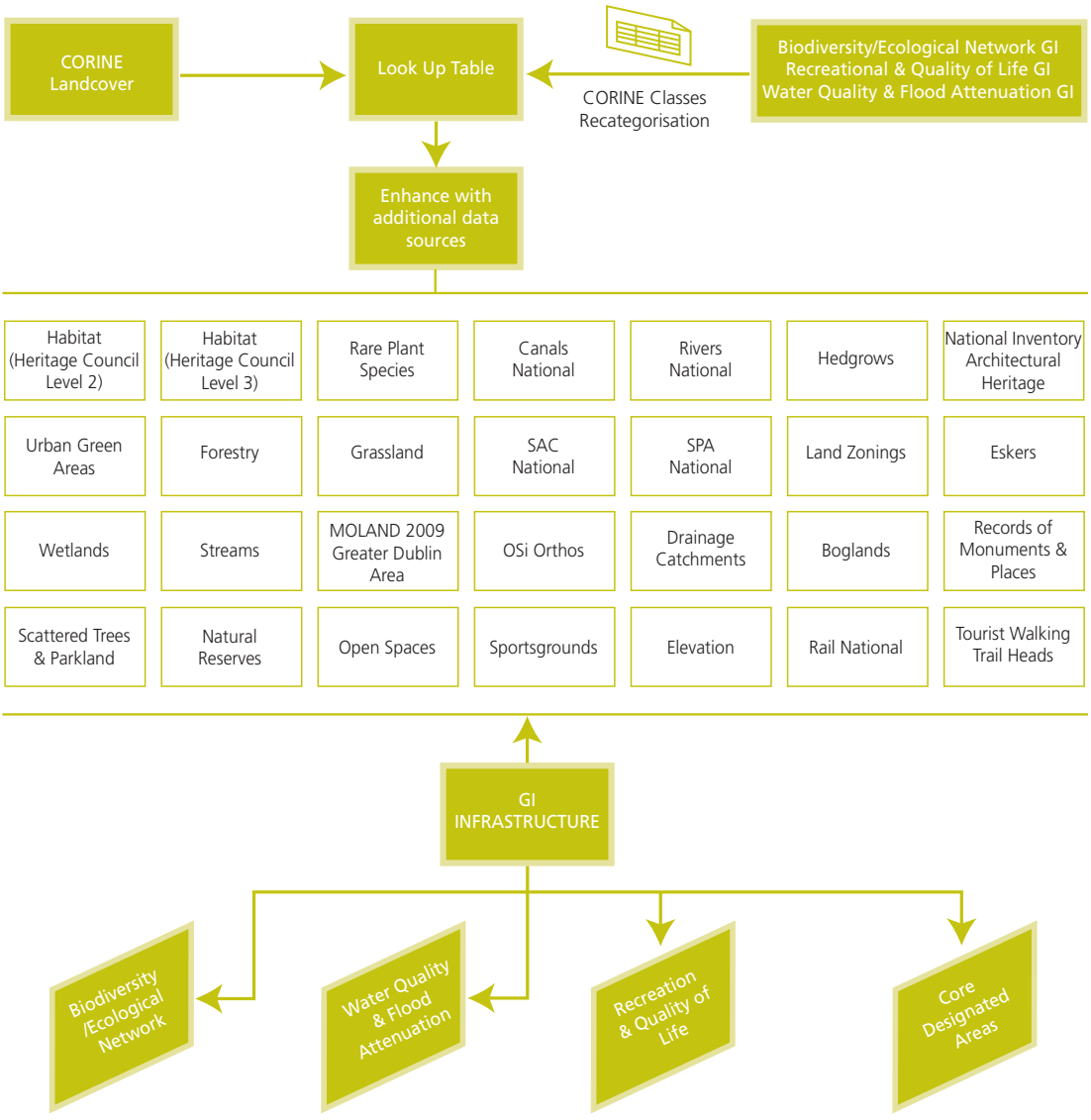

Figure 7: Process workflow for illustrative case studies mapping

4.3 Urban Area – North-East Dublin City

Introduction

The case study contains a core area of international importance, Dublin Bay which is a major amenity to the people living in the city and is linked functionally and spatially to inland watercourses within Ireland and internationally to biodiversity areas which are important for migratory bird species. Other key features of Green Infrastructure are wetlands, the Royal Canal, St Anne's Park, smaller public parks, railway line, gardens/institutional grounds and surviving hedgerows.

Figure 8: Illustrative case study for the Dublin 3 area: Potential recreation and quality of life Green Infrastructure.

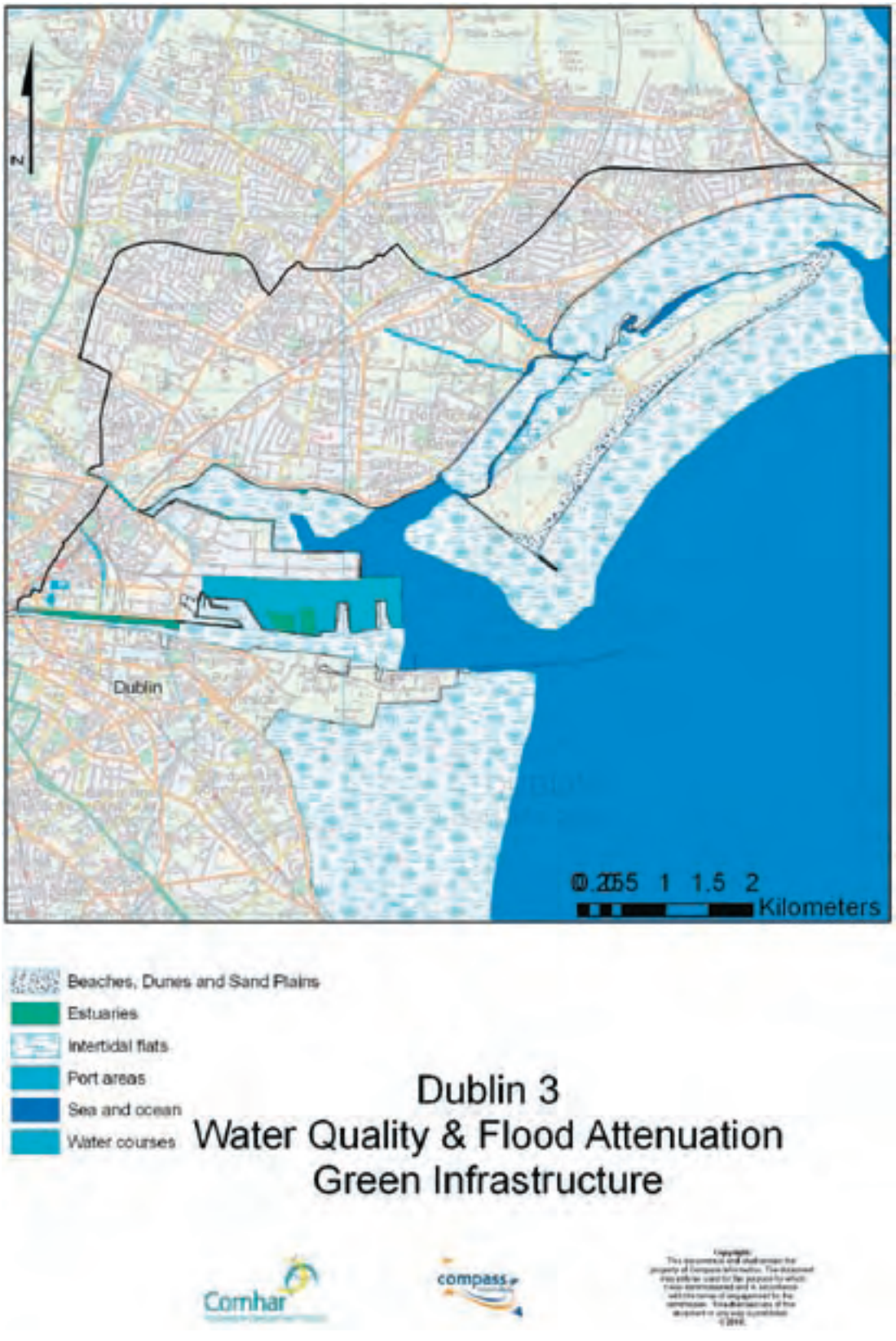

Figure 9: Illustrative case study for the Dublin 3 area: Water quality and flood attenuation Green Infrastructure.

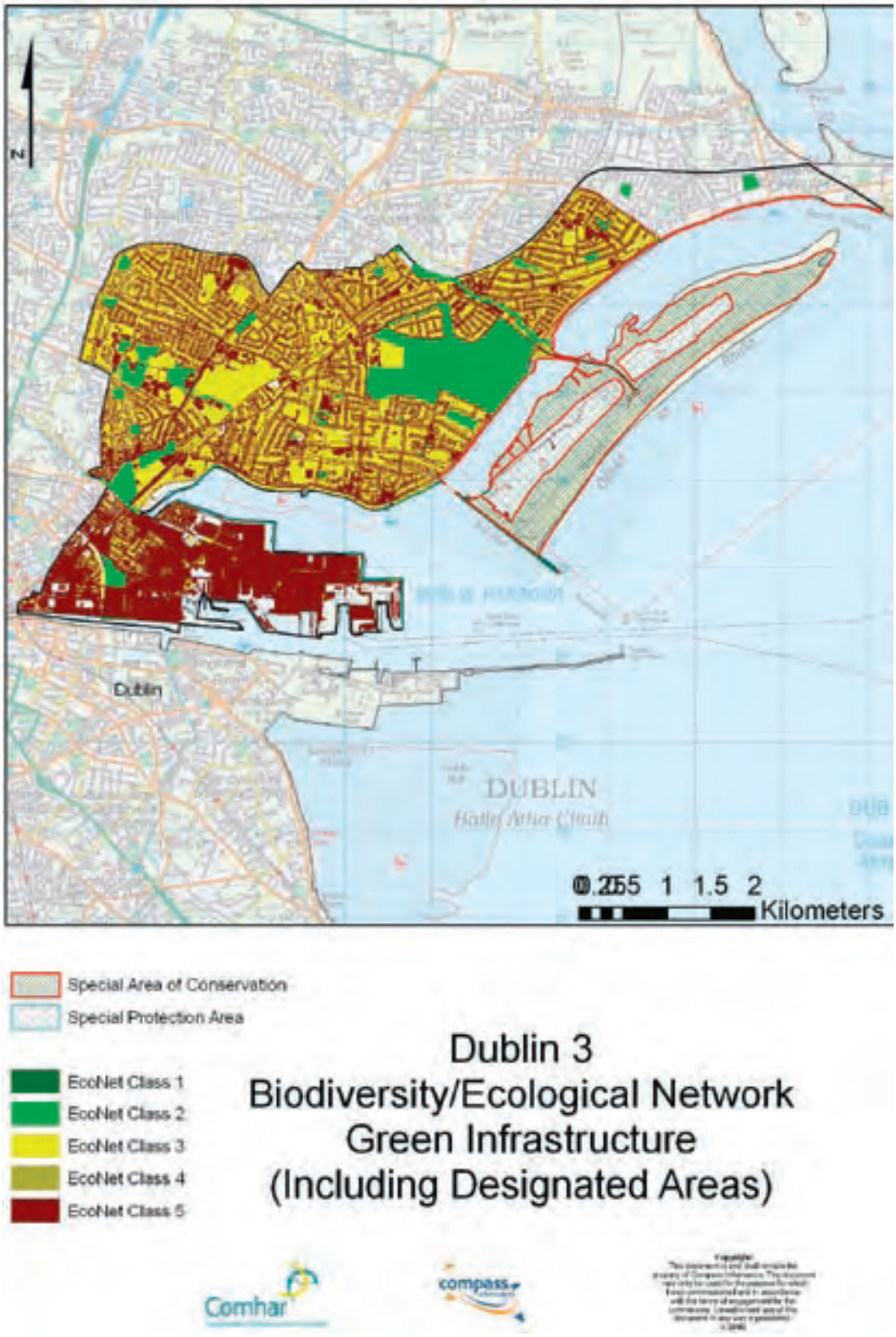

Figure 10: Illustrative case study for the Dublin 3 area: Biodiversity/Ecological network Green Infrastructure with designated areas.

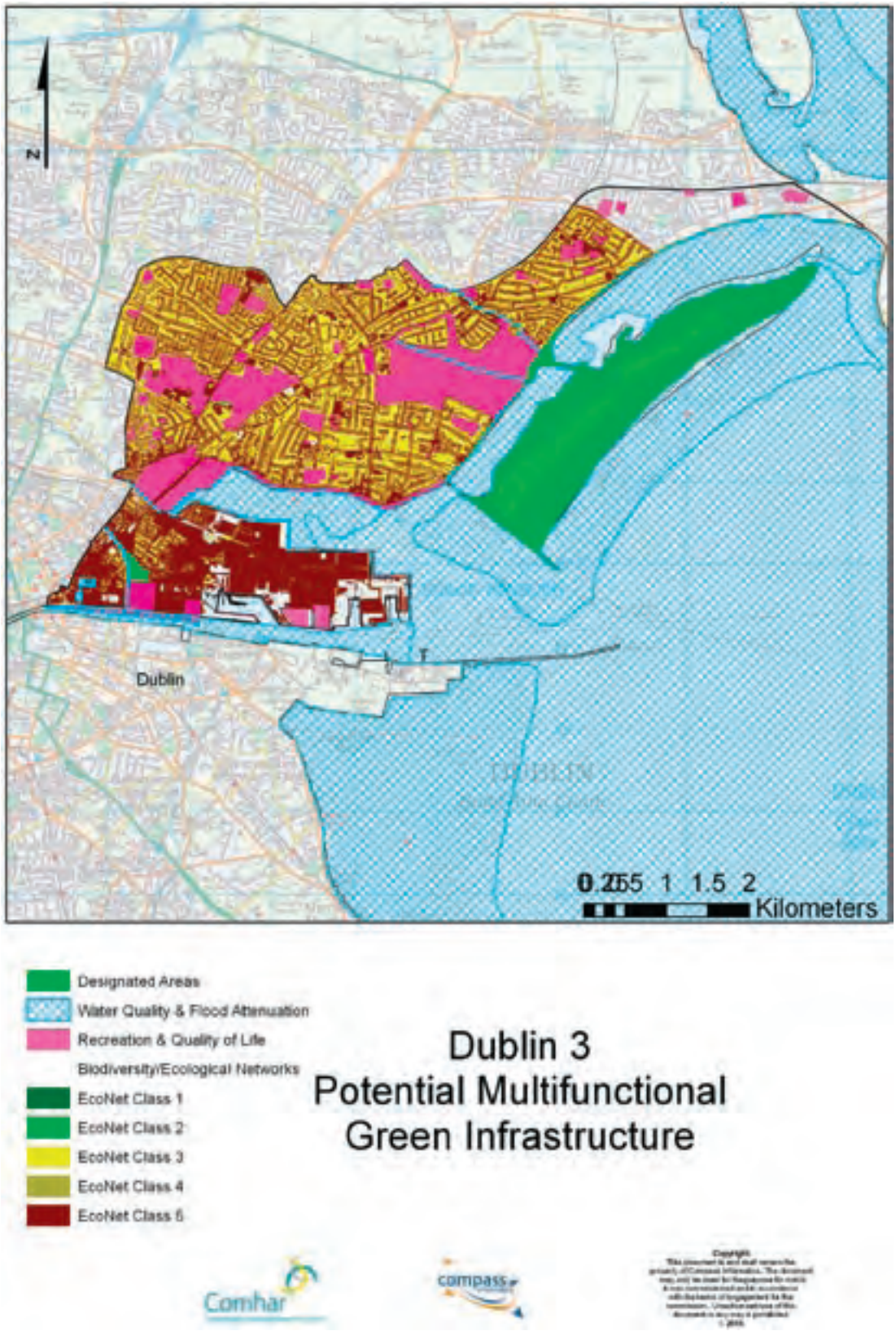

Figure 11: Illustrative case study for the Dublin 3 area: Multifunctional Green Infrastructure.

Services provided by the Green Infrastructure network

The most important feature of the Green Infrastructure, Dublin Bay, provides a range of interlinked services of particular value to biodiversity and amenity.

The bay, Bull Island, public parks, the Royal Canal, coastal promenade, institutional grounds and a golf course provide amenities particularly for informal passive recreation thus promoting good health, community building and social inclusion. Gardening is an important recreational activity in privately owned green spaces. The bay, the canal, the parks, particularly St Anne's park provide defining landscape features which can be viewed from public spaces. Access paths beside the sea and canal provide non-motorised transport routes of high amenity value. Flood control is provided principally by the bay and rivers (Tolka, Santry, Naniken). Rivers also receive surface water drainage. All unbuilt surfaces act as attenuation areas. All watercourses including the bay are receptors for liquid waste.

Unbuilt areas, gardens, soils, vegetated areas act as carbon sinks. Of particular value are areas covered by semi-natural vegetation which requires little management (trees and woodlands, old grasslands, wetlands). The bay provides a habitat for internationally important populations of birds. Small patches of semi-natural habitats are still present such as old grasslands and hedgerows.

Strategic Objectives

Principal objectives are maintaining Green Infrastructure particularly that associated with the key core area and improving connectivity and multi -functionality of the Green Infrastructure network as an amenity.

Priority should be given to managing the key features of Green Infrastructure to maximise their ecosystem functions, particularly the designated sites. Resources should be available to implement actions in management plans for designated sites which support sustainable development.

St Anne's Park, should be presented as a community resource with additional resources made available to expand its services and improve its biodiversity value.

Strategic actions

To enhance the quality of the key features of the Green Infrastructure network, water quality in rivers and streams flowing into Dublin Bay should be improved. The network of parks and open spaces increasingly used by internationally important populations of geese should be recognised and actively managed.

To optimise the value of a recreational green network a strategic plan is required which would focus on improving linkages between the key areas of recreational value, Bull Island, coastal promenade and St Anne's. The existing coastal promenade which is part of a proposed cross city cycling route should be developed and promoted as a "greenway" and extended to Howth. The potential of the Royal Canal, Tolka and Santry rivers should be developed as greenways. The railway line should become a more effective corridor/linking feature for biodiversity.

Actions are required to improve the multifunctionality of public and private green space for flood attenuation, biodiversity, amenity, food production, and water quality management. A network approach would allow conflicting uses to be accommodated within the network, and thus resolve conflicts between biodiversity, heritage protection, security and public usage.

Increased recognition should be given to non-designated but locally uncommon Green Infrastructure features such as hedgerows and mature trees as these also have significant cultural value.

The amenity value of biodiversity rich areas should be promoted and developed as an economic asset for tourism. The perceived recreation/conservation conflict around Bull Island should be researched and the solutions sought within an approach which integrates this site with other sites in its vicinity.

Green Infrastructure

Following guidelines in the recently produced Bull Island Management Plan, access and usage of Bull Island should be increased with the proviso that its biodiversity value is not significantly reduced. A similar priority should be given to development along the Royal Canal. Increased investment is needed to improve visitor services and interpretation of the key assets. These require promotion as a key resource for visitors to Dublin.

In order to mitigate for climate change, local development policies should ensure the retention of the maximum amount of vegetated and soft surfaces particularly near the coast and rivers. Wetlands which have been removed from the environs of rivers should be replaced and culverted/buried rivers should be restored to their natural state.

Particular "greening" initiatives should be promoted for new buildings such as green roofs, soft surfaces and biodiversity landscaping.

4.4 River Catchment/Peri-Urban Area – Broadmeadow, Fingal

Introduction

The peri-urban pilot focuses on the catchment of the Broadmeadow and Ward Rivers and their associated estuary. The estuary is an internationally important site for biodiversity and defines the landscape in this part of the study area. It is the most important core area, and rivers are the most important linking features. Other important features of Green Infrastructure are semi-natural habitats, grasslands and hedgerows within a farmed landscape and parks and amenity areas associated with rapidly growing settlements along the rivers and near the coast. This area has been subject to intensive research on water quality and hydrology to prepare river basin and flood risk management plans to comply with EU Directives.

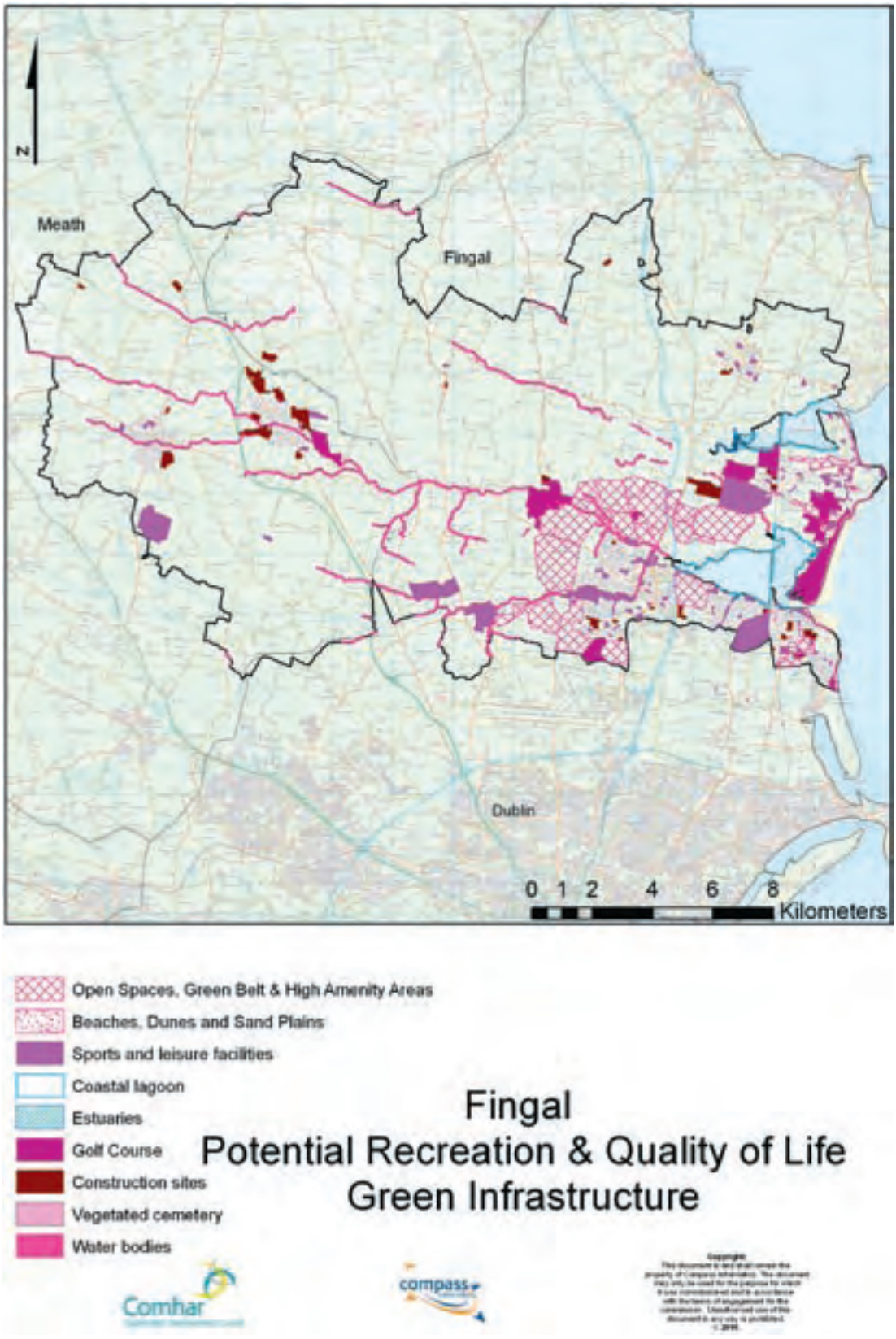

Figure 12: Illustrative case study for the Fingal/Broadmeadow catchment area: Potential recreation and quality of life Green Infrastructure.

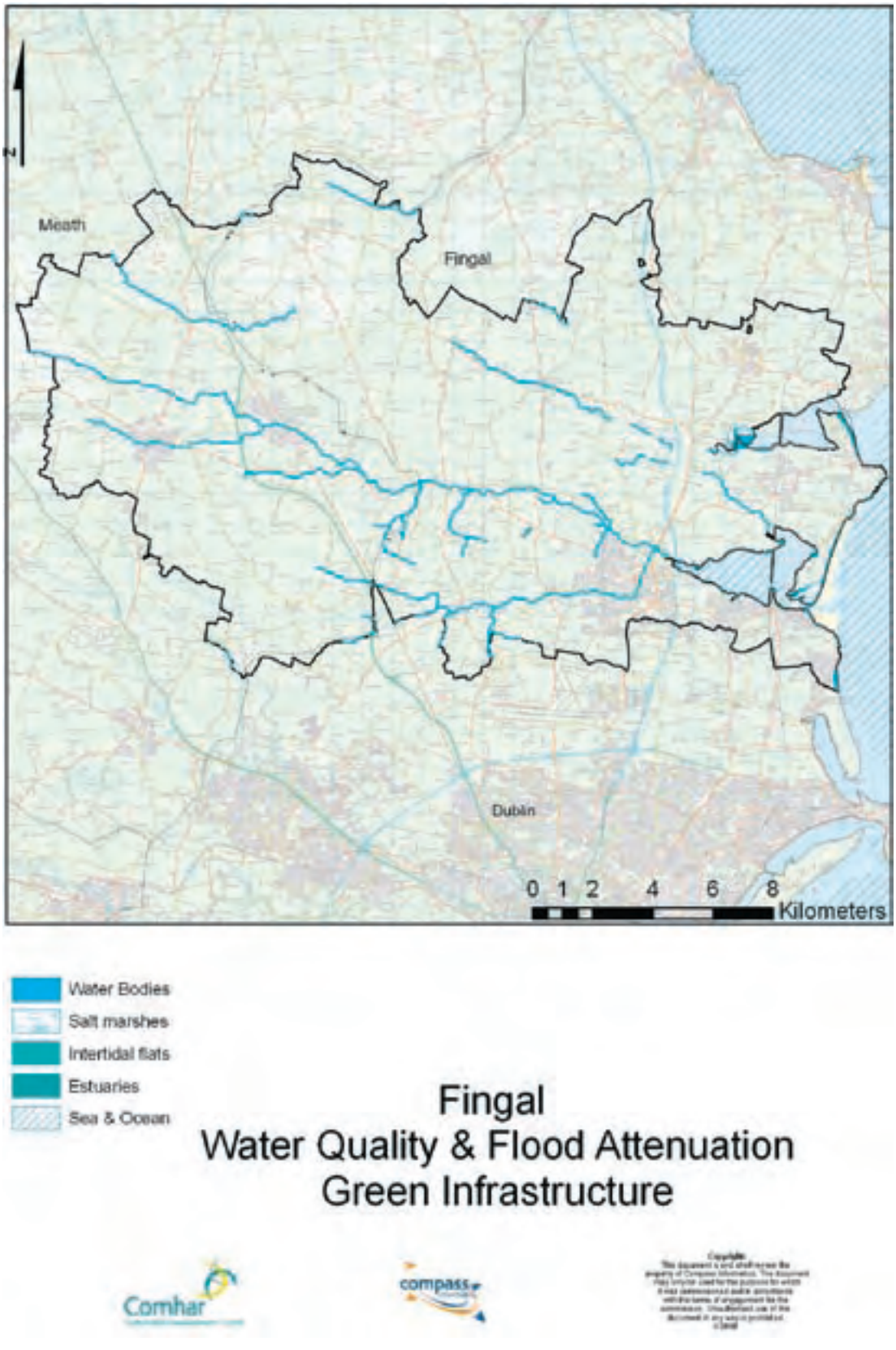

Figure 13: Illustrative case study for the Fingal/Broadmeadow catchment area: Water quality and flood attenuation Green Infrastructure.

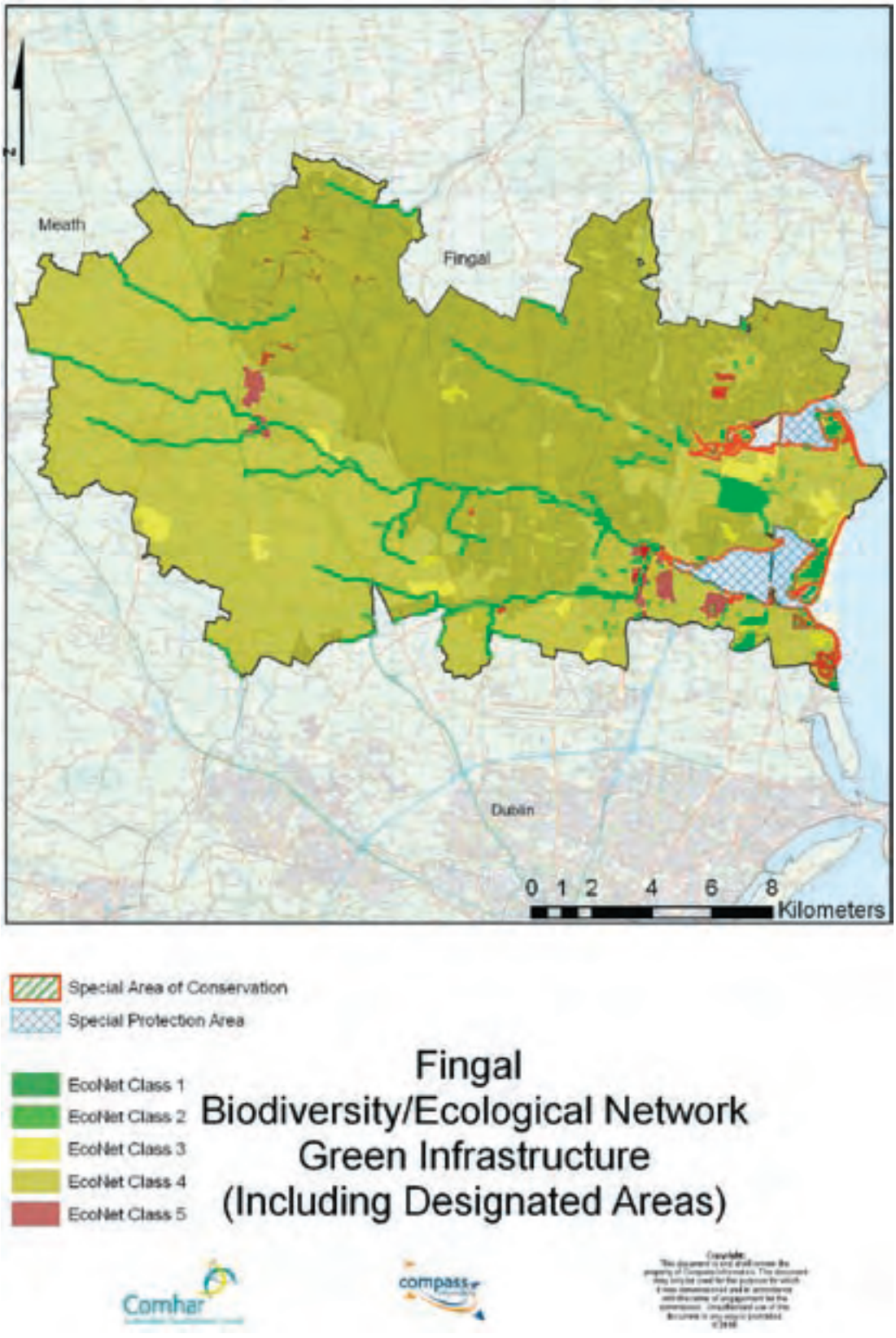

Figure 14: Illustrative case study for the Fingal/Broadmeadow catchment area: Biodiversity/ Ecological network Green Infrastructure with designated areas.

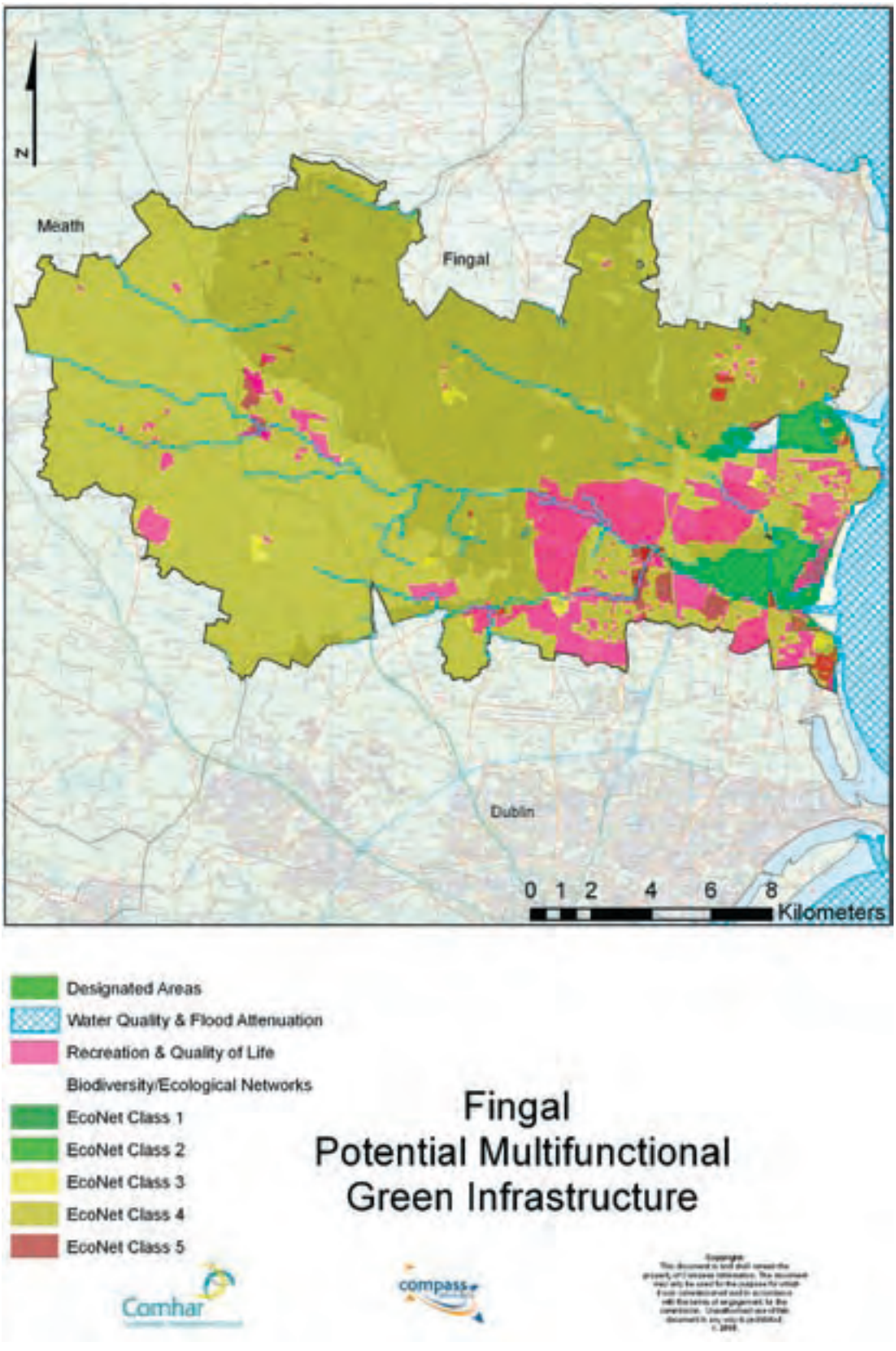

Figure 15: Illustrative case study for the Fingal/Broadmeadow catchment area: Multifunctional Green Infrastructure

Services provided by the Green Infrastructure network

The rivers and estuary are significant receptors of waste from point and diffuse sources. The rivers have a role in water supply, as watercourses are part of the recharge system for aquifers which are the principal sources of water.

The watercourses and marginal land around the coast are important for flood protection and will become increasingly important to mitigate for sea level rise caused by climate change. All unbuilt land including farmland, parks and gardens provide for flood attenuation.

Features of Green Infrastructure such as wetlands, woodlands and semi-natural habitats both inland and along the coast, are important carbon sinks and sites of carbon sequestration. Farmland is a location for a potentially sustainable horticultural industry based on good soils and proximity to Dublin.

The key core area, the estuary supports internationally important populations of birds. River channels support sustainable populations of fish. Farmed lands contain sites for rare features of biodiversity such as plants, important hedgerows and small amounts of semi-natural grassland habitat.

Access to the coast, publicly owned and managed parks, golf courses, and rivers improve quality of life for residents and provide a sense of place. Passive and active amenities provided by Green Infrastructure include walking, fishing, shooting and golf. Most public parks in towns are focused on rivers. The estuary is a popular attraction for bird watchers.

Strategic Objectives

Within this pilot area the principal objectives are maintaining and enhancing the function of the key network of the estuary and river, and developing it as an amenity.

Resources should be available to implement actions in management plans, for designated sites and for the River Basin Management Plan through appropriate planning policy or/and recreation provision.

Strategic actions

To improve and restore ecosystem functioning the following actions are required. They complement measures suggested by water quality and flood risk studies:

- Recognition of the key features of Green Infrastructure in local plans.
- Creation/restoration of marginal wetlands around watercourses and coastal areas to improve biodiversity and recreational provision.
- Promotion of forestry in intensively managed land but particularly near watercourses (riparian woodland).
- Support for landowners who manage their land intensively to reduce inputs to rivers and increase area of wetlands.
- Recognition of all surviving semi-natural features associated with wetlands and the coast (soft coastline, hedgerows and drainage ditches) in local plans.

- Recognition of cultural Green Infrastructure assets, such as Brackenstown Demesne and others, and promotion of their protection and management as resources for biodiversity, amenity, recreation and education.
- Adoption of development policies in local plans which will recognise the importance of soft features for flood control, biodiversity, water quality and amenity.

The amenity value of the Green Infrastructure network should be recognised by the development of an interlinked network of recreational trails based on the coast and the river to serve a range of uses, including those specifically related to the character of the Green Infrastructure network (fishing, water sports, environmental awareness).

To respond to climate change, local plans should indicate areas which will be required to allow for habitat and species movement resulting from sea level rise. Hard coastal defences if required should be confined to settlements. Development of housing and roads, should be encouraged in areas with poor quality Green Infrastructure. Development in the countryside should be discouraged. If necessary in the countryside it should be confined to areas currently used for intensive agriculture, ensuring that all features of Green Infrastructure are retained (hedgerows, ditches, sites for rare plants) and where new residents can make maximum use of existing services, public transport and non-motorised forms of transport to access services.

Forestry should be encouraged and guided by a strategic approach which would maximise its benefits to biodiversity/amenity/carbon sequestration.

To maximise the economic value of Green Infrastructure food production areas (for horticulture) should be recognised spatially and particular protection given to areas supporting low intensity food production. Freshwater fishing should be further promoted and developed as an amenity with economic spin offs. Sea and estuary fisheries should be managed to allow for sustainable harvesting.

4.5 Rural Area – Offaly-Westmeath

Introduction

The character of this pilot area is dominated by Green Infrastructure. Of particular importance is a network of peatlands, most of which have been developed by Bord na Móna and provide a major source of local employment. Other key features of Green Infrastructure are eskers, lakes, rivers and drainage ditches, woodlands, semi-natural wet and dry grasslands.

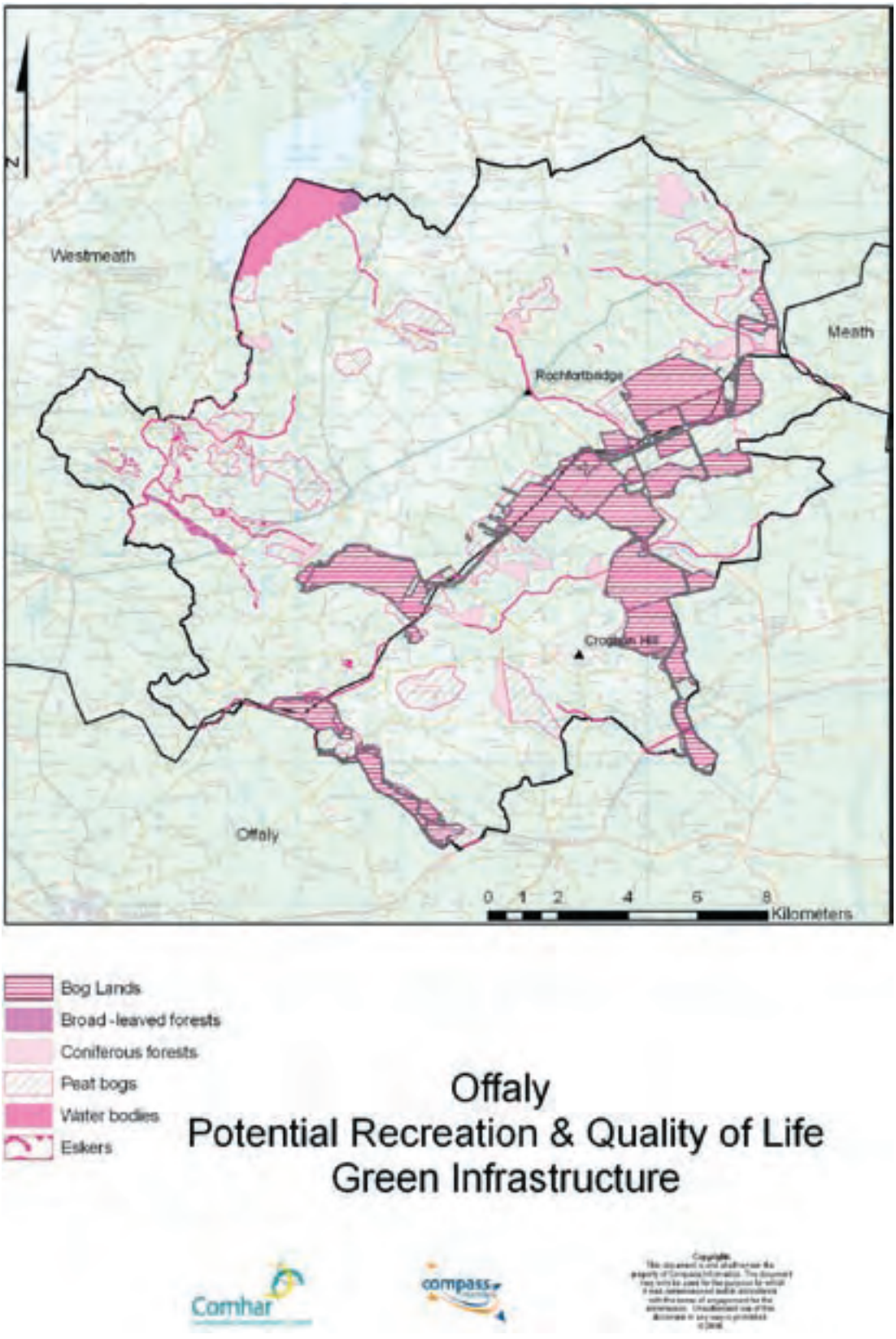

Figure 16: Illustrative case study for the Offaly-Westmeath area: Potential recreation and quality of life Green Infrastructure.

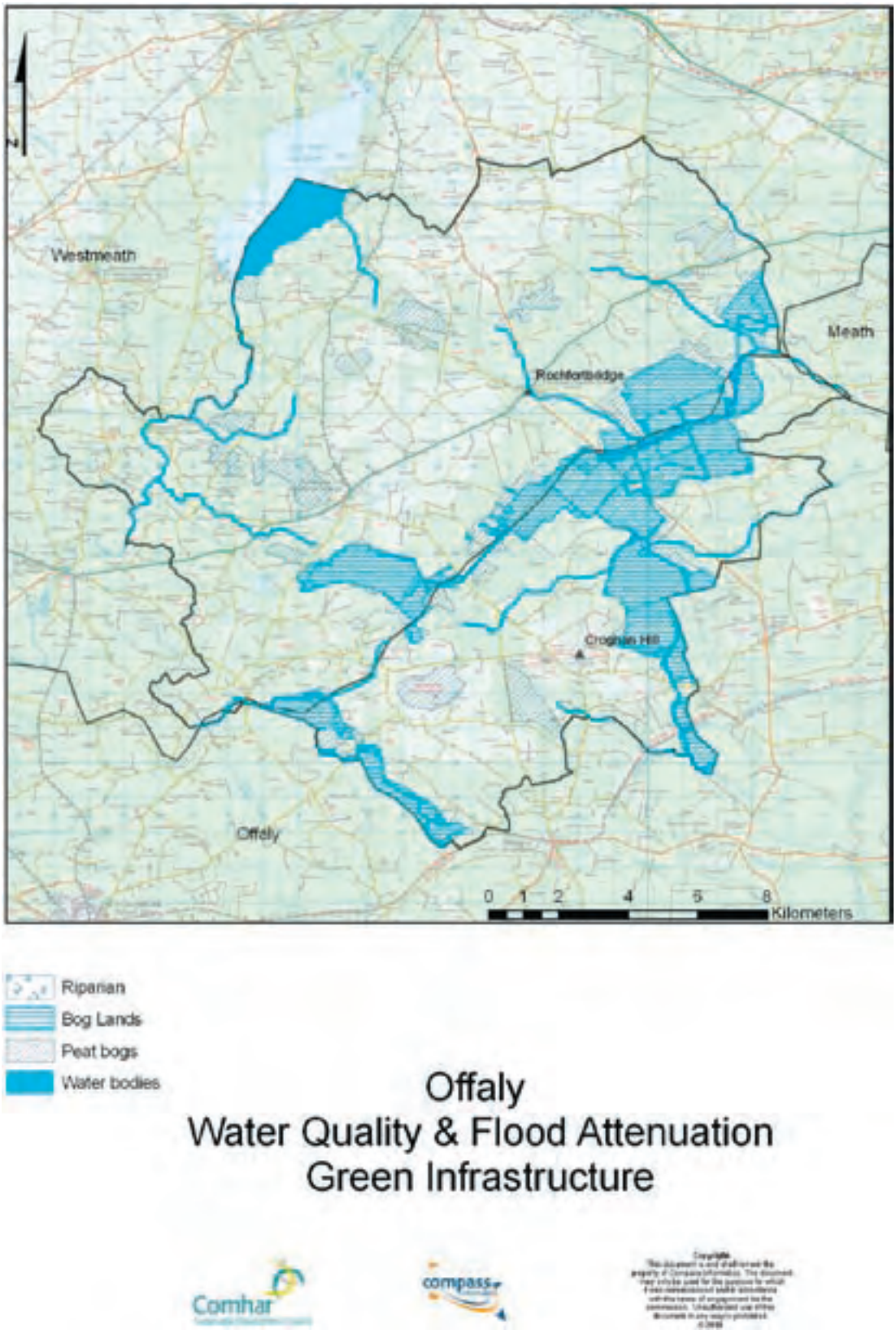

Figure 17: Illustrative case study for the Offaly-Westmeath area: Water quality and flood attenuation Green Infrastructure.

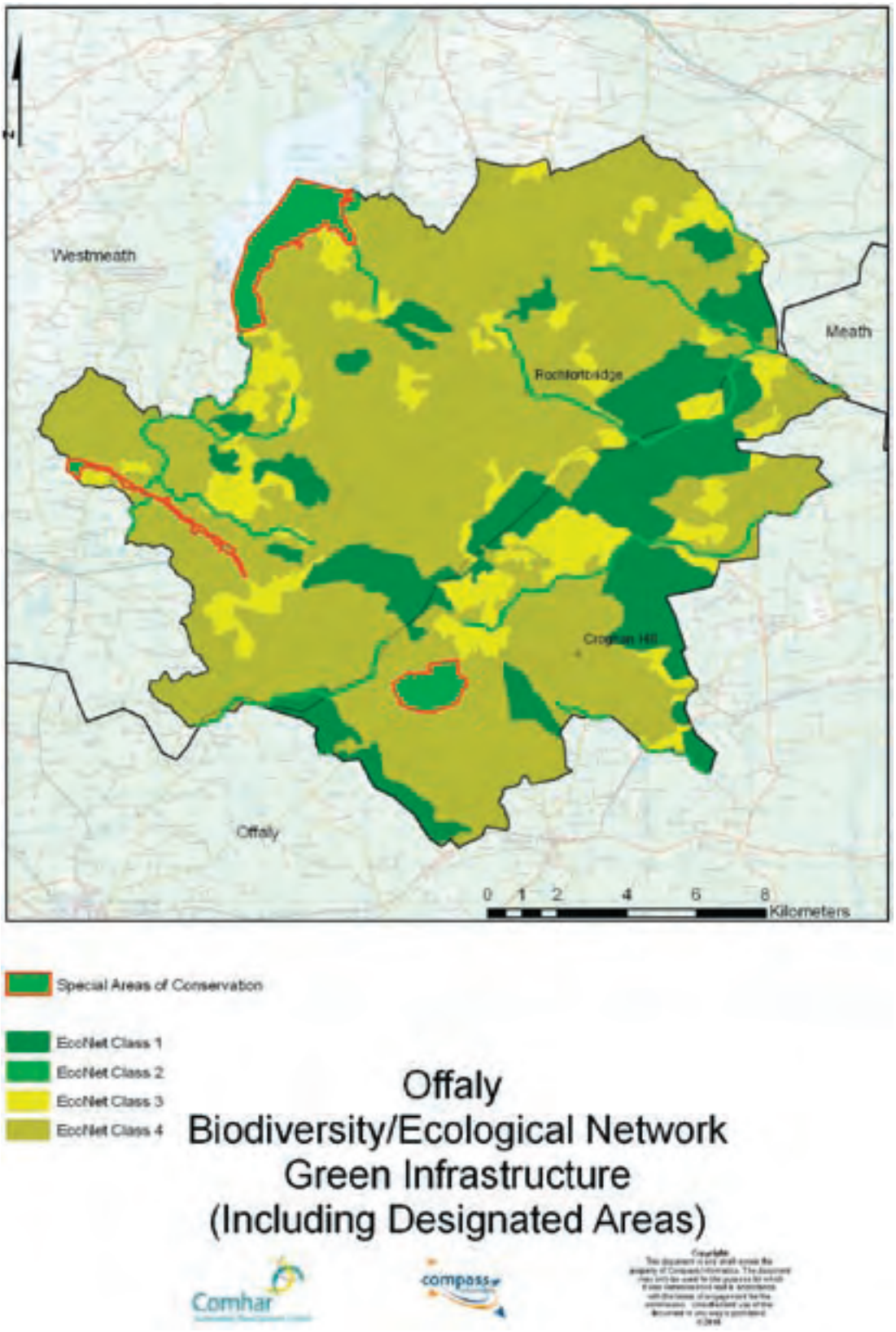

Figure 18: Illustrative case study for the Offaly-Westmeath area: Biodiversity/Ecological network Green Infrastructure with designated areas.

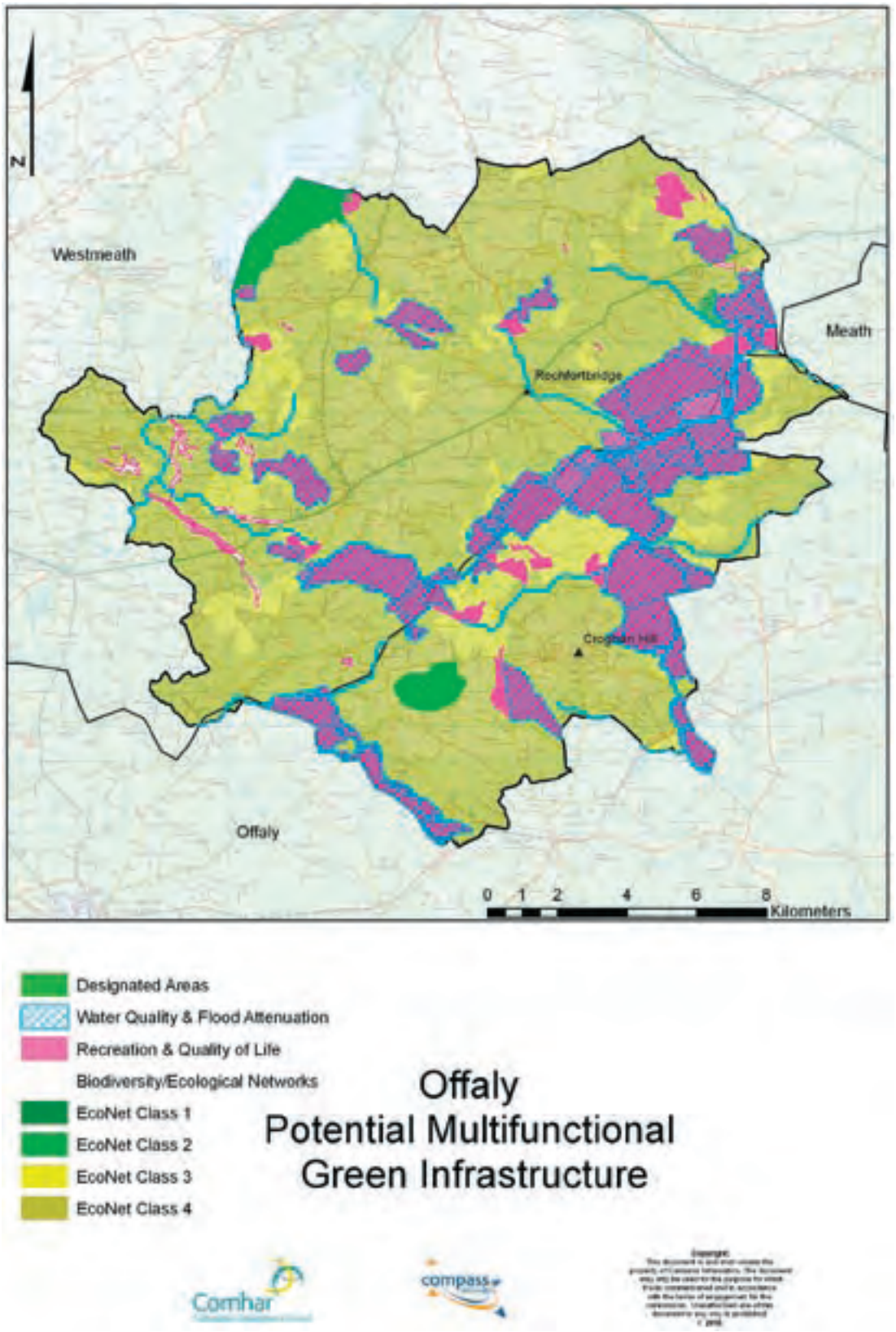

Figure 19: Illustrative case study for the Offaly-Westmeath area: Multifunctional Green Infrastructure

Services provided by the Green Infrastructure network

Peatlands, wetlands and all land with peaty soils are carbon sinks. The extent of land dominated by peaty soils implies that this area is of national importance for this purpose.

Farmland is an economic asset which in many locations is managed sustainably using low intensity food production systems which protects Green Infrastructure functions.

Eskers are sources of massive deposits of sand and gravel used in the construction industry. There is particular potential for exploitation of these types of assets below fields and bogs.

Surviving boglands are internationally important examples of self sustaining ecosystems which actively sequester carbon. The intact peatlands and less disturbed wetlands around the margins of rivers and lakes are important for biodiversity. The local economy is strongly reliant on the unsustainable practise of peatland exploitation. Exploited boglands now offer potential for restoration. Throughout the area there is a patchwork of relevant semi-natural habitats that are important for biodiversity.

Certain features of Green Infrastructure facilitate transport. Canal and eskers provide transport routes. The network of developed bogs is linked by a narrow gauge railway.

Watercourses and aquifers are sources of water. Watercourses and lakes act as waste receptors and ameliorate flooding.

Active/special interest amenities are provided as specific features of Green Infrastructure such as the canal, rivers and lakes, golf courses. Public usage is facilitated by agreement of access to publicly owned woodlands, the canal or key landscape features such as Croghan Hill.

Strategic Objectives

Within this pilot area the principal objective is to develop the network of peatlands, to maximise its value for amenity, biodiversity, and sustainable development.

Resources should be available to implement actions in management plans for designated sites and measures within the River Basin Management Plan to improve water quality and to support sustainable development.

Strategic Actions

This case study demonstrates the difference between the value given to different types of services by society and the challenge of switching from unsustainable to sustainable land use practises. Certain services in this location are provided regardless of location i.e. conservation of carbon in peat. The benefits of other services are tied to location e.g. flood relief is of more benefit when there are houses nearby. The value of recreation services depends on the number and kinds of users. Switching from unsustainable to sustainable land uses requires institutional support.

A strategic land use/development plan is required to maximise the value of the peatland network for its key functions which will assist in replacing employment lost when peatland exploitation ceases. Local stakeholder involvement is required in developing a Green Infrastructure Plan.

Cutaway bogs should not be given a land use zoning value of "disused industrial' or "brownfield" but instead their value as Green Infrastructure should be recognised.

To mitigate for climate change, the plan should should focus on maximising its value as a source of carbon credits, harvested materials and sustainable energy generation/production. Peatland is the most effective carbon store of all terrestrial ecosystems. Re-wetting improves peatland functioning as a carbon sink. A re-wetting of peatlands project is underway in Belarus, covering 42,000ha and plans exist to re-wet 1/3 of all its drained peatlands. Trials have shown that major benefits will result, including the sale of timber, reeds, grass, bog moss and carbon credits.

To maximise its value for recreation, planning should consider the development of a strategic sustainable network of activities/facilities serving local residents, Irish visitors and overseas tourists.

To maximise the development of the network within the wider countryside supports are needed to enable private landowners manage existing and potential linkages between peatlands for biodiversity and recreation. As these supports would probably target wetland restoration they would result in improvements to water quality.

The peatland network should be linked to other features of Green Infrastructure such as eskers, canal and rivers to provide a wider range and network of recreational facilities .

Applied ecological research is needed to understand the value of the network approach to peatland restoration. In particular, as a means to investigate the value of Green Infrastructure linkages in Ireland, the likelihood of movement/migration of native plant and animal species between core areas and islands (along newly developed/managed habitat corridors) needs to be ascertained. The potential for such linkages to facilitate the movement of invasive species should be considered in parallel.

4.6 Cross-cutting issues and lessons learnt

In contrast to the traditional approach to planning, Green Infrastructure planning gives priority to environmental assets. In urban and peri-urban areas it raises the profile of surviving natural and man made green features and supports the development of an integrated network of multifunctional green spaces. In rural areas it is likely to support water quality management planning under relevant EU Directives, highlight the most suitable areas for agri-environmental supports, forestry development and suitable areas for activity tourism and recreation based on the natural environment.

The pilot studies raise issues still to be resolved and discussed such as:

1. The integration of Green Infrastructure planning with traditional planning

A Green Infrastructure plan could be prepared as a special interest strategic plan whose results could inform county and local plans. An alternative approach is to communicate Green Infrastructure principles to plan makers, provide them with relevant baseline data, to support the incorporation of Green Infrastructure planning in traditional plans making greater use of zoning objectives in urban areas and landscape character assessment in rural areas.

2. The need for National Objectives

The preliminary analysis of national Green Infrastructure could be further developed to include the identification of key strategic links and projects in addition to the baseline information.

These limited pilot studies confirm the necessity for national direction which should either set targets/objectives or/and describe a process which would allow regional/local targets to be set within a strategic spatially defined framework. National direction would encourage statutory authorities to take this innovative approach to planning and would allow for regional co-operation. .The recently produced draft Greater Dublin Area Regional Planning Guidelines 2010 include a specific chapter on Green Infrastructure. Specific objectives are set out for the incorporation of Green Infrastructure policies within county development plans.

3. The introduction of strategic land use planning in areas which have not been subject to detailed spatial planning

Green Infrastructure planning requires detailed land use planning which is not part of the planning process for the countryside. The implementation of recently produced draft river basin management plans requires a spatial approach to be applied. This is likely to be resisted by private landowners unless accompanied by incentives. Typical incentives are agri-environmental, forestry or recreational schemes. However unless national direction is given to provide a spatial focus to these schemes they will continue to be offered to all applicants. A strategic recommendation of the draft Regional Planning Guidelines for the Greater Dublin Area GIR 29 states *'Each Council should prepare a county based Green Infrastructure Strategy linking to adjoining areas and following regional connections, and implement GI strategies in local area plans and development management processes'.*

4. Recognition of ecosystem services in local plans

While a national study has been carried out of the value of biodiversity including certain ecosystem services, this information should be available for local plans. There is a particular need to obtain economic recognition for boglands as carbon sinks.

5. Collection of appropriate information on local features of Green Infrastructure

Local studies are required to spatially define restoration areas where ecosystem services need or could be improved and corridors developed which allow for improvement in the distribution of species (including an assessment on the potential to facilitate the spread of invasive species). These studies should be landscape based and consider different management approaches to maximise the functioning of ecological networks.

5. **Creating Ireland's Green Infrastructure** – a planning approach

5. Creating Ireland's Green Infrastructure – a planning approach

5.1 SWOT Analysis

The following analysis of Green Infrastructure takes the SWOT approach of identifying and summarising the strengths, weaknesses, opportunities, and threats of the approach. This analysis serves to highlight what needs to be done to make the Green Infrastructure approach one that is central to spatial planning, including the obstacles to achieving that.

STRENGTHS

- Green Infrastructure approach to planning is grounded in sound science, spatial and landuse planning theory and practice.
- Concept is easy to explain. Green Infrastructure identifies what is of value in the natural environment, what is its function and how could it be improved as part of a multifunctional network.
- Green Infrastructure approach relevant to diverse environments at all scales in town and country. Each location has specific environmental assets which are used in particular ways by society.
- Provides a framework for integrating diverse natural resource and growth management activities in a holistic, ecosystem-based approach.
- Stresses the services associated with landscape, geodiversity and the natural environment and not constraints.
- Planning process identifies and highlights existing and potential ecological networks prior to development and opportunities for multifunctional use in urban and rural areas.
- Planning considers responses to the impact of climate change.
- Enables environmental management and development to be planned in harmony, not in opposition to one another.

WEAKNESSES

- No legally binding legislation for Green Infrastructure.
- No legally binding spatial planning legislation.
- No mention of Green Infrastructure in any adopted planning legislation or guidelines.
- No recognised methodology for Green Infrastructure planning.
- No single authority with responsibility for Green Infrastructure planning, therefore no obvious source of funding for implementation.
- Weak regional planning structures.
- Diverse objectives/aspects of Green Infrastructure require agreement/cooperation of varied stakeholders particularly landowners in a participatory planning process – no mechanism for such co-operation presently exists.
- Lack of development support mechanisms which can be targeted spatially to support the development of multifunctional networks based on ecological linkages.
- Lack of public knowledge/support for Green Infrastructure.
- No central data base/source of guidance on Green Infrastructure planning.

OPPORTUNITIES

- Potential to deliver landscape visions, landscape quality objectives or strategic guidelines through establishment of Green Infrastructure design principles.
- Green Infrastructure supports current government policies on sustainable development by integrating social, environmental and economic aspects of development.
- Provides for the recognition of nature as "natural capital" carrying out essential functions for society including food production.
- Need for targeted agri-environment supports could generate support for Green Infrastructure planning among the farming community.
- Biodiversity conservation and enhancement should lead to reversal of habitat fragmentation and reduction in the rate of biodiversity loss.
- Provides for recognition of existing ecological networks based on landscape features, rivers, coast and uplands.
- Process of Green Infrastructure planning will support social inclusion and community cohesion.
- Resultant policies will result in increased woodland cover, improved water quality and flood attenuation.
- Focus on Green Infrastructure planning will lead to enhanced protection of the cultural heritage to which it is linked, greater recognition for certain visual amenities and local distinctiveness.
- Focus on Green Infrastructure will reduce disturbance to sensitive habitats and species through improved management of human access, and the creation of alternative accessible open space for leisure and recreation.
- Provides a mechanism to balance environmental and economic factors and deliver 'joined up thinking'.
- Incorporate climate change adaptation measures into the spatial framework for development.
- Provides a broad, unifying vision for the future that diverse people and organisations can buy into – creating opportunities for diverse funding sources for implementation leading to job creation and social enterprise.
- Integration with planning policies related to land use (development control), measures required to implement river basin management plans or flood risk plans.
- Potential to support nature tourism/outdoor recreation.

THREATS

- Inconsistent messages and piecemeal approaches to the implementation of the Green Infrastructure approach to planning.
- Lack of support from key professionals focused on retaining traditional approaches to the management of biodiversity and spatial planning.
- Future changes in land use and from climate change are highly uncertain.
- Lack of integration of environmental issues into all sectors.
- Insufficient funding/support for measures which emerge from GI planning.
- Potential resistance from certain key stakeholders, e.g. farmers whose land not hitherto subject to detailed spatial planning.
- Data shortfall.
- Lack of effective structures to support regional planning.

5.2 Recommended Planning Process

The preparation of a Green Infrastructure plan which is usually carried out in response to objectives such as a decline in biodiversity needs to follow a defined approach. Whether this is carried out as part of or separate to the statutory development planning process, it should follow a typical rational planning methodology. It should include (a) a process planning stage, (b) analysis, (c) plan and strategy formulation, and (d) implementation, with feedback between the stages. As with any development planning exercise, it should incorporate stakeholder participation throughout the process.

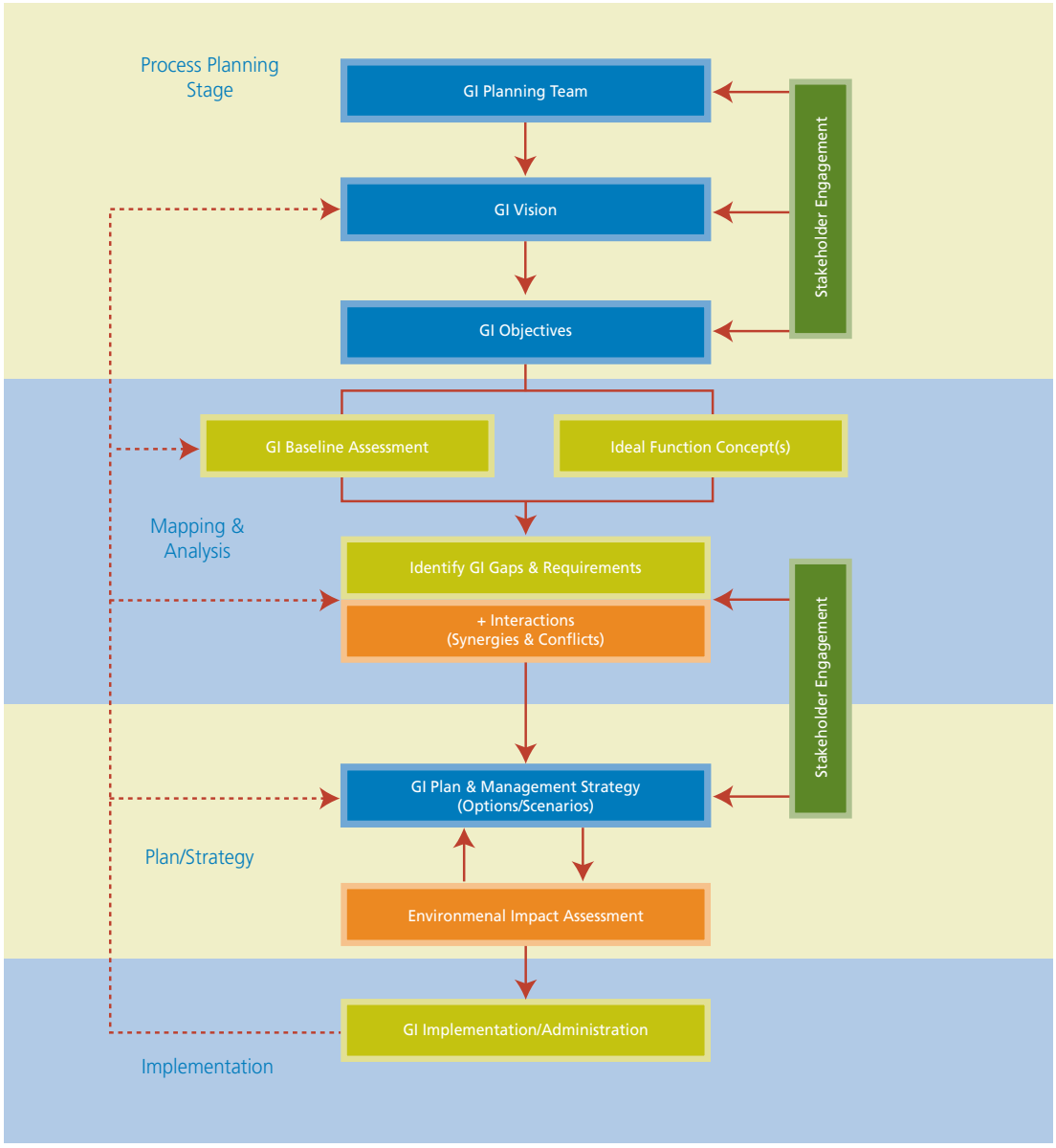

Figure 20: Green Infrastructure Planning Process Flow Chart

The specific detail of the various stages and tasks in a Green Infrastructure planning exercise will vary depending on a number of factors including the chosen definition and goals of the Green Infrastructure, the geographic and administrative context (particularly whether urban or rural) and scale of the study area, and the resources available for the exercise (especially the availability of data).

GI Planning Team

The planning process requires a multi-disciplinary team. The range of expertise required on the team depends on the range of services to be performed by the Green Infrastructure plan. A Green Infrastructure planning team would typically include or have access to the expertise of ecologists, landscape architects, planners and GIS specialists, as well as civil and sanitary service engineers (transportation, water quality and hydrology), agriculture and forestry experts.

GI Vision

A shared vision should initially be agreed for the Green Infrastructure, including the identification of the key components including its ecological network elements, the functions and services that it currently performs, and the over-arching principles to be applied in planning the Green Infrastructure such as its potential functions, values and priorities across functions.

The Green Infrastructure vision should be defined with consideration of its potential to contribute positively to biodiversity protection and enhancement, recreational open space provision, landscape character and amenity, sustainable transport, flood risk management, climate change adaptation, and primary production in the landscape (agriculture, forestry, etc.). In the course of defining the vision (and objectives – see below) all potentially related legislation, policy and initiatives for the study area e.g. Water Framework Directive, Flood Risk Management Guidelines, European Landscape Convention, should be identified so that all possibilities for spatial and functional synergies are considered.

Agreement on the vision will clarify the exact nature of expertise required for the planning process, the data requirements and the complexity and timeframe of the process. It will help to identify the potential stakeholders to be engaged in the process and possible funding sources for implementation.

GI Objectives

For each of the Green Infrastructure functions or ecosystem services provided by the network, specific, measurable, outcome-based objectives should be identified. This is essential for the justification and specification of actions in the Green Infrastructure strategy formulation stage, and for the measurement of success in the course of implementation.

For example, an objective for biodiversity enhancement might be the creation or restoration of X number of hectares of a particular habitat.

For recreation, an objective might be to provide an open space of a certain size within X minutes walk from every home, or to develop X kilometres of dedicated cycle path within the lifetime of the plan.

For water management, an objective (informed by relevant policy) might be to preserve all areas of land in a particular flood risk category from certain types of development.

For climate change adaptation, objectives might include the sequestration of X tons of carbon dioxide; the planting of X hectares of forest as a carbon sink or x trees to offset the heat island effect in an urban area; or developing the further robustness of X hectares of land for species and habitats adaptation.

Stakeholder and Resource-Holder Engagement

As it is the intention of Green Infrastructure planning to affect the development and management of land and resources, its implementation will have implications for the public and resource-holders in the form of both opportunities and constraints. Green Infrastructure planning should therefore be informed by stakeholder engagement throughout the process, from the definition of a vision and objectives to the formulation and implementation of the strategy.

Since Green Infrastructure has multiple functions it is inevitable that conflicts will arise in the course of its planning, for example the conflicts that exist between biodiversity protection and recreation in certain areas, or recreation and agricultural productivity. Stakeholder engagement will allow these conflicts to be identified early in the process, and for the minimum requirements of a particular function to be defined so that solutions can be found or compromises reached.

GI Baseline Assessment

Deciding on which Green Infrastructure assets to include is an important step in the process, as this may have significant social and economic implications. It is important that the decision to include any one resource type is taken carefully, mindful of the local context and the implications of its inclusion in what is effectively a development (or resource management) plan focusing on a network of natural features.

The assets for different Green Infrastructure functions may overlap (multi-functionality is one of its key characteristics) but it is necessary to understand the existing spatial and functional network of resources for each ecosystem service individually.

This stage of the process – the collection, mapping and analysis of data to arrive at a plan for development and management of natural areas, open space and related resources - is commonly recognised as the crux of Green Infrastructure planning. This is the stage that has been explored in the three case studies described in Chapter 4. However, planners and managers in the UK and Europe have stressed that this is just one stage in the Green Infrastructure planning process, and that a plan on its own without preparation, consultation and implementation is of limited value.

A geographic information system (GIS) facilitates the collection, management, mapping and analysis of information (by classification, overlaying, buffering, etc.). Experience suggests that considerable time will be spent in the gathering and analysis of data. It is also likely that adequate data may not be available or that the quality of data will vary across the study area. Best practice is to use compatible data where possible and to be transparent about a lack of information.

Defining the Ideal Spatial and Functional Scenarios

In parallel with the analysis of the baseline situation, the ideal spatial and functional scenario needs to be defined for each of the Green Infrastructure services, with reference to the vision and objectives established in the process planning stage. This is a theoretical exercise that involves the identification of the spatial enhancements (additions or enlargements of core areas, buffers, islands, connections/ corridors, etc.) and/or management interventions that would bring each service to a condition of optimal functionality.

This exercise should consider future scenarios as necessary, for example population growth (in relation to recreational open space) and climate change (in relation to carbon sequestration, flooding and water management, habitat robustness for adaptation purposes).

Identification of Gaps/Requirements and Interactions (Synergies and Conflicts)

By comparing the baseline situations with the ideal scenarios, in terms of spatial quantity and functional quality, the gaps in the Green Infrastructure (or requirements for development) can be identified. At this stage the synergies and conflicts between different functions should be thoroughly explored.

GI Plan and Management Strategy

This exercise is distinct from the identification of gaps in that it takes account of the conflicts (and synergies) that may exist between functions, and the resource constraints, administrative structures and timeframes for implementation of the plan. It is the process of articulating (in spatial and management terms) an achievable Green Infrastructure plan for the study area, and specifying the actions that will bring the existing scenario (or baseline situation) towards this condition.

The actions, which might include development/capital projects, resource management plans, development/management policies or zoning, promotional activities, etc., make up the Green Infrastructure strategy. Each action should be specified and if possible costed, and a measurable desired outcome (within a specific timeframe) should be defined. The responsible parties and stakeholders should be identified and if necessary the source of funding.

The definition of the Green Infrastructure plan and strategy should include a process of scenario planning and impact assessment (with reference to the vision and objectives, and the proper planning and sustainable development of the study area).

GI Implementation/Administration

Implementation of the specified actions is the ultimate goal of Green Infrastructure planning. The effectiveness of all of the preceding stages (particularly consultation and strategy formulation) will be tested by implementation. It is the longest-running, most important and often the most neglected stage of the process. International experience suggests that for a Green Infrastructure strategy to be effective it needs to be made the responsibility of a body or bodies with the resources and authority to carry out or direct the carrying out of actions.

Implementation should incorporate a monitoring programme, to determine whether actions have met their desired outcome, to allow feedback into the process and adjustments to be made where necessary.

5.3 Conclusions

The Green Infrastructure process is illustrated the diagram below. In summary, any Green Infrastructure approach needs to be conceived, planned and designed. Each of these elements need guidance, planning and implementation at all levels of the Irish planning system. Comhar SDC will further develop this work during its current term.

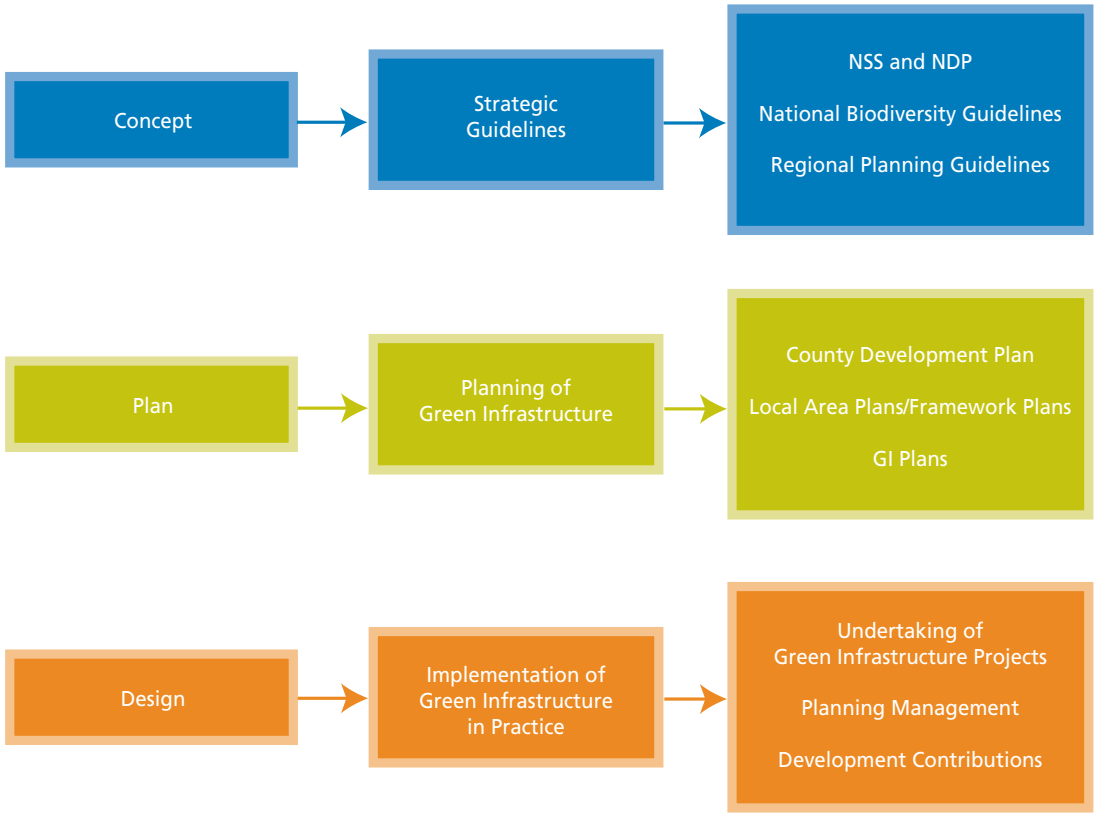

Figure 21: Green Infrastructure Planning Process Summary Flow Chart

6. **Making it happen** – opportunities and recommendations

6. Making it happen – opportunities and recommendations

6.1 Introduction

In order to progress the adoption and implementation of the Green Infrastructure approach a range of actions will need to be undertaken. These include inclusion of Green Infrastructure in policy and legislation; governance arrangements; further research; training; data creation and harmonisation; and awareness raising. Stakeholder involvement is key to the success of the Green Infrastructure approach and must be incorporated in each phase of its development. In recommending these actions, Comhar SDC and the Biodiversity Forum are urging the Government to grasp the opportunities that approaches such as Green Infrastructure can offer in bringing benefits to the environment, economy and society. These recommendations need to be addressed with urgency so that the window of opportunity to change policy and practice is not lost. Comhar SDC through its own work programme will seek to support the implementation of these recommendations, particularly in areas such as development of guidance, stakeholder participation and awareness raising. These recommendations have been prioritised into different phases in recognition of the process that will need to be undertaken to develop and implement a Green Infrastructure approach in Ireland.

6.2 Phase 1 – Creating Green Infrastructure for Ireland (2010-11)

The Green Infrastructure approach

- The approach recommended by Comhar SDC and the Biodiversity Forum to implement Green Infrastructure should be adopted by Government. The planning process should follow a typical rational planning methodology including: (a) a process planning stage, (b) analysis, (c) plan and strategy formulation, and (d) implementation, with feedback between the stages and stakeholder participation incorporated throughout the process. This allows for flexibility based on the nature of Green Infrastructure, local stakeholder needs and specific local objectives.
- A pilot study should be undertaken to develop a Green Infrastructure Strategy following the recommended planning process and incorporating a fuller area assessment, data analysis, stakeholder participation, and prescription of detailed actions. This should be facilitated by Comhar SDC in partnership with selected Local Authorities.

Governance and co-ordination

- Government should identify the Department of the Environment, Heritage and Local Government (DOEHLG) as the lead Department and assign appropriate resource to co-ordinate the implementation of Green Infrastructure and provide a support and advisory service. The DOEHLG should act as a champion of the Green Infrastructure approach.
- Comhar SDC, the Heritage Council and other key stakeholders should work with the lead Department to provide training and awareness raising on Green Infrastructure amongst the public, planning professionals and local authorities.

National Green Infrastructure framework and guidance

- National Green Infrastructure objectives should be developed and published to inform national and regional planning guidance, county and local development plans. This should be led by the DOEHLG.
- Guidance on Green Infrastructure should be developed to support local initiatives and build on best practices. Practical how-to guides should be developed for national, regional and local Green Infrastructure. This should be led by the DOEHLG and carried out in partnership with key stakeholders including Comhar SDC, Heritage Council, Local Authorities, regional authorities and landowners.
- A National Habitat Map at Heritage Council Level 2 detail and field resolution should be developed building on current initiatives to provide a basis for national to local Green Infrastructure maps.
- The National Framework Green Infrastructure Map should be further developed to incorporate additional Green Infrastructure elements such as climate change adaptation and food production and used to inform spatial planning and other policy areas. The map should be regularly revised as data improves and users provide feedback. This should be led by the DOEHLG.
- Integrated Regional Framework Green Infrastructure maps should be produced to guide and inform national and regional strategies and to provide a framework for local plans and implementation. This should be led by the DOEHLG in partnership with Regional and Local Authorities. The use of a GIS system means they can be produced at River Basin District, regional and local scales.

Current policy opportunities

- Green Infrastructure should be included in the revised National Biodiversity Plan as a key mechanism for integrating biodiversity concerns into sectoral policies and spatial planning. The National Biodiversity Plan should contain explicit reference to Green Infrastructure ideally in a section on partnership and integration processes. Resources should be allocated to allow for the implementation of the objectives of management plans for designated sites and river basin districts as these are almost all compatible with Green Infrastructure Planning.
- Green Infrastructure should be incorporated into the National Adaptation Plan as a mechanism of integrating biodiversity and climate change policies.
- Planning authorities should use the provisions in the Planning and Development (Amendment) Act 2010 to ensure that supplementary development contribution schemes support Green Infrastructure development.
- The recent commitment to undertake a Landscape Character Assessment should incorporate Green Infrastructure by mapping functions of the landscape and not just character. Legislation and guidelines developed to promote landscape planning should recommend that this takes place in the context of Green Infrastructure planning. The focus of Landscape Character Assessment should be extended to urban and peri-urban areas and potential linkages to support ecosystem functioning should be considered in landscape character areas. Information gathered to assist both processes should be shared. This should be led by the DOEHLG in partnership with the Heritage Council.

6.3 Phase 2 – Embedding and implementing the Green Infrastructure approach (2010 – 2015)

Integration into spatial planning and ongoing programmes

- The DOEHLG should encourage Regional Authorities to consider Green Infrastructure when developing Planning Guidelines (for example the Greater Dublin Area Regional Planning Guidelines 2010 already include a section on Green Infrastructure).
- The DOEHLG should ensure that the objectives of water and coastal management plans prepared under the Water Framework and Flood Risk Directives are fully supported by Green Infrastructure planning. Such Green Infrastructure plans complement and strengthen river basin plans as they have a spatial focus and should lead to improved ecosystem functioning thus resulting in improved water quality. High value areas (cores) are important for ecosystem functioning and biodiversity, other areas more important for water extraction or waste assimilation. Green Infrastructure would complement planning for WFD as it would emphasise the spatial planning implications of management and specify particular priorities for management in specific areas to maximise function of all elements in the network.
- A basis in legislation should be provided for harmonised and digital availability of all spatial plans. This would benefit Green Infrastructure and other planning and integration approaches and comply with requirements of Local Authorities and other state organisations under the EU INSPIRE Directive.

Research, capacity building and awareness raising

- It is recommended that the NPWS should support strategies and research to demonstrate multiple values of Green Infrastructure and the development of networks based on designated sites for multiple uses including biodiversity. Public statements on biodiversity should regularly emphasise specific and multiple values of biodiversity and ecosystem services to society. The DOEHLG, or a suitable conduit such as the Heritage Council, should promote messages to the public on the multiple values of biodiversity.
- Further research is necessary to assess the wider value and functions of Green Infrastructure including the economic benefits of ecosystem services to support the development of national and local plans.
- Local studies are required to spatially define restoration areas where ecosystem services require management or conservation. These studies should be landscape based and consider different management approaches to maximise the functioning of ecological networks.
- Training and awareness raising will be necessary. Training should be case based, developed in consultation with existing networks of professionals, and have a particular focus on consensus development and multi-functionality.

Embedding Green Infrastructure in agriculture and land use

- As all farmers own and manage Green Infrastructure assets, farmers and land managers should be offered entry to a new agri-environmental scheme which recognises multifunctional uses of land and ecosystem services. Recognition of this broader non-commercial production value by farmers and owners should be a basic requirement for any receipt of any production support. Further supports should then be offered based on the value of land for example as functioning Green Infrastructure, for example, as a carbon sink, part of a network of sites or possession of features which are important for water quality, flood amelioration and recreation.
- As the Green Infrastructure approach will lead to intervention in rural land use any proposal to do so should be presented as an opportunity. Such opportunities must allow benefits to flow directly to these landowners from agri-environmental, forestry development schemes, or potential future schemes around for example carbon sinks or recreation and tourism development. Development of the Green Infrastructure concept to influence planning in the countryside requires an unprecedented level of co-operation between stakeholders. It should be promoted jointly by DOEHLG and Deptartment of Agriculture, Fisheries and Food, facilitated by the Department of Community Rural and Gaeltacht Affairs which has successfully managed a multi stakeholder group to develop recreational access to the countryside.
- Spatially targeted financial supports could be provided following assessment and evidence to owners and land managers for land uses which improve functioning of networks by restoration of habitats, creation of new habitats, linkages, combination of functions, and development of infrastructure to serve particular functions.
- Particular financial support is needed for forestry to provide for:
    1. Strategic expansion of woodland cover to create multipurpose networks, of commercial value, which also improve recreation and biodiversity.
    2. Development of woodlands as carbon sinks.
    3. Expansion and strengthening of riparian woodlands, with potential integration with wetlands and flood control.
- Resources for semi-natural forestry development should be targeted to support existing carbon sinks and establish natural type woodlands in areas from which they have disappeared i.e. the fertile lowlands. The target for planting should ideally be fully native broadleaves and the species planted should relate to those species which were present in the original natural woodlands.

6.4 Phase 3– Putting in place the long term framework (2010-2020)

Data availability and harmonisation

- Effective implementation of the EU INSPIRE Directive and broader Spatial Data Infrastructure objectives is required.
- In order to support wider and ready access to digital base mapping from the national mapping agency - the Ordnance Survey of Ireland, pan-government or pan-departmental licensing agreements should be adopted or made more widespread. Arrangements for access to digital mapping by local bodies and community groups should also be enhanced to facilitate effective engagement.

Integration of Green Infrastructure across the policy framework

- The proposed Landscape Act should promote Green Infrastructure and the process of Green Infrastructure planning. It should also be noted that regulations and codes of practice should follow from such an act, similar to the building standards and the code of practice developed in relation to archaeology and road projects. Such a Landscape Act, will focus on overall landscape planning, management and conservation.
- When the National Spatial Strategy is revised it should fully consider the National Framework Green Infrastructure map and incorporate Green Infrastructure policies and objectives at a national level and outline guidance for the inclusion of similar Green Infrastructure policies and objectives at a more regional and local level.
- The next National Development Plan should contain a map of Green Infrastructure and outline priorities to maintain and enhance its functioning, referring to the implementation of these objectives within the SEA Process, and the WFD River Basin Management Plans. The National Development Plan should offer explicit support to effective stakeholder spatial planning partnerships and support for funding for measures focused on multifunctional networks. The Plan's section on Transport should also contain objectives to develop 'greenways' (non motorised transport routes) separately or adjacent to new roads.
- Tourism and recreational open space plans should describe Green Infrastructure, its current and future function as a recreation and tourism asset. Objectives should suggest the development of a strategic network of spaces which would also benefit ecosystem functioning, biodiversity, and the development of trails along existing linking features which also serve these functions.
- Rural development policies should seek to improve the quality of the rural environment and diversify rural economies through the use of Green Infrastructure planning. Such planning would recognise the multi functional values of land and facilitate a greater focus on developing land for sustainable agriculture, forestry and recreation. In the context of agriculture, the Green Infrastructure concept offers support for the maintenance of farming, particularly low input systems and the strict application of the Code of Good Agricultural Practice which protects soil carbon and water quality.

6.5 Conclusions

This baseline research aimed to assess the potential of the Green Infrastructure approaches in Ireland, to investigate and illustrate potential planning and implementation methodologies and tools, and to raise awareness of the approach through its outcomes and related workshops and conference. The Green Infrastructure approach outlined here is achievable and sufficiently flexible to reflect local priorities while fitting within a national and international framework. The recent decision by EU environment ministers to back the most ambitious of four European Commission proposed options to protect biodiversity after 2010 is a welcome step. This calls for a halt to biodiversity loss and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss. Implementing the EU decision will be extremely challenging for Ireland and will require new approaches and solutions. These will require an integrated and cross-sectoral approach as a focus on planning or nature conservation alone cannot deliver the actions required and will require the embedding of approaches such as Green Infrastructure in policy and practice.

Appendices

Appendix 1
Legislation and Policy Review

Legislation, policies and studies reviewed

To inform this study, legislation, policies and examples of best practice relevant to Green Infrastructure were examined. Sources are listed below and additional commentary is provided in the following section.

Global/European Strategies –Biodiversity and Spatial Planning

- 1992 Earth Summit in Rio de Janeiro
- Convention on Biological Diversity 1992
- EU Habitats Directive 1992
- Pan European Biological and Landscape Diversity Strategy 1996
- The EC Biodiversity Conservation Strategy (ECBS) 1998
- EU Action Plan: Halting the Loss of Biodiversity by 2010 - and Beyond.
- European Spatial Development Perspective ESDP (January 1999)
- The European Landscape Convention (ELC)
- Water Framework Directive 2000
- Commission of the European Communities proposal for a Directive "on the assessment and management of floods". 2006
- The New Charter of Athens 2003: The European Council of Town Planners' Vision for Cities in the 21st century
- European Council of Town Planners – Try it This Way: Checklist for Sustainable Development at the Local Level

National Strategies and Plans

- Wildlife Act 1976 and Wildlife Amendment Act 2000
- National Heritage Act 1976
- Sustainable Development - A Strategy for Ireland – 1997
- Planning and Development Act 2000
- Planning and Development (Amendment) Bill 2009 (Draft)
- Landscape and Landscape Assessment Guidelines – Draft Guidelines for Planning Authorities June 2000
- National Development Plan 2007-2013
- The National Spatial Strategy for the period 2002 – 2020
- Making Ireland's Development Sustainable – 2002
- National Biodiversity Plan 2002
- Guidelines for the production of local biodiversity action plans 2003
- National Climate Change Strategy 2007-2012
- Development Plans - Guidelines for Planning Authorities June 2007

- Development Management – Guidelines for Planning Authorities June 2007
- Report on Status of Habitats and Species NPWS 2007
- Interim Review of the National Biodiversity Plan Comhar SDC 2005
- Sustainable Residential Development in Urban Areas - Consultation draft guidelines for planning authorities February 2008
- Urban Design Manual – A best practice guide February 2008
- National Recreation Policy for Young People in Ireland – Office of the Minister for Children
- National Countryside Recreation Strategy – Comhairle na Tuaithe

Regional/Local Plans

- (Draft) Regional Planning Guidelines for the Greater Dublin Area 2004-2016
- Midlands Regional Planning Guidelines 2004-2016
- Greater Dublin Strategic Drainage Study 2005
- Climate Change Strategy for Dublin City 2008-2012
- South Dublin County Council Green Routes Strategy

Case studies

- Dutch National Ecological Network (info from Rob Jongmann)
- Cecil County Maryland Green Infrastructure Plan (greeninfrastructure.net)
- UK: Cambridge Sub-Region Green Infrastructure Strategy (info from Chris Sutton)
- Kells Backlands Local Area Plan
- Galway Recreation Needs Strategy (www.galwaycoco.ie)
- The Liberties LAP (Biodiversity and Open Space Plan) (www.theliberties.ie)
- Dunhill/Annestown Integrated Constructed Wetlands (Dr. Rory Harrington, pers.comm.)

Commentary on Selected Legislation and Policies

Biodiversity

Convention on Biological Diversity

The UN Convention on Biological Diversity (CBD) was ratified by Ireland in 1996. The CBD is pre-eminent amongst nature/biodiversity related Conventions, both in terms of its widespread support (188 countries plus the EU are Parties) and its comprehensive scope. The objectives of the CBD are the sustainable use of biodiversity and fair and equitable sharing of its benefits. It highlights all forms of biodiversity not just rare species and habitats and stresses the economic imperative for biodiversity management. In 2002 parties to the CBD agreed on a goal to halt the loss of biodiversity by 2010. In March 2007, the G8+5 environment ministers endorsed a study to look at the economic value of biodiversity and ecosystem services, as well as the long-term economic consequences of the continuing loss of biodiversity. The interim report of the study which was presented at the high-level segment of CBD COP9 (May 2008) showed that if the right policies are not adopted, the current decline in biodiversity and the related loss of ecosystem services will continue and even accelerate in some cases, leaving certain ecosystems beyond repair. With a "business-as-usual" scenario, serious consequences could arise by 2050:

- 11% of the natural areas remaining in 2000 could be lost, mainly due to conversion for agriculture, the expansion of infrastructure, and climate change;
- almost 40% of the land currently under low-impact forms of agriculture could be converted to intensive agricultural use, with further biodiversity losses;

The EC Biodiversity Conservation Strategy (ECBS), adopted in 1998,

This was developed to meet the EC's obligations as a Party to the CBD. The ECBS provides a comprehensive response to the many requirements of the CBD, and aims to anticipate, prevent and tackle the causes of significant reduction or loss of biodiversity at the source through the integration of biodiversity and development.

The EC Action Plan for the Conservation of Natural Resources

This action plan while principally stressing the importance of rare habitats and species also states the importance of enhancing the ecological function of land and the importance of the SEA mechanism in regulating impacts of development on biodiversity.

EU Action Plan: Halting the Loss of Biodiversity by 2010 - and Beyond.

In May 2006, the European Commission issued a communication, "Halting the Loss of Biodiversity by 2010 – And Beyond". This communication was accompanied by an Action Plan containing over 150 actions to be implemented at Community and Member State Level. It has ten key objectives:

1. To safeguard the EU's most important habitats and species;
2. To conserve and restore biodiversity and ecosystem services in the wider EU countryside;
3. To conserve and restore biodiversity and ecosystem services in the wider EU marine environment;
4. To reinforce compatibility of regional and territorial development with biodiversity in the EU;
5. To substantially reduce the impact on EU biodiversity of invasive alien species and alien genotypes;
6. To substantially strengthen effectiveness of international governance for biodiversity and ecosystem services;
7. To substantially strengthen support for biodiversity and ecosystem services in EU external assistance;
8. To substantially reduce the impact of international trade on global biodiversity and ecosystem services;
9. To support biodiversity adaptation to climate change; and
10. To substantially strengthen the knowledge base for conservation and sustainable use of biodiversity, in the EU and globally.

Green Infrastructure is the key tool to implement to implement Objective 4 .

Pan-European Biological and Landscape Diversity Strategy

This initiative was developed by the Council of Europe in response to the CBD and ratified by Ireland in 1995. The primary goals of the PEBLDS are:

1. To reduce threats to Europe's biological and landscape diversity

2. To increase the resilience of Europe's biological and landscape diversity
3. To strengthen the ecological coherence of Europe
4. To assure public and civic involvement and awareness concerning biological and landscape diversity issues.

In 2007, the Council of Europe published a discussion paper on climate change and the conservation of EU biodiversity. It focuses upon the principles that must underpin the development of adaptation strategies for biodiversity conservation in the face of climatic change, as well as providing the background evidence from which these principles emerge.

Recent conference organised by UNEP and the Council of Europe[42] concluded there was a need enhance the services provided by ecosystems; reflecting governmental efforts to green Europe's economy.

Birds Directive (79/409/EEC)

The Birds Directive provides protection for certain bird species (listed in Annex 1 of the Directive). Details of this and other relevant EU directives are on the following web site; www.europa.eu.int/comm.environment/nature/legis.htm. The possession of self sustaining populations of these birds has resulted in the designation of areas as Special Protection Areas under this Directive.

Habitats Directive (92/43/EEC)

The Habitats Directive gives protection to particular habitats and species listed in annexes to this directive. The possession of good quality habitats or sustaining populations of these species has resulted in the designation of areas as Special Areas of Conservation (SAC's) under this directive.

While the emphasis in the Habitats Directive is on specific habitats and species it also recognises the need for management of the wider countryside. The preamble states that "land use planning and development policies should encourage the management of features of the landscape which are of major importance to flora and fauna".

The Habitats Directive also states (Article 3) that there are obligations on member states to maintain features of the landscape which will improve the ecological coherence of the Natura 2000 network. The obligations and the type of features are highlighted in Article 10 as follows:

"Such features are those which by virtue of their linear and continuous structure (such as rivers with their banks or traditional systems for marking field boundaries (i.e. hedgerows) or their function as stepping stones (such as ponds or small woods) are essential for the migration, dispersal and genetic exchange of wild species."

The Habitats Directive was brought into force in Ireland through the European Communities (Natural Habitats) regulations 1997 (SI/97/094). This specifies the role of local authorities in protecting such areas through regulating development. The Planning and Development Regulations 2001 (S.I. 600 of 2001) made under the Planning and Development Act, 2000 provides for the recognition of "European sites" (SAC's and SPA's) by planning authorities.

42 www.coe.int/t/dg4/cultureheritage/nature/Biodiversity/STRACO2009/5conference_en.asp

Wildlife (Amendment) Act 2000

This act is the principal piece of wildlife legislation in Ireland. It allows for the statutory designation of protected areas (Natural Heritage Areas) which can be of landscape or ecological interest. It provides protection to wild species of plants and animals and in so doing implements other international obligations on biodiversity which apply to Ireland (such as the Bonn and Bern Conventions and the Convention on Biodiversity).

National Biodiversity Plan 2002

The National Biodiversity Plan 2002 sets out the general framework for implementing the Convention on Biological Diversity. For the first time a national plan stated that local authorities have an important role in local biodiversity management. The plan has been subject to two reviews and a new plan is currently being developed. It contained a specific recommendation that each local authority prepares a Local Biodiversity Plan. As a result guidelines for the production of local biodiversity action plans were produced by the DOEHLG with the assistance of the Heritage Council in 2003. Support is provided by DOEHLG to local authorities to enable them to prepare Local Biodiversity Plans and the Heritage Council has provided funding support for Biodiversity Officers.

Interim review of the implementation of the National Biodiversity Plan. Dept of the Environment 2005

Reviews carried out by Comhar SDC and the Department of Environment described poor progress in implementing the 91 actions of the National Biodiversity Plan and recommended a more integrated approach including the setting of measurable targets. Work is now underway to produce a second Biodiversity Action Plan.

Second National Biodiversity Plan

A discussion paper produced by the Biodiversity Forum of Comhar SDC in April 2008 on the National Biodiversity Plan[43] stated the need to identify and protect Local Biodiversity Areas and develop strategies in partnership with architects, landscapers and health professionals.

Spatial Planning

European Spatial Development Perspective ESDP (January 1999)

The ESDP provides guidelines for spatial planning in Europe. Environmental policies of the ESDP include *'the continued development of European ecological networks, as proposed by Natura 2000, including the necessary links between nature sites and protected areas of regional, national, transnational and EU-wide importance'* and *'the integration of biodiversity considerations into sectoral policies (agriculture, regional policies, transport, fisheries, etc) as included in the Community Biodiversity Strategy'*.

The European Landscape Convention (ELC)

The ELC seeks to embody the protection of landscapes in law. The ELC recognises the multifunctional value of landscapes and that landscape is the 'integrating medium' for land use planning. It seeks to consider landscapes from the outset in plan-making, which is fully consistent with the Green Infrastructure approach.

43 www.comharsdc.ie/publications/index.aspx?PAuto=173

As required by the ELC local Authorities in Ireland have prepared or are in the process of preparing Landscape Character Assessment's (LCA) for each of the counties.

Development Plans - Guidelines for Planning Authorities June 2007

The Development Plan sets out policies for the protection of the environment and heritage and is an important source of information for landowners, developers, communities and members of the public in this regard. Development plans must offer clear guidance on sustainable development policies and objectives, both national and local, which address the various issues involved, such as climate change, waste management, transport, urban development, sustainable communities, use of natural resources etc.

The Development Plan outlines policies and objectives for the proper planning and sustainable development of a certain area over a 6 year time period. There is no direct reference to Green Infrastructure in the guidelines. Indirectly the core issues of Green Infrastructure such as biodiversity, open space, heritage and sustainable development are addressed with guidance on providing policies for these issues in the Development Plans.

Whilst the primary focus of these guidelines is on development management as a process, the underlying objective of that process is to contribute towards a sustainable and high quality environment. Many planning policy objectives aim to protect the natural environment, through prudent use of natural resources and the avoidance of pollution. Development management has the potential to make a significant contribution towards achieving sustainable forms of development.

Part 11 of the Act outlines the content of Development Plans – Section 10 2(e) states that 'the preservation of the character of the landscape where, and to the extent that, in the opinion of the planning authority, the proper planning and sustainable development of the area requires it, including the preservation of views and prospects and the amenities of places and features of natural beauty or interest'.

Section 204 of the Planning and Development Act 2000 allows for the designation of an LCA. In accordance with Section 204 of the Act, a planning authority may designate any area or place as an LCA for the purposes of the preservation of the landscape.

Landscape Character Assessment (LCA) is a process, which describes, maps and classifies landscapes objectively. Meath County Council in Section 8.4.4 of their County Development Plan 2007-2013 state that they *'will explore the designation of Landscape Conservation Area(s), pursuant to Section 204 of the Planning & Development Act, 2000, in respect of their core areas for (a) the Tara and Skryne area(s) and (b) Loughcrew and Slieve na Callliagh Hills'*. The purpose of such plans and/or designations is to protect the rural character, setting, historic context and archaeological heritage of the landscape. In identifying and/or designating such areas, the Planning Authority will be required to ensure that the scope and extent of such designation is sufficient to conserve the specific areas requiring protection.

Planning and Development (Amendment) Bill 2009

The purpose of the Act is to amend and extend the Planning and Development Act 2000, to amend the Transport (Railway Infrastructure) Act 2001 and to provide for related matters. The Act makes no direct or indirect reference to Green Infrastructure, biodiversity, landscape or open space. However it strengthens the obligations for local plans to adhere to national policies and guidelines.

Tree Preservation Order (TPO)

Tree Preservation Orders fall under Section 205 of the Planning and Development Act, 2000. The objective of a TPO is to protect trees, groups of trees and woods of amenity value. Trees, which are the subject of a TPO, cannot be felled unless the owner applies for planning permission to the local authority. Tree Preservation Orders are made only if it appears to the Planning Authority that it is expedient and in the interest of amenity on the environment to protect a tree, group of trees or woodlands, which may be under threat.

Sustainable Development

1992 Earth Summit in Rio de Janeiro

At the 1992 Earth Summit in Rio de Janeiro, world leaders agreed on a comprehensive strategy for "sustainable development" -- meeting our needs while ensuring that we leave a healthy and viable world for future generations. One of the key agreements adopted at Rio was the Convention on Biological Diversity (CBD).

The Water Framework Directive (2000/60/EC)

The main objectives of the WFD are:

- Expanding the scope of water protection to all waters: surface waters and groundwater;
- Achieving "good status" for all waters by 2015;
- Water management based on river basins;
- "Combined approach" of emission limit values and quality standards, plus phasing out particularly hazardous substances;
- Involving the public more closely;
- Ensuring water pricing is correct; and
- Streamlining legislation.

Under this directive there is an obligation on authorities to draw up and implement river basin management plans to maintain the quality of waters.

The New Charter of Athens 2003: The European Council of Town Planners' Vision for Cities in the 21st century

In this document the European Council of Town Planners (ECTP) presents a vision for European cities in the 21st century. This is a vision of a network of cities, which will:

- "retain their cultural richness and diversity, resulting from their long history, linking the past through the present to the future;
- become connected in a multitude of meaningful and functional networks;
- remain creatively competitive whilst striving for complementarity and co-operation;
- contribute decisively to the well-being of their inhabitants and users;
- integrate the man-made and the natural elements of the environment."

In calling for the preservation and development of **connected networks** of habitats, open space, water bodies, cultural heritage features and the surrounding rural landscape, the ECTP Charter essentially advocates Green Infrastructure as a key element of spatial planning in Europe.

The dominant theme of the charter is the concept of **connectivity**. In relation to environmental connectivity the Charter states that "as human beings belong to a living species, maintaining a possibility of contact with natural elements is not only a source of well-being, but also a prerequisite for survival".

In relation to nature, landscape and open space the Charter states that the opportunity for all to live and work in proximity to connected, well-maintained elements of cultural and natural heritage must be carefully preserved and facilitated. These elements include significant landscapes, archaeological sites, monuments, traditional neighbourhoods, parks, squares and other open spaces, water bodies (lakes, rivers, wetlands and the sea shore), nature reserves, and rural areas. Spatial planning should continue to protect these elements as well as strive to create new areas of open space which connect the urban fabric.

European Council of Town Planners – Try it This Way: Checklist for Sustainable Development at the Local Level

In this practical guidance document the ECTP reiterates the importance of Green Infrastructure planning in urban areas (although without naming it as such), suggesting possible components of the network and stressing the importance of its connection to the urban hinterland.

It advocates that areas with specific natural qualities or essential parts of ecological main structures should be protected from spatial development, and that urban development should be guided by protected areas. It recognises that spatial planning can maintain or increase the number and size of green spaces and stimulate bio-diversity. The main objectives for nature and ecology in the practice of urban planning are identified as follows:

- "Complete eco-systems with uninterrupted flows and closed cycles.
- Ecological cohesion, large valuable areas connected by corridors.
- Maximal bio-diversity.
- Nature and ecology as basic component of any sustainable spatial development, action plan and urban design".

In relation to ecological systems the guide recommends that ecological connections and natural passages between the urban area and its rural (including agricultural) outskirts should be provided. It recommends the use of watercourses, geological features, areas of natural vegetation and other habitats as components of a 'green framework'. Importantly, the guide suggests that varying degrees of accessibility to the green framework be allowed, based on the relative social and biodiversity values of each component.

Greenways

Greenways in Europe are understood as transport corridors developed along the routes of historic or disused communication pathways, for the use of non-motorised or slow-mode traffic. Key characteristics are continuity, separation from roads and respect for environmental conditions. Inland waterway towpaths have been identified as having potential for greenway development/promotion. Like most other routes with greenway potential (e.g. disused railway lines, historic roads along eskers), towpaths have characteristics that make them suitable as connecting components of a Green Infrastructure. Greenways are promoted in Ireland by the Heritage Council through its membership of the European Greenways Association (www.aevv-egwa.org).

In the US greenway planning began in the late 19th Century with Emerald Necklace plan for Boston - a 10 mile long park system along the Muddy River. Later expanded into a comprehensive 'green space framework' for the metropolitan area, incorporating three rivers, six mostly connected green wedges on the outskirts, beaches, islands and numerous small squares, playgrounds and parks in the most densely populated urban areas.

The concept of greenways – linkages between areas of natural and recreational open space in a connected network – is well established internationally in both rural and urban settings and at varying scales.

Sustainable Development - A Strategy for Ireland – 1997

The aim outlined for Ireland in our first sustainable development strategy, published in 1997, was "to ensure that economy and society in Ireland can develop to their full potential within a well protected environment, without compromising the quality of that environment and with responsibility towards present and future generations and the wider international community". The integration of environmental considerations into other policy areas is a key means of securing balanced development.

National Development Plan 2007-2013

In the current National Development Plan (NDP) Natural Heritage and Biodiversity are among the main challenges cited alongside climate change, eutrophication and waste management. The Plan recognises the importance of biodiversity, both for its environmental services (e.g. food, freshwater, clean air etc) and in its own right. It reiterates the commitment to halt the loss of biodiversity by 2010 and Ireland's responsibility under the two EU Directives — the Habitats Directive and the Birds Directive — to protect the integrity of habitats and species of European importance. Similar to the NSS the NDP does not make a direct reference to Green Infrastructure. The impact of the plan on the environment is assessed and under Agriculture it is stated that *'In line with the relevant EU regulatory framework, a central theme of that strategy/programme is the environment. The focus is on enhancing natural resources and landscapes. Various measures including afforestation, agri-environment, compensatory allowances and farm waste management-related capital investment address this priority'.* The forestry measure will mitigate climate change. The agri-environment measure will protect biodiversity and traditional agricultural landscapes and will build on the now well-established success of the Rural Environment Protection Scheme (REPS). The support for less favoured areas through compensatory allowances will promote the continued use of agricultural land, thus maintaining the countryside and improving sustainability'.

The National Spatial Strategy 2002 – 2020

This is principally a framework to assist Ireland to achieve "a better balance of social, economic, physical development and population growth between the regions". The NSS recognises that sustainable development is more than just an environmental concept.

There is no direct reference to Green Infrastructure in the NSS. Section 1.4 – Sustainable Development Policy Framework states *'that sustainable development means amongst others 'avoiding adverse impacts on environmental features such as landscapes, habitats and protected species, river catchments, the maritime environment and the cultural heritage'.* Landscape protection is a recurring policy objective for the different region as outlined in the strategy. Landscape protection is outlined as a driver of economic development in rural areas with its potential for tourism growth etc.

A study of ecological networks which was commissioned to inform the National Spatial Strategy (Tubridy and Compass Informatics, 2001) emphasised the value of small scale habitat features, linkages between habitats and the restoration of biodiversity values as a priority in urbanised environments.

National Climate Change Strategy 2007-2012

The National Climate Change Strategy 2007-2012 builds on Ireland's first Climate Change Strategy and its purpose is: to show clearly the measures by which Ireland will meet its 2008-2012 Kyoto Protocol commitment. The Strategy envisages considerable expansion of forestry and energy-crops, continued support for these industries and for farmers to get involved. Ireland will be expected to achieve further significant greenhouse gas emission reductions in the post-2012 period. Actions taken to meet 2012 targets will have a major bearing on preparations for more challenging targets post-2012.

The Minister for the Environment, Heritage and Local Government has powers under planning legislation to issue guidelines to planning authorities. A series of guidelines have been issued which support climate change policies:

- Residential Density Guidelines (1999);
- Guidelines on Sustainable Residential Development;
- Wind Energy Guidelines (2006);
- Planning and Development Regulations 2007.

Sustainable Residential Development in Urban Areas - Consultation draft guidelines for planning authorities February 2008

The aim of these draft guidelines is to set out the key planning principles which should be reflected in development plans and local area plans, and which should guide the preparation and assessment of planning applications for residential development in urban areas. These guidelines state that biodiversity/public open spaces, especially larger ones, can provide for a range of natural habitats and can facilitate the preservation of flora and fauna and care needs to be taken to integrate existing landscape features, mature trees/plants into a development site.

Greater Dublin Strategic Drainage Study 2005

Recognises the multiple values of wetlands and the limited capacity of major sewers which when overflowing can affect the quality of receiving watercourses. Recommends the expansion of wetlands in urban areas, retention of porous surfaces and the development of Sustainable Urban Drainage Systems.

(Draft) Regional Planning Guidelines for the Greater Dublin Area 2004-2016

There is no direct reference to Green Infrastructure in the Regional Planning Guidelines. Section 9.4 deals with Natural Heritage and states that planning authorities should carry out a landscape character assessment of their administrative area, in consultation with neighbouring authorities, in accordance with guidance from the DEHLG. Section 9.6 deals with Open Spaces and Recreation. The Guidelines state that public open space is a vital element in the creation of a quality urban environment, offering opportunities for passive and active recreation, contributing to the quality of life of communities and the identity of town or village's within the GDA, whilst also offering real environmental and ecological benefits.

It is envisaged that the creation of recreational opportunities and the provision of open space in rural areas will contribute to the rural economy and importantly, further contribute to the social and community infrastructure in rural towns and villages thus enhancing the quality of life of the residents and other rural dwellers. Section 9.7 deals with Green Belts with their objective to protect and enhance the open nature of lands between urban areas and to ensure accessibility thereof for agricultural use and recreational uses to urban-based population.

As part of the review of the current Regional Planning Guidelines an issues paper was made available for public consultation in February 2009. Section 3.5 outlines environmental issues including natural heritage and biodiversity and the Water Framework Directive. Recent drafts of the guidelines contain a section on Green Infrastructure.

National Recreation Policy for Young People in Ireland – Office of the Minister for Children

The National Recreation Policy for Young People published in 2007 provides a strategic framework for the promotion of recreational opportunities for young people. In discussing the factors that restrict people's engagement in recreation activities a number of issues of relevance to Green Infrastructure were identified. These include poor planning, which has resulted in the growth of population centres without putting in place the necessary infrastructure to support play and recreation, and the poor quality of the physical environment. In areas perceived as un-welcoming or unsafe, especially heavily trafficked areas, children and teenagers are reluctant to play in the public realm or to walk/cycle outside of their neighbourhood to avail of facilities.

The issues highlight the necessity of strategic planning for a network of attractive open spaces connected by safe linkages (removed from vehicular routes) for the provision of leisure and recreation opportunities. Green Infrastructure planning for any settlement area, rural or urban, could contribute to the delivery of these objectives. The Recreation Policy identifies a range of responsible bodies and funding sources which might potentially be employed in the preparation and implementation of Green Infrastructure plans.

National Countryside Recreation Strategy – Comhairle na Tuaithe

Set up by the Minister for Community, Rural and Gaeltacht Affairs in 2004, Comhairle na Tuaithe had the remit of developing a National Countryside Recreation Strategy. The Council was comprised of representatives of farming organisations, recreational users and state bodies with an interest in the countryside. Published in 2007, the Strategy contained a number of strategic objectives including the development of 'a suitable structure to deliver a national countryside recreation service in a strategic and coordinated way'. Many of the submissions to Comhairle na Tuaithe expressed sentiments that are compatible with the concept of Green Infrastructure, for example:

- The Forest Service (Dept Agriculture and Food): "Ireland's forests are capable of fulfilling many different roles – providing timber and employment, enhancing both the environment and the landscape, promoting biodiversity, sequestering atmospheric carbon. Providing for recreation is another component of this mix. [The recreation potential of forests] can only be fully realised if developed in an integrated fashion with other recreational actors and initiatives in the surrounding areas".
- The Irish Farmers Association noted that most of their 85,000 members do not object to the use of their land by people who want to enjoy the countryside, citing the widespread uptake of the now discontinued REPS Public Access Supplementary Measure. Significantly, the IFA stated that it is the belief of farmers that "the only way to ensure walks remain open is to have a scheme which rewards farmers for maintenance and provides an incentive to participate".

- Failte Ireland: "Failte Ireland sees countryside recreation as a key component in promoting regional spread and growing tourism to rural areas… To achieve optimum use of the countryside for recreational purposes, it is essential that a management system is put in place urgently… Uninterrupted access to the countryside by walkers is essential… without agreed access… Ireland does not have a Walking Product to market".

These submissions (and the Strategy as a whole) suggest the requirement for a countryside plan that has both spatial and administrative dimensions, incorporating the principles of multiple use, continuity/connectivity, and coordinated, multi-agency planning and management of resources. Green Infrastructure as both a spatial concept and a planning approach provides a mechanism for the achievement of this goal. It has the potential to be used (as it has been in Wales and England) to secure and direct funding for access provision to private lands, or for the development and promotion of tourism products, etc.

Case Studies

Galway City Recreation and Amenity Needs Study

The concept of sustainable recreation is central to the study. It recognises that careful design of facilities can help to bring about positive environmental change, and that areas at risk of decline or under threat can be restored while allowing access for appropriate use by the community.

- Strategic Policy 8: Enhance linkages and connectivity within the green network (comprising open spaces including parks, natural heritage areas, walkways/greenways and other open space).
- Strategic Policy 9: Creatively design open space to facilitate and encourage appropriate management of natural resources and the use of sustainable materials and practices.

Kells Backlands LAP

"A landscape framework should incorporate a variety of quality open space/amenity experiences inclusive of active sports and play facilities, passive and tranquil areas for walking, cycling and seating, areas to enjoy the natural environment alongside retained features such as trees, hedgerows and watercourses and dynamic urban squares where civic events may be held."

The Liberties LAP Biodiversity and Open Space Plan

The first of its kind in Ireland, the LAP integrates biodiversity and open space planning. Objectives/ actions of the plan include:

- Provide a network of public parks - some large and some small 'pocket parks' that are attractive for recreation and wildlife and which are well managed and maintained.
- Integrate biodiversity and open space provision within developments, particularly when developing derelict sites which currently provide an element of biodiversity for the area.
- Provide a network of linkages joining the new and improved green spaces. These links will feature street tree planting and landscaping and will provide for pedestrian and other slow transport modes such as horses and cyclists.
- Promote ownership and use of the public realm, biodiversity and open space network through a programme of education, empowerment and active participation.

The fundamental concepts of Green Infrastructure, e.g. multi-functionality, connectivity, etc. are increasingly emerging in local development plans although with no recognised definition or a method of Green Infrastructure planning the concept remains somewhat vague.

Appendix 2
Local Authority Survey Overview

As a task within the project, a survey of selected staff in selected local authorities was undertaken. The following local authorities were surveyed:

Cork County Council, Clare County Council, Dun Laoghaire Rathdown County Council, Fingal County Council, Kildare County Council, Meath County Council, Monaghan County Council, Sligo County Council, Offaly County Council, Dublin City Council, South Dublin County Council, Westmeath County Council. Within these local authorities the principal respondent was the Heritage Officer with the exception of Offaly, Westmeath and Dublin City where planners were the main informants.

Contact with the local authorities was initiated by a member of project Steering Group (Gerry Clabby, Heritage Officer, Fingal County Council) who contacted Heritage Officers and requested co-operation with survey. This was followed by an email from the research team containing a brief introduction to project, an explanation of Green Infrastructure, and a list of questions to be addressed during a telephone interview. An interview then followed of typically 20-60 minutes duration.

Questions

1. What are the typical datasets you use in bring biodiversity issues to bear within planning policy and decision-making?
2. Of datasets such as CORINE landcover, Forest Service and Coillte forestry, Teagasc/EPA soils, and similar, which do you have readily available to you and in use?
3. Of local datasets, to what extent do you have habitat maps, wetland surveys or similar available?
4. How useful have these datasets been as regards making biodiversity considerations part of the planning agenda?
5. To what extent are you aware of the Green Infrastructure, or Ecological Networks, concept?
6. To what extent are other relevant staff, including planners, aware of the Green Infrastructure, or Ecological Networks, concept?
7. Have there been any implementations of the above concepts in your area?
8. Were you to implement a Green Infrastructure, at what level or through what mechanism would you find this most appropriate, and achievable? Via Local Area Plans, County Development Plan, Regional Guidelines, River Basin Management Plan or other?
9. Were you to implement a Green Infrastructure, what specific sites or what specific feature types would you see at of key importance to the Infrastructure? For example riparian zones, uplands, parks, gardens, hedgerows.

Appendix 3
Ecological Network Class Explanatory Note

The Biodiversity element of the national framework and case studies maps created by this project, utilised the Ecological Network classes first formulated and described in the study undertaken by Tubridy, Ó Riain and partners on behalf of the Environmental Protection Agency, Ireland[44]. The following text is an extract from that report.

The study developed criteria to classify the relative importance of different areas within an Ecological Network. Five types of areas were defined on the basis of "naturalness".

Areas within EcoNet Class 1 should have the following characteristics:

1. Supports natural or near-natural vegetation types.
2. Contains landscape features which act as corridors as well as core areas such as uplands, rivers, lakes and coastline.
3. They contain flora and fauna which are specialists i.e. typical of particular habitats or support migratory species either as feeding, nesting or roosting areas, particularly species such as those listed in Annex 1 of the Birds Directive, Annex 2 and 1V of the Habitats Directive, and in the Red Data Books for plants, vertebrates, plants and stoneworts.

Class 2 areas should have the following characteristics:

1. Supports natural or near-natural vegetation types.
2. While they have many of the species and characteristics which would be expected to occur in a natural or semi-natural area quality has been reduced due to development impacts. This is revealed by water quality analyses, examination of management impacts or field surveys. Therefore the area does not support all expected species or functions.
3. Area has potential to revert to class 1 with management.

Class 3 areas should have the following characteristics:

1. Does not contain natural or semi-natural vegetation types.
2. Flora and fauna is dominated by native species. However many non-native species of plants will be found.
3. Area of little importance for rare or migratory species.
4. Unlikely to be designated.
5. Area subject to low intensity management. Therefore they are unlikely to change if management ceases and they have particular potential for improving biodiversity.

Class 4 areas should have the following characteristics:

1. Habitats in the area have appeared as a result of recent development (within last 100 years).
2. They support a mix of species (native and exotic) and the proportion of non-native plants is between 20-35%.
3. Management is intensive and is contributing to their low biodiversity value

44 Tubridy M, O Riain, G (2002). Preliminary study of the needs associated with a National Ecological Network. ERTDI Report (2000-LS-4-4), Environmental Protection Agency, Ireland. http://www.epa.ie/downloads/pubs/research/land/EPA_ecological_network_ERTDI5_synthesis.pdf

4. Habitats of little importance for rare or migratory species.
5. No designations.

Class 5 areas should have the following characteristics:

1. Does not contain natural or semi-natural vegetation types.
2. They support a mix of species (native and exotic) and the proportion of non-native plants is at least 35% or higher.
3. Management is intensive and is contributing to their low biodiversity value
4. Habitats of little importance for rare or migratory species.
5. No designations.

The criteria were applied to CORINE Landcover in order to rank the different landcover types within it. While CORINE Landcover is not a habitat map it was possible to link habitats to landcover type in order to make an assessment of the naturalness of landcover. This was supplemented by additional data on habitats, species and Ordnance Survey mapping to construct the ecological network GIS.

Class 1 areas contain all examples of the following landcover types:

Natural grasslands
Moors and heathlands
Bare rock and sparse vegetation
Unexploited bog
Beaches and dunes
Intertidal flats
Coastal lagoons in the highest categories in a Dúchas lagoons survey (Healy et al., 1998; Healy, 1999)
Estuaries
Sea and Ocean.

Class 2 areas include:

Broadleaf forest
Burnt areas
Watercourses
Canals
Inland Marsh
Lakes
Coastal lagoons not in highest categories in Dúchas survey (Healy et al., 1998; Healy, 1999)
Saltmarshes

Class 3 areas include:

Green urban areas
Sports and Leisure
Low productivity grassland
Mix of high and low productivity grassland
Principally agriculture with significant areas of natural vegetation
Scrub
Mixed forest
Hedgerows

Class 4 areas include:

- Discontinuous urban fabric
- Road and Railway
- Airports
- Mineral Sites
- Arable land
- High productivity grass
- Annual crops and permanent crops associated with agriculture
- Complex cultivation patterns
- Coniferous forest
- Exploited bog

Class 5 areas include:

- Continuous urban fabric
- Industrial
- Sea ports
- Dump Sites
- Construction Sites

Appendix 4 Preliminary CORINE Landcover Reclassification to Green Infrastructure Elements

CORINE & MOLAND RECATEGORISATION TO GREEN INFRASTRUCTURE ELEMENTS				
DESCRIPTION	CORINE CODE	BIODIVERSITY (ECONET)	WATER QUALITY & FLOOD ATTENUATION	RECREATION & QUALITY OF LIFE
ARTIFICIAL SURFACES				
Urban Fabric				
Continuous Urban Fabric	111	5		
Residential continuous dense urban fabric	1111	5		
Residential continuous medium dense urban fabric	1112	5		
Discontinuous urban fabric	112	4		
Residential discontinuous urban fabric	1121	4		
Residential discontinuous sparse urban fabric	1122	4		
Residential urban blocks	1123	5		
Informal discontinuous residential structures	1124	4		
Industrial Commercial and Transport Units				
Industrial or commercial units	121	5		
Industrial areas	1211	5		
Commercial areas	1212	5		
Public and private services	1213	5		X
Technological Infrastructure for public service	1214	5		X
Archaeological sites	1215	3		X
Places of worship	1216	4		X
Non-Vegetated cemetery	1217	4		
Hospitals	1218	4		
Restricted access services	1219	4		
Road and rail network	122	4		
Fast transit roads and associated land	1221	4		
Other roads and associated land	1222	4		
Railways and associated land	1223	4		
Other rails	1224	4		
Parking sites for private vehicles	1226	5		
Parking sites for public vehicles	1227	5		
Port areas	123	5		
Airports	124	4		
Military airports	1242	4		
Mine Dump and Construction Sites				
Mineral extraction sites	131	4		
Dump sites	132	5		
Construction sites	133	5		X
Artificial Non-Agricultural Vegetated Areas				

CORINE & MOLAND RECATEGORISATION TO GREEN INFRASTRUCTURE ELEMENTS				
DESCRIPTION	CORINE CODE	BIODIVERSITY (ECONET)	WATER QUALITY & FLOOD ATTENUATION	RECREATION & QUALITY OF LIFE
Green urban areas	141	3		X
Vegetated cemetery	1411			X
Sport and leisure facilities	142	3		X
AGRICULTURAL AREAS				
Arable Land				
Non-irrigated arable land	211	4		
Greenhouses	2113	4		
Pasture				
Pasture	231	4		
Pasture improved	2311	4		
Pasture unimproved	2312	4		
Pasture improved-wet	23111	4		
Pasture improved-dry	23112	4		
Pasture unimproved-wet	231121	3		
Pasture unimproved-dry	231122	3		
Heterogeneous Agricultural Areas				
Annual crops associated with permanent crops	241	2		
Complex cultivation patterns	242	4		
Land principally occupied by agriculture	243	3		
FOREST AND SEMI-NATURAL AREAS				
Forest				
Broadleaf forest	311	2		X
Coniferous	312	4		X
Mixed forest	313	3		X
Scrub and/or Herbaceous Vegetation				
Natural grasslands	321	1		
Moors and heathland	322	1		
Transitional woodland/scrub	324	3		
Open spaces with little or no vegetation				
Beach dunes sands	331	1	X	X
Bare rocks	332	1		
Sparsely vegetated areas	33	1		
WETLAND				
Inland Wetlands				
Inland marshes	411	2	X	X
Peat bogs	412	1	X	X
Peat bogs-raised	4121	4	X	X
Peat bogs-blanket	4122	4	X	X
Peat bogs-raised-exploited	41211	4	X	

CORINE & MOLAND RECATEGORISATION TO GREEN INFRASTRUCTURE ELEMENTS				
DESCRIPTION	CORINE CODE	BIODIVERSITY (ECONET)	WATER QUALITY & FLOOD ATTENUATION	RECREATION & QUALITY OF LIFE
Peat bogs-raised-intact	41212	1	X	X
Peat bogs-blanket-upland	41221	4	X	X
Peat bogs-blanket-lowland	41222	4	X	X
Peat bogs-blanket-upland-exploited	412211	4	X	
Peat bogs-blanket-uplands-intact	412212	1	X	X
Peat bogs-blanket-lowland-exploited	412221	4	X	
Peat bogs-lowland-blanket-intact	412222	1	X	X
Maritime Wetlands				
Salt marshes	421	2	X	
Salines	422	2	X	
Intertidal flats	423	1	X	
WATER BODIES				
Continental Waters				
Stream courses	511	2	X	X
Water bodies	512	2	X	X
Coastal lagoons	521	1	X	X
Estuaries	522	6	X	X
Sea ad ocean	523	6	X	X
Burnt areas	334	2		

*** List of landcover include Corine & additional higher detail MOLAND landcover classes**

Appendix 5 Preliminary Heritage Council Habitats Reclassification to Green Infrastructure Elements

HERITAGE COUNCIL HABITAT (FOSSIT) RECATEGORISATION TO BIODIVERSITY GREEN INFRASTRUCTURE ELEMENT		
DESCRIPTOR	**FOSSIT LEVEL 3**	**BIODIVERSITY (ECONET)**
Horticultural land	BC2	4
Buildings & artificial surfaces	BL3	5
Arable crops	BC1	4
Tilled land	BC3	4
Flower beds and borders	BC4	4
Stone walls and other stonework	BL1	4
Shingle and gravel	CB1	1
Fixed dunes	CD3	1
Embryonic dunes	CD1	1
Marram dunes	CD2	1
Dune scrub and woodland	CD4	1
Dune stacks	CD5	1
Lower salt marsh	CM1	2
Lagoons and saline lakes	CW1	1
Tidal rivers	CW2	1
Spoil and bare ground	ED2	5
Non-marine caves	ED1	5
Active quarries and mines	ED4	5
Refuse and other waste	ED5	5
Other artificial lakes and ponds	FL8	4
Calcerous spring	FS1	2
Improved agricultural grassland	GA1	4
Marsh	GM1	2
Dry calcerous and neutral grassland	GS1	1
Sedimentary sea cliffs	CS3	1
Wet grassland	GS4	1
Dense bracken	HD1	3
Moderately exposed rocky shores	LR2	1
Sheltered rocky shores	LR3	1
Mixed substrata shores	LR4	1
Shingle and gravel shores	LS1	1
Sand shores	LS2	1
Muddy sand shores	LS3	1
Mud shores	LS4	1
Mixed sediment shores	LS5	1
(Mixed) broadleaved woodland	WD1	3
Mixed broadleaved/conifer woodland	WD2	3
Yew woodland	WD3	3
Conifer plantation	WD4	4
Amenity grassland (improved)	GA2	4
Oak-ash-hazel woodland	WN2	2
Scattered trees and parkland	WD5	2
Wet willo-alder-ash woodland	WN6	2
Immature woodland	WS2	3
Ornamental/non-native shrubs	WS3	4

Appendix 6 Workshop Attendees

Anja Murray	An Taisce
Bridget Loughlin	Kildare County Council
Catherine Farrell	Bord na Mona
Cathrine Pedersen Schirmer	Irish Environmental Network
Cathy Maguire	Comhar SDC
Ciaran McEoin	Comhar SDC
Colm McCoy	Regional Planning Guidelines Officer
Con Gregg	Publica Consulting
David Bagnall	Brady Shipman Martin
David Korowicz	Feasta
Deirdre Scully	Regional Planning Guidelines Officer
Doug Corrie	National Trails Centre
Eoin McLoughlin	Comhar SDC
Gearoid O'Riain	Compass Informatics
Gerry Clabby	Fingal County Council
Helen Hughes	National Roads Authority
Jack Golden	NPWS
John Paul Casey	Keith Simpson and Associates
Karen Foley	UCD
Karin Dubsky	Coastwatch
Ken Whelan	Marine Institute
Mary Tubridy	Mary Tubridy and Associates
Maryann Harris	Dublin City Council
Michael Hannon	South Dublin County Council
Mick Lennon	
Niamh Kirwan	Comhar SDC
Noel Casserly	Comhar SDC
Noel McEvoy	Dublin City Council
Ornagh Darcy	Irish Rural Dwellers Association
Pat Farrell	Irish Farmers Association
Pauline Riordan	Dublin City Council
Richard Butler	Cunnane Stratton Reynolds
Risteard Morrisey	Comhar SDC
Rosemary Gibbons	Dublin City Council
Shirley Clerkin	Monaghan County Council
Siobhan Egan	Birdwatch Ireland
William Hynes	Keith Simpson and Associates