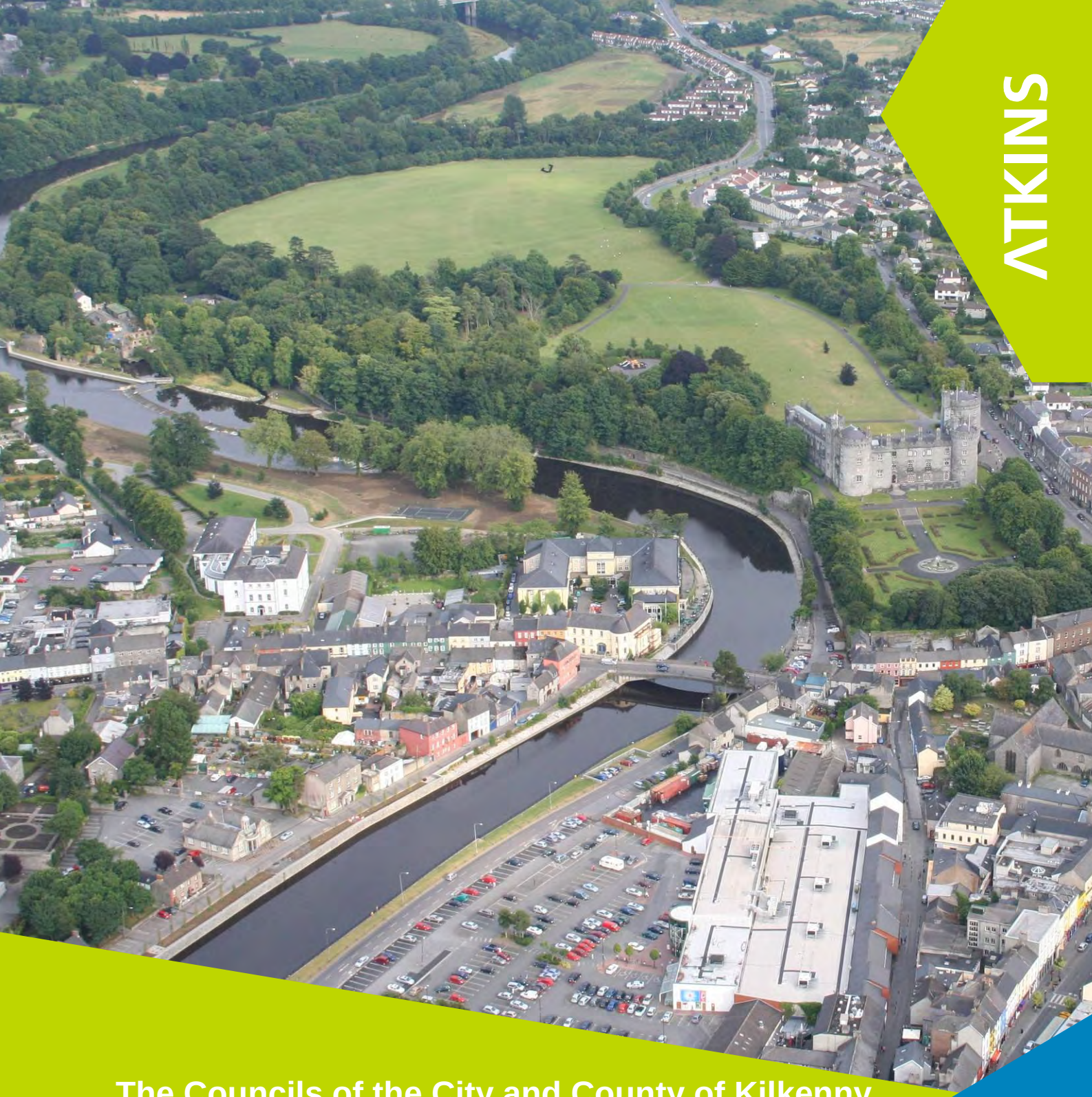

ATKINS

The Councils of the City and County of Kilkenny

Habitat Survey and Mapping of Kilkenny City

Habitat Survey Report

24th November 2010

An Chomhairle Oidhreachta
The Heritage Council

Kilkenny Heritage Forum

The Councils of the City and County of Kilkenny

Habitat Survey and Mapping of Kilkenny City

Habitat Survey Report

24th November, 2010

Notice

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Executive Summary

Habitats in and around urban areas can provide valuable resources for wildlife and humans. For example, suburban gardens can provide nectar for insects and nesting and foraging for birds, bats can roost in old buildings, and old stone walls can support a diversity of wildflowers, ferns and mosses. Similarly, urban and suburban habitats can provide vital services for humans, such as protecting soil and water quality, regulating surface water and floods, carbon sequestration, and providing space for recreation and relaxation. For these reasons, the Councils of the City and County of Kilkenny have policies relating to conserving and managing habitats, including those of local biodiversity interest that are not protected by law. A critical first step in conservation and management is having the necessary information. For this reason, the Councils of the City and County of Kilkenny have undertaken a habitat survey and mapping project for Kilkenny City and Environs.

The primary aims of this project were to survey, map and assess habitats within Kilkenny City and Environs, to identify Green Infrastructure, and to raise awareness about the natural heritage of the City. These were achieved by:

- Reviewing information that already exists from previous studies
- Discussions with a wide range of experts and local people
- A field-based habitat survey
- Compiling habitat maps and a habitat database

The results were used to provide baseline information on the habitats in Kilkenny City and Environs, to identify areas of key Green Infrastructure, and to develop recommendations for further work in this area.

It is no surprise that buildings and gardens are the most abundant group of habitats in Kilkenny City and Environs, covering 45% of the total study area. These include a wide range of habitats and land-use types, such as private houses and gardens, roads, public buildings and associated landscaping and industrial estates. These vary widely in their value for wildlife. Kilkenny City is rich in old stone walls and buildings that support a diverse range of plant species which provide food and shelter for insects, birds, bats and small mammals. Older housing estates with well developed gardens, ornamental shrubs and mature trees are of higher wildlife value than newer estates dominated by lawns and a few saplings. Weedy, neglected corners can be of great benefit for plants and insects and often suffer from inappropriate tidying.

Intensive agriculture dominates the outskirts of the City Environs, especially to the west, and comprises 31.8% of the total study area. These are improved grassland pastures for livestock and large tillage fields, which are of generally little ecological value.

Amenity grasslands occupy 10% of the study area and comprise another habitat type with limited benefit for wildlife because they are intensively managed and poor in structural and species diversity. Although they can be important for recreation, a large proportion of the public amenity grassland in estates appears to be underused and has great potential to be enhanced through sensitive tree and wildflower planting or even vegetable and herb gardening.

The remaining habitat groups each occupy less than 4% of Kilkenny City and Environs, but are much more important for biodiversity than their area would suggest. These habitats include rivers, semi-natural grassland, woodland, wetlands, lakes and disturbed ground. The River Nore is the most important aquatic habitat in the study area. Semi-natural wet grasslands, wet woodlands and pockets of reed swamp are found along its length and also along the Breagagh and Pococke Rivers. These are some of the most natural habitats to be found in Kilkenny City and Environs and are particularly important for a range of waterbirds and waders. Less welcome along riverbanks is Himalayan balsam, a pretty but highly invasive non-native plant that outcompetes natural riverbank vegetation. Other wetlands and small lakes are scattered about the study area. These include some of the most ecologically valuable habitats in Kilkenny

City and Environs; some of them are proposed for national designation as important natural heritage sites and these are described in more detail below.

Small patches of species-rich calcareous grassland are most common on steeply sloping ground near the River Nore. These are the most valuable habitats for wildflowers, including orchids and the nationally rare nettle-leaved bellflower. Mature woodlands on drier ground also typically cluster about the rivers. These are or were parts of large demesnes and include woodlands in Kilkenny Castle grounds and at the Island to the north of the City. Most of the trees in Kilkenny City woodlands are not native to Ireland, but still provide valuable cover and shelter for mammals and birds and provide habitat for the more common woodland plant and fungi species.

Hedgerows and treelines can be important ecological corridors encouraging the movement of mammals and other wildlife through intensive farmland and suburban areas. They are also valuable as habitats in their own right, especially for nesting birds and foraging bats. Hedgerow structure varies considerably and is strongly influenced by management, such as cutting, replanting and fencing. The more common hedgerow shrubs include hawthorn, elder and blackthorn, often with elm, ash and sycamore trees. Many hedgerows in the City Environs are not actively managed, which leads in time to a change from a tightly planted hedgerow to a gappy line of leggy shrubs and trees. This reduces a hedgerow's value for wildlife and also its value to the landowner as a livestock barrier.

The results of the habitat survey were used to map areas of key Green Infrastructure. Green Infrastructure is a network of interconnected green spaces that conserve biodiversity and provide ecosystem services to people, such as regulating surface water and floods and providing space for recreation and relaxation, as mentioned above. As not all pieces of Green Infrastructure are equally valuable, the most important areas were identified, focusing primarily on their biodiversity value. Also included were habitats that buffer or complement the most important ones, habitats that perform significant ecosystem services, and habitats that act as corridors or stepping stones across the study area. Green Infrastructure areas in Kilkenny City and Environs include:

- *The River Nore and Environs*: This is the most important piece of Green Infrastructure in the area and is already designated as being of international ecological importance. It forms an ecological corridor through the entire City and Environs. A wide range of valuable habitats occur along the river, supporting a diversity of wildlife. The River Nore Walk is an important recreational amenity, and the river floodplains are important for flood control.
- *Lough Macask* and *Newpark Marsh*: These two sites are wetlands proposed for designation as nationally important natural heritage areas. They support a range of wetland plants and birds, and their value is increased by the scarcity of wetland habitats throughout the county. Newpark Marsh is an important amenity area and there is scope for improving the amenity function of Lough Macask.
- *St. Kieran's College and Environs* and *St. Canice's Cathedral and Environs:* These two sites are more urban in nature and consist of a mixture of institutional buildings, older private housing estates, well-developed gardens and mature trees. These areas provide some of the best wildlife habitat in the more built-up parts of the City and function as stepping stones increasing connectivity with the River Nore. The mature trees serve to regulate local climate (shade and shelter) and play a role in carbon sequestration.
- *Breagagh River* and *Pococke River*: These two rivers are tributaries of the River Nore and are less significant than the Nore, but they also support valuable woodlands and semi-natural grasslands along their banks. They are also ecological corridors, with the Breagagh linking the Nore to the west of the study area and the Pococke linking the Nore to the southeast of the study area.
- *Kilkenny Golf Course:* Although of less ecological value, the golf course has a significant recreational function. The wooded areas have some potential for supporting birds and mammals and, if allowed to mature, provide carbon sequestration.
- *Smaller stepping stones:* A number of smaller sites with particular potential to act as stepping stones between the larger sites include St. Maul's graveyard, St. Mary's Church and graveyard, ponds and

wetlands at Lakeview Drive, mature trees in the Castlecomer Road area, and a small complex of wet grassland and scrub at Oldpark.

Recommendations were developed following on from the results of the habitat survey and include recommendations for strategic planning of Green Infrastructure, measures to conserve and enhance biodiversity, further research required and raising public awareness of the natural heritage of Kilkenny City and Environs.

1. Introduction

1.1 Background

1.1.1 Scope of the Project

Plate 1.1 – Kilkenny Castle lawns and woodland (Photo: G. Smith)

The value of natural and semi-natural habitats in Ireland is widely recognised, if not always fully appreciated. Natural areas provide homes for wildlife, trees and wildflowers, but they also provide a wide range of benefits for the humans that live and work in and near them, including opportunities for recreation and relaxation, protection of soil and water quality, flood regulation, carbon sequestration, and sustainable production of food and fuel. Lately, we have come to recognise that habitats in and around urban areas can be just as important in many ways as larger, wilder areas in the country (Miller and Hobbs, 2002; Dearborn and Clark, 2010). Suburban gardens can provide nectar for bees and butterflies, bats can roost in old buildings, and urban trees can clean the air and provide shelter from sun and wind.

In recognition of the importance of urban and suburban habitats, the Councils of the City and County of Kilkenny have policies relating to their identification, conservation and management. The Kilkenny Biodiversity Plan 2009-2014 and the Kilkenny Heritage Plan 2007-2011 propose actions to address biodiversity in Kilkenny City and to prepare a plan for its management. Finally, policies H65 and H66 of the Kilkenny City and Environs Development Plan 2008-2014 promote, respectively, the identification of “sites of local nature conservation interest, not otherwise protected by legislation” and the protection of “wildlife habitats and landscape features which form part of habitat networks”. A crucial part of achieving these goals is to gather information on the habitats of the Kilkenny City. Accordingly, the Councils of the City and County of Kilkenny in partnership with the Kilkenny Heritage Forum and the Heritage Council have commissioned Atkins to carry out this work.

The primary aims of this project were to survey, map and assess habitats within Kilkenny City and Environs, to identify Green Infrastructure, and to raise awareness about the natural heritage of the City. Achieving these aims is necessary if the habitats of Kilkenny City are to be managed for the benefit of people, animals and plants. Information on habitat quality and location permits identification of a Green Infrastructure network for Kilkenny City: interconnected green spaces that conserve biodiversity and provide ecosystem services to people. Understanding the location, extent and characteristics of Green Infrastructure in the City is essential for managing it sustainably. The main mechanisms for doing this are strategic plans, such as City and County development plans, and practical management plans and strategies that will be developed in the future. There is a high level of awareness of the value of Kilkenny’s built heritage which has contributed to its conservation. A similar level of understanding of the value of the City’s natural

heritage is fundamental if its sustainable management is to be a priority in planning and is to be implemented on the ground.

The project study area is defined by the development boundary of Kilkenny City and Environs as defined in the Kilkenny City and Environs Development Plan 2008-2014 (Figure 1.1). The study area is mainly bounded on the east by the Eastern Bypass and on the west by the proposed line of the Western Bypass. The study area and development plan boundary includes additional areas occupied by existing and planned industrial and business parks to the southeast at Sionhermitage and to the south at Loughboy. The study area includes Kilkenny City Centre, suburban areas and surrounding agricultural lands, the latter of which are mainly to the west of the City Centre. The development plan area totals 1816 ha; the total area of habitats mapped in this study is slightly larger at 1885 ha, as the site boundary divides a number of fields in the west along the line of the proposed Western Bypass.

1.1.2 Habitat Surveying

According to *A Guide to Habitats in Ireland* (Fossitt, 2000), the standard description of Irish habitats, "habitats are the basic building blocks of the environment that are inhabited by animals and plants, and which are important as units for site description and conservation management." Habitats are defined by the living things that are found there, mainly plants, and also by environmental conditions, such as geology, water, topography and human management. *A Guide to Habitats in Ireland* (Fossitt, 2000) classifies Irish habitats in a number of types in a hierarchy under a few broad categories, such as grasslands, freshwater bodies, cultivated and built land, peatlands, and woodlands.

Information on the type, location and extent of habitats is collected during a habitat survey. This can be used to prepare a habitat map, as we have done, which can clearly and simply outline the spatial characteristics of habitats in an area, particularly any linkages among them. Additional information on habitats is often collected, such as a habitat's main plant species or conservation status, depending on the reasons why the survey is being carried out and how the results will be used. Information we collected on Kilkenny City's habitats included: conservation value, threats, abundant and characteristic plant and animal species, presence of invasive exotic species (see Box 2), connectivity with other habitats, and notes on current and past management.

As with many habitat surveys, our habitat survey data have been stored and manipulated in a Geographical Information System (GIS), a computer-based information system tailored to store, process and manipulate spatial data. Use of GIS allows easy production of habitat maps and the ability to interrogate geographical datasets to answer particular questions. In the habitat survey of Kilkenny City, we used GIS to find out what were the most abundant habitats in the City and to help identify important areas of Green Infrastructure.

More information on how we surveyed and mapped the habitats of Kilkenny City is given in Section 0 below and elsewhere in this report.

1.1.3 Habitat Evaluation and Site Designation

One piece of information on habitats that is frequently collected during surveys is the ecological value of a particular habitat. Habitats are evaluated on a number of criteria, including their rarity, the abundance and diversity of species they support, how natural or modified by humans they are, their fragility, and their size. Habitats of greater nature conservation importance should be offered greater protection than those of less value.

Plate 1.2 – Lough Macask pNHA (Photo: G. Smith)

The EU has identified a number of habitat types that are most important across Europe. Fifty-nine of these internationally valuable habitats are found in Ireland. These habitat types are listed in the EU Habitats Directive (92/43/EEC), and the Habitats Directive also requires member states to identify sites that contain representative examples of these habitat types. These are known as Special Areas of Conservation (SACs), of which there is one in Kilkenny City: the River Barrow and River Nore SAC (site code 2162).

At the next level of designation, sites that are of national ecological importance because of the habitats, species or geological features they support are being designated as Natural Heritage Areas (NHAs). There are three sites proposed for designation as NHAs (pNHAs) within the study area – all wetlands. These are Lough Macask pNHA (site code 1914), Dunmore Complex pNHA (site code 1859) and Newpark Marsh pNHA (side code 845). A fourth site, Archersgrove pNHA (site code 2051) is located just outside the study area along the banks of the River Nore to the southeast of the City. Parts of the Dunmore Complex pNHA and all of Archersgrove pNHA are also part of the River Barrow and River Nore SAC.

Below these, it's possible to recognise habitats or sites of county-level or local importance for natural heritage. Not many sites of county or local importance, however, have yet been formally recognised. The Black Quarry at Archersgrove, thought to be the first location where Kilkenny Black Marble was quarried, is a geological and historical site of county importance (Clarke *et al.*, 2007) listed in the Kilkenny County Development Plan 2008-2014. The County Development Plan also identifies two sites of county importance for nature conservation and other values, but neither of these are in the environs of Kilkenny City. As noted above, the Kilkenny City and Environs Development Plan 2008-2014 highlights the importance of nature conservation outside of nationally and internationally designated sites, and has policies relating to identifying undesignated sites of local nature conservation interest.

1.1.4 Green Infrastructure

Ecological Networks

Once habitats have been surveyed and mapped, the next question is how best to manage them. One approach is the establishment of *ecological networks*. Ecological networks are made up of core areas of high biodiversity value connected by corridors or stepping stones. Corridors are more or less linear avenues of habitats that link larger areas of habitats and allow animals, birds and plants to move among them. Examples of corridors could be hedgerows linking areas of woodland or rivers and riverside habitats connecting larger areas of wetlands or natural grasslands. Stepping stones are more isolated habitat patches located in built-up areas or intensive farmland that allow animals and plants to jump between core habitat areas. Stepping stones could include small wetlands or ponds in farmland, grasslands that have developed on abandoned quarries, or even urban parks. The importance of corridors and stepping stones is that it reduces ecological fragmentation in the landscape. Increasing connectivity among habitats gives plants and animals greater access to living space and other resources, allows them to recolonise areas where they may have been lost, and maintains their health by reducing inbreeding.

Plate 1.3 – Dense hedgerows along the Bleach Road: potential ecological corridors (Photo: E. Delaney)

Under the Habitats Directive (Article 10), planning and development policies must endeavour to conserve and manage sustainably corridors and stepping stone habitat features essential for the migration, dispersal and genetic exchange of plants and animals. Improving the connectivity and coherence of the network of SACs and SPAs is a particular objective of the Habitats Directive.

Green Infrastructure

The idea of ecological networks has recently been expanded into the concept of *Green Infrastructure*. Rather than focusing solely on biodiversity, Green Infrastructure also takes into account the benefits that green areas can provide for humans. According to the recently published report, *Creating Green Infrastructure for Ireland* (Comhar, 2010):

> *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.*

Plate 1.4 – Wet woodland beside the River Nore: Green Infrastructure providing biodiversity and flood control (Photo: G. Smith)

The concept of Green Infrastructure highlights both the intrinsic importance of natural habitats and also the ecosystem services they provide to humans. Ecosystem services performed by Green Infrastructure can include a wide range of things, such as:

- Providing clean water
- Providing food, both directly and also indirectly, such as by supporting populations of bees to pollinate crops
- Controlling surface water and flooding
- Regulating local climate, such as providing shade or shelter from wind, and global climate through carbon sequestration
- Conserving soil and soil nutrients
- Conserving historic landscapes and built and cultural heritage
- Providing spaces for recreation and sport, improving the physical well-being of people
- Improving the mental and spiritual well-being of people, enhancing quality of life and providing a connection between people and nature

The Green Infrastructure concept is primarily a planning tool (see also Box 1). Identifying the location and characteristics of Green Infrastructure is essential if the ecosystem services they provide are to be managed in a sustainable fashion. Key pieces of Green Infrastructure can be identified and taken into account when preparing plans, such as local development plans, biodiversity plans and tourism strategies. Similar to habitat survey and mapping, Green Infrastructure can be mapped using existing data sources supplemented by field survey where

required. In fact, a habitat map is a critical piece of baseline information required for Green Infrastructure mapping.

Box 1. Kilkenny Plans and Policy on Green Infrastructure and Natural Heritage

Although Green Infrastructure is a new and emerging concept, the thinking behind it is already embedded in the Kilkenny City and Environs Development Plan 2008-2014 and the Kilkenny County Development Plan 2008-2014.

Policies H65-H69 in the Kilkenny City and Environs Development Plan 2008-2014 highlight the importance of nature conservation outside designated sites. Section 7.11.3 of the plan emphasises that "habitats and landscape features have an important role to play as ecological 'corridors' or 'stepping stones', and this role is underlined in the policies below:

- H65 Identify, in co-operation with the relevant statutory authorities and other relevant groups, sites of local nature conservation interest, not otherwise protected by legislation.
- H66 To protect and enhance wildlife habitats and landscape features which form part of habitat networks, such as river corridors and associated habitats.
- H67 To ensure that any development in or near sites of local conservation interest will minimise any significant adverse impact on the features for which the site has been designated.
- H68 Minimise the loss of habitats and features of the wider countryside (hedgerows, ponds, streams, wetlands, trees etc) through the planning process, which are not within designated sites.
- H69 Where the loss of habitats and features of the wider countryside is unavoidable as part of a development, to ensure that appropriate mitigation and/or compensatory measures are put in place, to conserve and enhance biodiversity and landscape character.

These policies are replicated in policies H13-H17 of the Kilkenny County Development Plan 2008-2014.

1.2 Objectives and Outputs

The main objectives of this project are to:

- Survey and map the habitats of Kilkenny City and Environs
- Evaluate the nature conservation value of habitats and identify likely threats
- Identify and map flora of conservation interest, potential habitat features of value to fauna, and invasive exotic species (see Box 2)
- Identify, evaluate and map the Green Infrastructure in the study area
- Assess and map the hedgerows of Kilkenny City and Environs

Plate 1.5 – Common knapweed, a characteristic wildflower of semi-natural grasslands (Photo: G. Smith)

- Raise awareness about the biodiversity of the city
- Recommend future work following on from this project

The outputs of this project include:

- A GIS database of Kilkenny City habitats, including information on habitat type, location, conservation value and threats
- A GIS database of Kilkenny City Green Infrastructure
- A series of maps depicting habitats, Green Infrastructure and invasive species
- Photographs of key habitats and Green Infrastructure
- This project report

Box 2. Invasive exotic species

Exotic or alien species are plants or animals that are not native to Ireland – in other words, species that did not colonise naturally at the end of the last Ice Age, approximately 10,000 years ago, but have been introduced by humans. Most alien species that have become naturalised in Ireland do not have significant negative impacts on our biodiversity. These include species such as ivy-leaved toadflax, a common plant of old stone walls, crack willow, a tree of riversides and wetlands, and bank vole, an introduced rodent in the southwest of Ireland now thought to have been accidentally imported from Germany with machinery for the Shannon Scheme in the 1920s.

Unfortunately, a minority of exotic species become invasive, spreading rampantly throughout native habitats and threatening biodiversity by competition, overgrazing, predation, habitat alteration, disease or dilution of native gene pools through hybridisation. Invasive species can have serious economic impacts through costs of control, decreases in or damage to economically beneficial species, damage to infrastructure, and reductions in water quality.

Further information about invasive exotic species is available from Invasive Species Ireland (http://www.invasivespeciesireland.com/) and the National Biodiversity Data Centre (http://invasives.biodiversityireland.ie/).

Invasive exotic species found in Kilkenny include:

Himalayan balsam (Plate 2.12) is a pretty plant that has escaped from garden cultivation to become established along rivers throughout Ireland. It forms dense stands, outcompeting native species and habitats. It dies back in the winter exposing the bare soil underneath, which poses a risk of erosion and siltation to the adjacent river.

Japanese knotweed (Plate 3.12) is another garden escape that forms dense stands in nearly any open habitat. It shades out native species and can even damage nearby walls and roads with its tough underground rhizomes.

Snowberry is a shrub with pretty white (but poisonous) berries that spreads less quickly than the above two plants. Nevertheless, it can be invasive in hedgerows and woodlands, outcompeting native shrubs.

Bamboo (Plate 2.17) does not disperse as widely as the worst of the invasive plant species, but where it is planted, it can run rampant and be difficult to control. Woodland on the River Nore at Talbotsinch is infested with bamboo.

Grey squirrel has eliminated the native Irish red squirrel from most of eastern Ireland by direct competition for food and by spreading a virus lethal to red squirrels. It damages young trees by stripping bark, often girdling and killing them.

Butterfly bush is considered by many to be a beneficial plant as it is a good source of nectar and pollen for butterflies and other insects, as its name suggests. However, it can become an invasive pest in urban environments. As it can root in masonry, it can damage old stone walls and other built heritage. It may also outcompete weedy urban plants that are food plants for caterpillars, contrary to its butterfly-friendly reputation.

1.3 Methods

The methods we used to meet the project objectives are briefly outlined in this section, with additional details given in Chapter 3 below and Appendix C. The first step was to carry out the habitat survey of Kilkenny City. The recent *Best Practice Guidance for Habitat Survey and Mapping* (Smith *et al.*, 2010) provides advice on how to plan, carry out and use the results of a habitat survey project. According to this guidance, there are five main steps in a good habitat survey that were followed for this project:

1) Planning the survey in line with the survey objectives,

2) Reviewing information that already exists for Kilkenny City,

3) Carrying out habitat survey and mapping in the field,

4) Compiling the results into a database, preparing habitat maps and writing the project report, and

5) Interpreting and using the results of the survey.

The survey was planned in conjunction with the Kilkenny Heritage Officer and a Steering Group made up of members of the Kilkenny Heritage Forum. The area to be covered by the survey was that covered by the Kilkenny City and Environs Development Plan 2008-2014 (Figure 1.1).

We reviewed information from previous studies on the habitats and biodiversity of Kilkenny City. This included previous habitat surveys, such as the survey of the northern River Nore carried out by Muyllaert and Jennings (2009), information in Environmental Impact Statements, and data from other studies, such as a study on the flora of old stone walls (Fuller, 2009) and a proposed management strategy for Newpark Marsh (Malone O'Regan, 2005). All information sources are outlined in Chapter 5. Where available, we incorporated digital habitat data into our habitat mapping GIS.

We consulted with individuals and organisations that could provide information on habitats and biodiversity in Kilkenny City. These included:

- The Project Steering Group
- Kilkenny County Council Parks Department
- National Parks and Wildlife Service
- An Taisce
- Keep Kilkenny Beautiful
- BirdWatch Ireland

A public meeting was held on 14th July, 2010 in City Hall at which we requested any information members of the public could provide on habitats and biodiversity. The meeting also served to raise awareness of the project and Kilkenny's natural heritage.

Prior to field survey, we used information from previous studies to prepare preliminary habitat maps using GIS. We brought these preliminary maps into the field along with Ordnance Survey Ireland (OSi) mapping and aerial photographs. We surveyed habitats in the field on 13th – 16th July, 2010, and on a follow-up visit on 18th August, 2010. We classified habitats according to the Heritage Council classification system (Fossitt, 2000) and marked their extent on the preliminary habitat maps. We collected additional information on conservation value and threats on prepared data sheets (Appendix D). This information included whether the habitat corresponded with a habitat of European conservation importance listed on Annex I of the EU Habitats Directive, if the habitat supported any rare species, threats to the habitat, and the presence of non-native invasive species. We also took photographs of habitats. We evaluated the nature conservation value of habitats according to the scale recommended by the National Roads Authority in their ecological impact assessment guidelines (NRA, 2009). We used this scale as it is the only widely used, published ecological evaluation scale available for Ireland. In this system, habitats (or other ecological features) are rated as being of importance for nature conservation at a number of geographical scales (reproduced in full in Appendix C):

Plate 1.6 – Carrying out habitat surveys in Kilkenny Castle grounds (Photo: G. Smith)

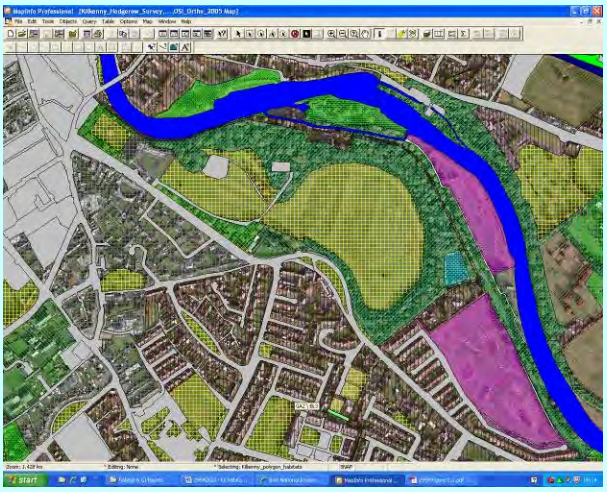
- International importance
- National importance
- County importance
- High local importance
- Low local importance
- Negligible importance

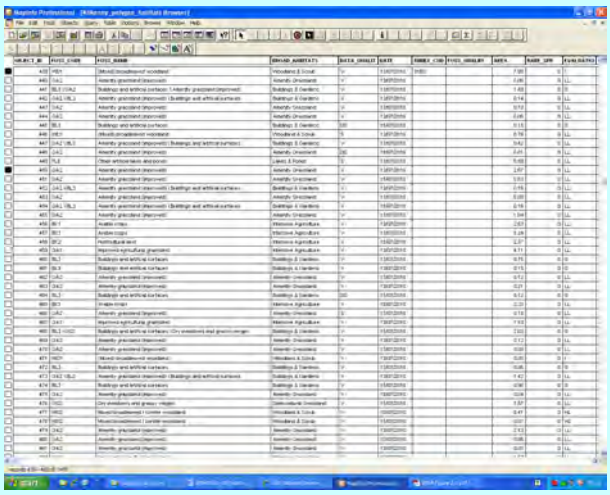
We also collected more detailed information on townland boundary and roadside hedgerows (Appendices C and D). This included data on hedgerow height, width, species composition, management and structure.

We combined our field survey data with existing habitat information into a GIS database (Box 3). We used this database to prepare habitat maps and to identify areas of Green Infrastructure. Further information on this process is provided in Chapter 3.

Box 3. Geographical Information Systems (GIS)

The Kilkenny City and Environs habitat mapping data have been stored in a Geographical Information System (GIS) that was also used to analyse the data and produce the maps in this report. A GIS is a computer-based information system designed to store, process and manipulate geographical data. All habitats in Kilkenny City and Environs have been mapped, and their locations and extent are stored in the GIS as two-dimensional shapes (polygons) or, for habitats like hedgerows or smaller streams, as lines. The real strength of a GIS, however, is that the habitat polygons and lines are also associated with information. This makes it easy to create maps colour coded by habitat type or conservation value, as this information is stored in the GIS data table, as shown in the screen-grabs below. Each row within the table is an individual habitat polygon, and each column corresponds to variables such as habitat type, area, survey date, and conservation value. Data within the table can be quickly analysed to find out important facts about Kilkenny's habitats. For example, the total area that different habitat types occupy within Kilkenny City was determined for this report using the GIS database.





2. Habitats of Kilkenny City

2.1 Habitat Classification

2.1.1 How are Habitats Classified?

Irish habitats are classified according to a scheme published by the Heritage Council, *A Guide to Habitats in Ireland* (Fossitt, 2000). In this scheme, habitats are grouped into a number of broad types that are further divided into a three-level hierarchy. Level 3 of the hierarchy is the most detailed, and each level 3 habitat type is assigned a name and a three-character alphanumeric code. Habitat types are defined and described in *A Guide to Habitats in Ireland* (Fossitt, 2000), which defines habitats based on vegetation structure, plant species composition, and environmental characteristics. The classification of terrestrial and freshwater habitats is outlined in Appendix B.

2.2 Kilkenny's Habitats

2.2.1 Overview

The habitats of Kilkenny City are mapped according to level 3 of the Heritage Council classification scheme in Figure 2.1.

Table 2.1Table 2.1 outlines the area and percentage area of the Kilkenny City study area occupied by a number of broad habitat groups. These do not faithfully follow the upper levels of the Heritage Council habitat classification hierarchy in order to highlight some important results, like the abundance of amenity grasslands relative to semi-natural grasslands and agricultural lands. The Heritage Council habitat types assigned to each broad habitat group are detailed in Appendix B. Table 2.2 outlines the total length of hedgerows and treelines in Kilkenny City.

Plate 2.1 – River Nore Linear Park (Photo: G. Smith)

As would be expected, buildings and gardens were the most abundant group of habitats in Kilkenny City (Table 2.1), covering nearly half of the study area. This group includes the habitat types such as buildings and artificial surfaces (BL3), as well as lawns (GA2), flower beds (BC4), ornamental shrubs (WS3) and other habitat types present in private gardens.

The second-most abundant habitat group in the study area was agricultural land (Table 2.1), which includes improved agricultural grassland (GA1) and tillage (BC1-BC3). Most of the agricultural land is located on the western side of the study area, with smaller, but still substantial areas to the east and south.

Amenity grassland (GA2) occupies 10% of Kilkenny City (Table 2.1). This total does not include the lawns of private houses, but does include public grassy spaces within estates, playing pitches, and larger lawns in such institutions as Kilkenny Castle, schools and hospitals.

The remainder of the habitat groups each occupy less than 5% of the total study area (Table 2.1). Semi-natural grasslands and woodland and scrub are relatively uncommon. Disturbed ground includes areas where construction or other activities have created patches of more or less bare soil (ED2-ED3). Rivers, mainly the River Nore, occupy 1.4% of the study area. Wetlands, including marsh (GM1), swamp (FS1-2) and a small spring (FP1), are rare and tend to occur in the northern part of the study area. Finally, a few small lakes and ponds can be found in the City and environs.

The general characteristics of these habitat groups in Kilkenny City are described in more detail below.

Plate 2.2 – Hedgehog in a Kilkenny suburban garden (Photo: L. Scott)

Table 2.1 – Abundances of habitat groups[1] in Kilkenny City and Environs in hectares (ha) and as a percentage of the total area

Habitat Group	Area (ha)	Percentage
Buildings & Gardens	883.0	46.0
Intensive Agriculture	610.8	31.8
Amenity Grassland	191.0	10.0
Woodland & Scrub	81.7	4.3
Disturbed Ground	64.7	3.4
Semi-natural Grassland	48.9	2.5
Rivers	26.2	1.4
Wetlands	9.8	0.5
Lakes & Ponds	3.1	0.2
Total	**1919.2**	**100.0**

Kilkenny City and environs supports over 104 km of hedgerows and over 13 km of treelines (Table 2.2; Figure 2.2). The density of hedgerows in Kilkenny City and Environs is 5.4 km per km^2. This is comparable to a hedgerow density of 5.8 km / km^2 in Fingal (McCourt and Kelly, 2007), which is a similar landscape of urban, suburban and intensive agricultural land. Other counties support varying densities of hedgerow, depending on landscape and land use. A survey of Co. Laois

[1] See Appendix B for Heritage Council habitat types assigned to each broad habitat group.

hedgerows found a density of 7.3 km / km^2 (Foulkes and Murray, 2005), and an ongoing survey of Co. Meath has estimated a hedgerow density of 9.5 km / km^2 (Smith *et al.*, unpublished data). It is likely the hedgerow density over all of Co. Kilkenny would be more similar to that of Meath, as both are mainly lowland counties with a similar history of early settlement by the Anglo-Normans and a similar landscape of large improved grassland and tillage fields.

Table 2.2 – Linear habitats in Kilkenny City and Environs with total lengths in metres

Habitat	Length (m)
Hedgerows (WL1)	103,661
Treelines (WL2)	13,157
Total	116,818

Hedgerows and treelines have the potential to act as refuges for plant and animal species in otherwise hostile environments, such as intensive grassland or cereal fields. They may also act as corridors, allowing the movement of some animals between larger areas of habitat. These linear habitats are described in more detail below.

2.2.2 Buildings and Gardens

This category includes areas of built land, e.g. private dwellings, public premises, roads, car parks and industrial areas, in addition to gardens, lawns, flower beds and ornamental shrubs. Obviously, these habitats were most abundant toward the central part of Kilkenny City. Indeed, the centre of Kilkenny City was dominated by built surfaces such as roads, pathways, business and retail premises. The more built-up areas, such as large retail units, car parks and roadways, provide little or no biodiversity value to Kilkenny City and we evaluated them as being of little ecological significance.

Plate 2.3 – Old stone walls: flour mill ruins on the grounds of St. Canice's Hospital by the River Nore (Photo: E. Delaney)

The City centre also supported a number of old walls, often consisting of limestone, which are a common feature within the city. A study on the flora of old stone walls within Kilkenny City was completed in 2009 (Fuller, 2009), which found that these are an important wildlife habitat within the City. Fuller (2009) discovered that old stone walls supported a diverse range of plant species, and she recorded a total of 78 species of higher plants from Kilkenny's walls. The most common plant species included ivy leaved toadflax, red valerian and polypody fern. Fuller (2009) concluded that old stone walls represent a significant resource biodiversity and wildlife habitat resource. Wall vegetation provides food and shelter for insects, such as bees, butterflies and moths. Birds, bats and small mammals may also benefit from old stone wall habitats. Fuller (2009) suggests that old stone walls within Kilkenny City may act as habitat

corridors for insects and other small animals, but that further research is needed on the ecological value of stone wall flora in urban areas.

Plate 2.4 – Roosting bats (Photo: L. Scott)

Old buildings in Kilkenny City can be of particular importance to bats, as they provide roosting space in attics and crevices. For example, Roche (2003) found that four bat species – common and soprano pipistrelles, brown long-eared bats and Leisler's bats – roost in the attics of Lyrath House, just outside the Kilkenny City and Environs study area. There are nine species of bats present in Ireland, of which five have been recorded in and around Kilkenny City according to Bat Conservation Ireland records – the four mentioned above, plus Daubenton's bat, which prefers feeding over water.

Research has highlighted the value of old buildings in urban areas as bat roosts. In Kilkenny, this work includes a survey of St. Mary's Church, which found that five species either roost or forage in the church grounds (Aughney, 2005). Bats require buildings with crevices or small holes into which they can crawl, which tend to be more common in older than in newer buildings. In addition, roosting or hibernating bats are sensitive to changes in temperature, and the temperature of old stone buildings often fluctuates less than that of buildings made of more modern materials. Due to declines in bat populations across Europe, all bat species are protected under Irish and EU law. Repointing crevices in old stone walls and bridges with mortar or concrete risks the loss of roosting space for bats, or worse, can entomb any bats that may be hiding within.

Plate 2.5 – Older estate (Talbotsinch Village) with well-established trees and gardens (Photo: G. Smith)

In most cases, especially the suburban areas of the city, buildings and other hard surfaces coincided with gardens or well manicured lawns. The majority of these habitat mosaics also supported ornamental shrubs and immature and mature trees. Older private dwellings were often bordered by mature deciduous trees such as lime, horse chestnut, beech and sycamore. Older housing estates established in the 1960's and 1970's supported large public amenity grassland areas, well-developed flower and shrub gardens, and maturing trees such as field maple, silver birch and cherry. More recently established housing estates supported public amenity grassland of varying sizes, private lawns, less mature and diverse flower and shrub gardens, and sapling trees, such as silver birch, alder, cherry and maple.

Although the majority of plant species found in estates and suburban gardens are planted, non-native species, these areas can still be of local importance for birds, insects and small mammals. The more mature estates and suburban houses are of greater benefit, as the larger trees and

denser shrubs and garden hedges provide greater cover and foraging opportunities for wildlife. Older flower gardens tend to be more diverse, providing a wider range and longer availability of nectar for butterflies, bees, moths and other insects. Talbot's Inch Village is an example of an older neighbourhood of good local value for biodiversity.

The main threat to the ecological interest of buildings and gardens is inappropriate management. Biodiversity can be beautiful, but not always: scruffy, weedy corners of gardens or neglected parts of estates are often of higher ecological interest than well-manicured lawns. Clearing these unsightly areas removes habitats for wild, weedy plants, like bramble and common ragwort, and the invertebrates and birds they support. Fuller (2009) noted that overzealous clearance of vegetation on old walls and inappropriate restoration are significant threats to old stone wall flora. Conversely, diversifying the structure and composition of gardens, such as replacing lawns with flower beds or flowering shrubs, can enhance local biodiversity. Other threats to the natural heritage of built land and gardens include dumping of household waste and the spread of non-native invasive plants such as Japanese knotweed and butterfly bush.

Plate 2.6 – Diverse weedy flora in derelict site (Photo: G. Smith)

2.2.3 Intensive Agriculture

Plate 2.7 – Cereal field in city environs (Photo: G. Smith)

The outskirts of the study area is dominated by intensive agriculture. This includes improved grassland pastures supporting dairying and beef cattle in addition to large arable fields supporting cereals such as barley, wheat, maize and oats and vegetable crops such as potatoes. The majority of these habitats are of little ecological value, particularly the improved grassland pastures that are dominated by swards of perennial rye grass. The cereal fields provide suitable feeding for birdlife, particularly when the crop is near maturity. Most of these habitats are bordered by hedgerows of varying condition that oftentimes provide the only areas of semi-natural habitat within an otherwise intensively managed landscape. (Hedgerows are discussed in further detail in Section 2.2.8 below.) Although of little value for biodiversity, intensive agriculture can provide useful ecosystem services, primarily food production, but also water regulation and carbon sequestration.

The most recent threats to these habitats include the expansion of the city in the form of housing estates, industrial estates, and roads, including the proposed construction of the ring road network to the east and north of the city.

2.2.4 Rivers, Wetlands and Ponds

Kilkenny City was founded on the River Nore, a large lowland river. Along its course, the River Nore supports several habitats and species protected under the EU Habitats Directive, including alluvial woodland, floating river vegetation, otter, crayfish, and three species of lamprey. As a result, the majority of the river system and some adjoining semi-natural habitats have been designated as being of international ecological importance as the River Barrow and River Nore SAC. The River Nore acts both as a major ecological corridor connecting habitats within the study area to habitats north and south of the City and as an important habitat in its own right. The Nore supports Atlantic salmon and brown trout, in addition to other kinds of fish and a range of aquatic invertebrates. The most notable of these is the Nore freshwater pearl mussel, which is found in the River Nore upstream of Kilkenny in Co. Laois and was formerly known from Co. Kilkenny[2]. The Nore freshwater pearl mussel is the only known subspecies of pearl mussel worldwide to occur in base-rich waters. It is critically endangered in Ireland as it has not successfully reproduced in over 20 years, and it is protected under the EU Habitats Directive. It is highly sensitive to water quality, and a former population in the River Barrow has become extinct due to water pollution.

Plate 2.8 – Weir on the River Nore at the Island (Photo: G. Smith)

Within Kilkenny City and Environs, much of the River Nore is fringed along its course by semi-natural woodland and pockets of non-native woodland. Where woodland does not border the watercourse, habitats such as wet grassland frequently occur, and also to a lesser extent isolated areas of marsh and tall-herb swamp. The Breagagh River is another significant watercourse within the study area which flows in from the north-west, taking on an east-west course before joining with the River Nore near the City centre. The Pococke River forms part of the eastern boundary of the study area and supports areas of linear woodland and wet woodland, particularly nearer its confluence with the River Nore.

Plate 2.9 – Riverside trees along the Breagagh River (Photo: E. Delaney)

[2] Current locations of freshwater pearl mussel populations in the River Nore were taken from Water Framework Directive draft sub-basin management plans. There is a record of freshwater pearl mussel in the Nore north of Kilkenny City from 1926, according to the All Ireland Non-Marine Molluscan Database held by the National Biodiversity Data Centre.

Wetlands are not common in Kilkenny City, and include an area of marsh designated as part of the Dunmore Complex pNHA on the northern boundary of the study area. This is quite a diverse marsh area of notable importance for wildlife in the locality. This habitat is dominated by an assemblage of tall herb, grass and sedge species. These include tall fescue, meadowsweet, lesser pond sedge, common valerian, yellow iris, common marsh bedstraw, water horsetail and great willowherb.

Reed and large sedge swamp, wetland habitats characterised by shallow standing water and tall, dense emergent plants, occur in small pockets in the environs of Kilkenny City. Typical plant species include common reed, bulrush and branched bur-reed. Reed and large sedge swamps were frequently found in association with lakes, ponds or slow-flowing rivers. One example is Newpark Marsh pNHA, located just north of the city centre. It supports open water fringed by areas dominated by tufted sedge, water dock, branched bur-reed, bulrush, and common club-rush with willows beginning to encroach on the central section of the wetland. Another example is found at Lough Macask pNHA. These important sites are discussed in more detail in Chapter 3.

Plate 2.10 – Reedswamp at Newpark Marsh pNHA (Photo: E. Delaney)

Artificial lakes and ponds also occur within the study area. These are generally small water bodies, some of which occur within housing estates created to serve as water features or attenuation measures. Some of these areas support fringing aquatic plant growth such as common reed and bulrush with occasional grey willow, white willow and alder. Building new ponds with an eye to habitat creation for wildlife can be beneficial, particularly in localities where wetlands are rare. Wildlife ponds have the potential to act as stepping stones, aiding the movement of wetland birds, plants and invertebrates between larger wetland areas. Guidance for building wildlife ponds is widely available on the internet, such as on the Ulster Wildlife Trust website[3]. Natural wetlands are almost always better for biodiversity, however, and thus replacing one lost to development with a created pond is usually not equal compensation.

[3] www.ulsterwildlifetrust.org

Plate 2.11 – Green-veined white along the River Nore – food plants are watercresses and members of the cabbage family (Photo: D. Ledwidge)

The rivers and wetlands within Kilkenny city are of high quality for nature conservation, and many are designated as being nationally or internationally important. As much of County Kilkenny is dominated by habitats of dry ground, freshwater and wetland habitats serve to increase the range of wildlife that can live in a given area. For example, they provide very important refuges for common waterbirds such as Grey Heron, Moorhen, Mallard and Mute Swan. Freshwater habitats and wetlands are important for insects that spend at least part of their lives in water, such as dragonflies, damselflies and mayflies. Plants that favour wetlands or damp ground provide food for a wider range of terrestrial insects, including butterflies and shield bugs.

The rivers and their adjoining habitats also provide very good examples of green infrastructure or ecological corridors within Kilkenny City and contribute significantly with the movement of plants and mammals through the city. Their role as Green Infrastructure is discussed in further detail in Chapter 3.

Threats to the rivers include the spread of invasive exotics, particularly Himalayan balsam and Japanese knotweed. Other threats include littering or dumping and water quality (see Chapter 3). Threats to wetlands include drying out or siltation. Recently, there were concerns that Newpark Marsh was drying out, as the water table was seen to be lower than it was historically (Malone O'Regan, 2005; D. Ledwidge, pers. comm.). However, consistently wet periods, in particular the summers, over the last three years have maintained water levels within Newpark Marsh and dissipated fears for this site's ecological integrity, at least temporarily.

Plate 2.12 – Himalayan balsam along the River Nore (Photo: D. Ledwidge)

2.2.5 Semi-natural Grassland

A large proportion of the semi-natural grassland in Kilkenny City and Environs is wet grassland. Many of these areas are located in the floodplains of the River Nore. Other smaller patches of wet grassland are scattered throughout the study area and are generally associated with localised depressions or on the margins of wetlands, such as Lough Macask. A typical Kilkenny wet grassland supports an assemblage of tall grass, sedge, rush and herb species, such as tall fescue, reed canary grass, lesser pond sedge, hard rush, meadowsweet, great willowherb and purple loosestrife.

Plate 2.13 – Wet grassland with meadowsweet adjacent to the River Nore at Talbotsinch (Photo: G. Smith)

Kilkenny city and environs also supports areas of dry grassy meadows, a semi-natural grassland type characterised by coarse, tufted grass species, such as cocksfoot, false oat grass and couch grass, and large broadleaved herbs, like hogweed, meadow vetchling and common knapweed. Coarse grasses can support a range of butterfly species, such as speckled wood, meadow brown and ringlet. These habitats are most commonly found as linear strips of vegetation bordering roadsides and the railroad but also occur where areas of improved grassland have been left unmanaged for many years. Grassy verges along the railway or around the Kilkenny ring road have the potential, if managed correctly, to act as wildlife habitat and corridors for smaller animals. Irish hare and deer (species not known) have been spotted along the ring road (P. Durkin, L. Scott, pers. comm.). Barn Owl was reported at the public consultation meeting to forage along the grassy verges adjacent to the railway.

Older graveyards that have not been intensively managed have the potential to support dry meadow habitats diverse in plants and insects, as well as small pockets of scrub and old stone wall communities (Goodwillie, 1995). St. Mary's Graveyard was formerly noted to have supported a locally high level of biodiversity (Goodwillie, 1995). A later resurvey found that vegetation clearance and other work to "improve" the graveyard has resulted in the loss of most of the site's wildlife value (MacGowan, 2005). However, MacGowan (2005) also notes that "with balanced maintenance the site, however, does have potential to be of great wildlife interest and value". St. Maul's Graveyard still supports a dry grassy verge flora and is discussed in Chapter 3 below.

The study area also supports isolated patches of species-rich calcareous grassland. These are usually found as patches of unimproved ground near the River Nore, typically on steeply sloping ground on thin soils. These grasslands are typically species rich, with a good assemblage of grass and herb species. Orchid-rich grassland patches occur along the ring road at the Bennetsbridge roundabout. An isolated pocket bordering the Bleach Road supports yarrow, hawkweeds, knapweed, hogweed, sheep's fescue, yellow rattle and restharrow. On the margins of the River Nore near the northern boundary of the study area grows nettle-leaved bellflower, a rare plant species listed on the Irish Red Data Book for vascular plant species (Curtis and McGough, 1988). Nettle-leaved bellflower is also known from the banks of the River Nore at Archersgrove, just south of the study area boundary. Also at Archersgrove, but just within the ring road, the Black Quarry supports a diverse area of calcareous grassland and some scrub. It is thought to be the first location where Kilkenny Black Marble was quarried, and is therefore recognised as a geological and historical site of county importance (Clarke *et al.*, 2007) listed in the Kilkenny County Development Plan 2008-2014. Plant species found there include common knapweed, sheep's fescue, marjoram and bush vetch. The margins of the old quarry are beginning to become encroached with blackthorn, hawthorn and bramble.

Plate 2.14 – Nettle-leaved bellflower (Photo: E. Delaney)

Most of the semi-natural grasslands within Kilkenny City are of significant nature conservation value. These are rare habitat types in a landscape dominated by large tracts of improved grassland and arable fields. Calcareous grasslands in particular support a diverse range of flowering plants, some of which are locally or nationally rare, which in turn provide habitat for a wide range of invertebrates and larger animal species.

Threats to semi-natural grassland include agricultural improvement through fertilising, infilling, draining, and reseeding. Other potential threats include over-grazing or excessive mowing, or conversely abandonment, which allows scrub encroachment. Similarly, grazing or mowing at inappropriate times of the year can reduce plant diversity if they are not allowed to flower and go to seed. In more urban situations, improvement or tidying through herbicide use, fertilisation, reseeding or mowing excessively or at the wrong times of year can result in the loss of biodiversity value of grassy verges.

2.2.6 Amenity Grassland

Like improved agricultural grassland, areas of improved amenity grassland are of little ecological value. This category includes the larger public and private lawns found in housing estates and institutional grounds. (Strictly speaking, smaller lawns are also included in this category, but we have included most small lawns in the buildings and gardens category, as there are practical difficulties in mapping them separately.) They are dominated by a small number of grasses, mainly perennial ryegrass, and support only a limited range of broadleaved weed species, such as dandelions, white clover and daisies. Amenity grasslands are maintained by regular mowing with frequent use of fertilisers and herbicides.

Plate 2.15 – Amenity grassland playing pitch at Dicksboro GAA club (Photo: E. Delaney)

Some amenity grasslands may be regularly reseeded, and conversion to improved amenity grassland is a threat to more diverse semi-natural habitats, especially dry grassy verges.

2.2.7 Woodlands and Scrub

Woodlands and scrub are located throughout Kilkenny City and its Environs. In many areas they occur as small isolated pockets associated with private dwellings and public institutions. Other larger areas are more typically found along watercourses, such as the large areas of woodland fringing the River Nore and those areas fringing the Breagagh and Pococke Rivers.

The most abundant woodland types within the study area were mixed broadleaved woodland and mixed broadleaved / conifer woodland, with a large proportion of non-native tree species comprising the canopy. The most common broadleaved trees in Kilkenny woodlands included beech, sycamore, lime and ash, and some of the most common conifers were Scots pine, Sitka spruce, Lawson's cypress and Monterey cypress. The largest of these mixed non-native woodlands is located within the grounds of Kilkenny Castle, adjacent to River Nore.

Plate 2.16 – Wet woodland beside River Nore (Photo: E. Delaney)

Scattered trees and parkland is a habitat type characterised by mature deciduous trees in and around areas of amenity grassland, where they do not form a closed woodland canopy. Parkland in Kilkenny generally occurs in larger private residences, older housing estates and public institutions, such as schools and hospitals, which supported large gardens with mature trees. Non-native tree species, such as lime, horse chestnut, sycamore and beech, are characteristic of parklands.

The most common types of semi-natural woodland, those dominated by native species, are wet woodland and riparian (riverside) woodland. The main tree species in these woodlands in Kilkenny are grey willow, white willow, crack willow, alder, ash and osier. These woodlands are most common along the margins of the River Nore and also border a section of the Pococke River near the southern boundary of the study area.

Scrub can be found in isolated parcels throughout the Kilkenny study area. Due to the intensive nature of the farming practices and the dominance of urban and suburban habitats, scrub in Kilkenny is notably reduced in area relative to many other parts of Ireland. Most scrub occurs as patches of gorse or bramble on steep slopes within improved grassland fields or as fragmented patches around historical features, such as ringforts or mounds. Other species occurring in scrubland areas include hawthorn, blackthorn and elder, with occasional sapling trees such as ash, grey willow and sycamore.

Overall, woodland and scrub are of considerable ecological importance within Kilkenny City and Environs. Even those dominated by non-native species provide valuable cover and shelter for mammals and birds and provide habitat for the more common woodland plant and fungi species. These habitats, particularly those that fringe the River Nore and Breagagh Rivers, further enhance the ability of these watercourses to act as ecological corridors. This will be discussed in greater detail in Chapter 3.

Threats to the areas of woodland include invasive species, which can impact on a woodland's ability to regenerate. Bamboo dominates large areas of the understorey of woodland at the Island on the River Nore on the northern edge of Kilkenny environs. A North American grey squirrel was also seen there during the habitat survey. This species has out-competed the native Irish red squirrel in many areas of Ireland east of the Shannon, and damages young trees by bark stripping (Carey *et al.*, 2007). Grey squirrel is also abundant in woodlands at Kilkenny Castle (D. Ledwidge, pers. comm.). Himalyan balsalm is another invasive exotic species abundant in the woodland along the river Nore, south of Kilkenny Castle

Plate 2.17 – Bamboo invading broadleaved woodland (Photo: G. Smith)

Other threats to woodland and scrub include dumping of household waste, as evidenced on woodlands fringing the Bleach Road and the wet woodland bordering the Pococke River toward the southern of the study area.

2.2.8 Disturbed Ground

The disturbed ground habitat group includes areas that have been disturbed in the recent past by human activity, such as construction or quarrying. Large areas of bare soil are typical of recently disturbed ground. Older patches support a diverse community of weeds and other "fugitive" plant species that need disturbed ground for their seeds to germinate. Typical plants of disturbed ground include thistles, docks, annual meadow grass, common ragwort, charlock, poppies and scarlet pimpernel. The diversity of flowering plants means that recolonising disturbed ground habitats can be important habitats for insects, such as butterflies and bees. Patches of bare soil are important as basking areas for invertebrates and for burrowing insects, such as solitary bees. Earth banks along disused quarries and elsewhere can also be used for nesting by Sand Martins, which have established a colony in an old sand pit at Glendine, just outside the study area boundary.

Plate 2.18 – Corn poppy, a common disturbed ground species (Photo: L. Scott)

If left alone, patches of disturbed ground will develop into semi-natural grassland and scrub. Abandoned quarries can often develop into species-rich calcareous grassland, as has happened with the Black Quarry. The old sand pit at Glendine supports at least five species of orchid, including bee orchid (L. Scott, pers. comm.). However, disturbed ground associated with construction is often converted into ecologically dull amenity grassland when construction activities are finished.

2.2.9 Hedgerows and Treelines

Hedgerows are most common in the outer sections of the study area bordering habitats utilised for intensive agricultural purposes. The structure of these hedgerows varies considerably, and is strongly influenced by past or ongoing management practices, such as cutting, replanting and fencing. Shrub species composition tends to vary, but the more common include hawthorn, elder and blackthorn. Frequently occurring tree species include elm, ash and sycamore. In many instances, hedgerows have been left unmanaged over the long term, and the maturation of the trees and shrubs results in a transition from a tightly planted hedgerow to a gappy hedgerow and treeline structure. Other hedgerows of better structural condition support a continuous line of tightly planted and stock proof shrub species, mainly hawthorn.

In many instances, hedgerows provide valuable conduits and corridors for small mammals and other animals throughout sections of the site, such as those nearby the Breagagh River and west of the Breagagh River tributary. Many bat species in particular use hedgerows and treelines as commuting routes to guide them to and from roosts and feeding areas.

Hedgerows are also of significant habitat value themselves, particularly in places where woodland is uncommon. Well-developed hedgerows can support a range of plant species typical of open woodland and woodland edges, including herb robert, primrose and false wood brome. Dense hedgerows provide important nesting space for birds, and hedgerow fruits, including elder, bramble and hawthorn, are an important food resource. Some degree of grazing at the base of the hedgerow may be beneficial by keeping competitive species, such as bramble, in check and creating patches of disturbed soil for solitary bee nesting. Hedgerows and hedge banks provide space for burrows for mice and rabbits, and entrances to badger setts are frequently hidden in hedgerows.

Threats to hedgerows include removal, lack of long term management and fragmentation by construction and infrastructure development.

Treelines – a single or narrow row of trees lining roads or acting as shelter belts – are found throughout the study area both in the rural outskirts and within the built up areas nearer the city centre. Within the city centre these treelines are generally made up of large mature deciduous trees, such as lime, beech, copper beech, horse chestnut and sycamore. Treelines fringing farmhouses and other private dwellings within the rural areas were usually made up of ash or occasionally hybrid black poplars.

Plate 2.19 – Regularly managed hedgerow, but with poor species and structural diversity, adjacent to a cereal field (Photo: G. Smith)

We surveyed a total of 41 townland boundary and roadside hedgerows in more detail. We present the results in the tables below in terms of the percentage of hedgerows surveyed that fell into each structural class.

Most Kilkenny hedgerows average more than 2.5 m height (Table 2.3), and all but a few are between 1-3 m wide (Table 2.4). Tall and wide hedgerows are generally better for biodiversity, as they provide more shelter for wildlife. The size of the surveyed hedgerows is largely determined by management – as half of the hedgerows have not been trimmed or otherwise managed for a long time (Table 2.8), they have been left to grow tall and wild.

Table 2.3 – Hedgerow height

	< 1.5 m	1.5 – 2.5 m	2.5 – 4 m	> 4 m
Percentage of hedgerows	4.9	24.4	39.0	31.7

Table 2.4 – Hedgerow width

	< 1 m	1 – 2 m	2 – 3 m	> 3 m
Percentage of hedgerows	0	46.3	46.3	7.3

Although sizeable, vigorously growing hedgerows are good as wildlife corridors, lack of management can lead to gaps developing. Gaps develop as hedgerow shrubs become tall and leggy in the absence of pruning, and also as a result of shading from dense foliage above. Nearly half (48.8%) of hedgerows had gaps totalling more than 10% of their length, and three hedgerows (9.8%) were completely derelict (Table 2.5). Hedgerows with significant gaps do not function well as ecological corridors and also tend not to support as diverse a hedgerow and woodland flora. On the other hand, over a quarter of the surveyed hedgerows were in very good shape (Table 2.5), and had a diverse vegetation structure, including a dense base and emergent trees (Table 2.6).

Table 2.5 – Hedgerow gappiness

	None	<5%	5-10%	10-25%	25-50%	> 50%
Percentage of hedgerows	28.6	19.5	22.0	24.4	14.6	9.8

Table 2.6 – Hedgerow vegetation structure

	Shrubs Only	Shrubs & Field Layer	Shrubs, Trees & Field Layer – Open Base	Shrubs, Trees & Field Layer – Dense Base
Percentage of hedgerows	26.8	22.0	22.0	29.3

Few Kilkenny hedgerows were bounded by ditches, and only six (14.2%) were bounded by ditches filled with water (Table 2.7). As a general rule, water-filled ditches increase the ecological value of hedgerows, as they increase the number of plant and animal species that a hedgerow can support. However, given the relatively dry, well-drained soil of farmland in the Kilkenny City environs, the low frequency of water-filled ditches is to be expected.

Table 2.7 – Hedgerow physical structure

	None	Bank	Bank & Ditch	Bank, Ditch & Still Water	Bank, Ditch & Flowing Water
Percentage of hedgerows	24.4	48.8	12.2	7.3	7.3

The ideal hedgerow profile for biodiversity and maintenance of long-term structure is an A-shape, as this combines a dense base with a top that does not shade the bottom excessively. Only one hedgerow surveyed was pruned to this shape (Table 2.8). The large proportion of unmanaged hedgerows suggests that the condition of Kilkenny hedgerows will deteriorate over time, leading to a larger number of leggy, gappy hedgerows that have lost most of their functionality as stock-proof barriers and as ecological corridors.

Table 2.8 – Hedgerow management

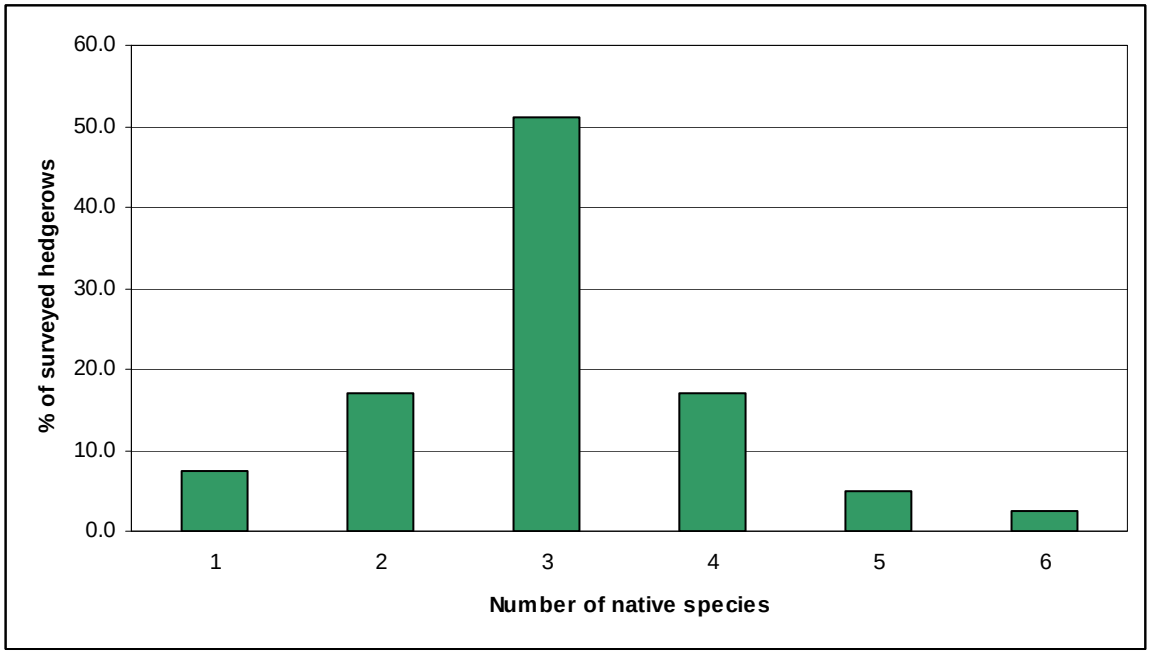
	Unmanaged < 5 yr	Long-term Unmanaged	Box Profile	Cut One Side	Cut Both Sides	A-Shape Profile
Percentage of hedgerows	19.5	48.8	12.2	14.6	2.4	2.4

Over half the surveyed hedgerows were composed of three native species of shrubs and trees (Figure 2.3). Foulkes and Murray (2005), who have carried out a number of county hedgerow surveys, consider that a hedgerow containing an average of four native species per 30 m length can be considered a species-rich hedge. In all cases, we surveyed more than a 30 m length of each hedgerow, but it's not possible to determine the increase in the number of species our survey approach produced. Ten surveyed hedgerows supported four or more species; of these, two had five species and only one had six.

The most commonly occurring native shrub species were hawthorn, blackthorn and elder. Most hedgerows also supported ash trees of varying sizes. Other less commonly occurring native tree species in hedgerows in the city environs included wild cherry, goat willow, pedunculate oak and

grey willow. A few hedgerows also contained the native hazel and wild privet. English elm is a non-native tree species commonly found in shrub form in hedgerows. The non-native sycamore was also occasionally found. Other non-native trees recorded in hedges included beech, field maple, whitebeam (an ornamental cultivar), hybrid black poplar, crack willow and white willow. The invasive snowberry shrub was found in one hedgerow. Bramble and ivy grow in most hedgerows, and dog rose was also frequently recorded. Typical broadleaved herbs and climbers in Kilkenny City and Environs hedgerows include bush vetch, tufted vetch, cleavers, hedge bindweed, nettles and hogweed. The trees and shrubs found in Kilkenny City environs hedges are similar to that found in other eastern counties, such as Kildare (Foulkes, 2006) and Fingal (McCourt and Kelly, 2007). Gorse hedgerows are frequent in western and upland areas of Ireland, but their absence from this part of Kilkenny is not surprising.

Figure 2.3 – Number of native species in surveyed hedgerows



The method of hedgerow surveying we used (Appendix C) allows for scores to be assigned to hedgerows based on structural, ecological and historical characteristics (Table C.3).

Table 2.9 – Summary of hedgerow conservation value

Score Range	Conservation Value[4]	Number of Hedgerows
5-10	Low	0
11-15	Moderate	4
16-19	Moderate	11
20-24	High	23
25-30	High	3

[4] This conservation value rating applies strictly to hedgerows and does not correspond to the NRA (2009) ecological evaluation scale.

The large number of high value hedgerows is not surprising, as townland boundary and roadside hedgerows were selectively chosen for sampling. Townland boundary hedgerows and those shown as present on 1840s Ordnance Survey maps are assigned a higher score. These hedgerows are likely to be older than ordinary hedgerows and are also more likely to support a higher number of native trees and shrubs because of the greater time available for natural colonisation. It is likely that the average hedgerow in Kilkenny City and Environs would receive a lower conservation value score. However, the management and therefore structure of these hedgerows is likely to be similar to those surveyed.

Plate 2.20 – Overgrown hedgerow bordering improved pasture (Photo: E. Delaney)

In summary, townland boundary and roadside hedgerows in the study area are of moderate to high conservation value in the local context. However, many are not being actively managed and are at risk of becoming derelict through neglect in the short to medium term. Management in the form of pruning, replacing dead trees and shrubs, and regenerating hedgerows through laying is necessary to prevent hedgerows becoming gappy and losing their ecological function as wildlife habitats and corridors. Hedgerows that actively function as livestock barriers are more likely to be actively managed by landowners.

3. Green Infrastructure

3.1 Defining Green Infrastructure in Kilkenny

Central to the concept of Green Infrastructure is multi-functionality: provision of a number of ecosystem services. Not all pieces of Green Infrastructure perform the same functions, however, and not all are of equal value. The grassy strip between a footpath and the road surface provides some water regulation services by providing a green space for excess water to soak into, and it also provides a very limited habitat for plants and insects. On the other hand, a riparian wetland would have a much greater capacity to absorb water and would support a much greater range of biodiversity. In order to be useful, any project identifying Green Infrastructure must recognise these differences in value and distinguish what are the most important components. This was our main challenge in preparing this report.

We initially looked at habitats that we evaluated as being of Low Local importance for nature conservation or greater. However, this resulted in too many areas being identified as potential Green Infrastructure to be useful. We then looked at habitats of High Local importance or greater, but this resulted in too few areas identified and also overlooked the other ecosystem services provided by Green Infrastructure. We settled on a phased approach using High Local importance habitats as a starting point and adding other habitats and habitat complexes that provided important ecosystem services or acted as ecological corridors or stepping stones. These areas we identified as key Green Infrastructure, and these are named and discussed in more detail in Section 3.2 and are mapped in Figure 3.1.

Plate 3.1 – Ducks in amenity grassland in Richview adjacent to Dunmore Complex pNHA wetlands (Photo: E. Delaney)

The criteria we used for identifying key Green Infrastructure were:

- Habitats of High Local conservation value or greater
- Adjacent habitats of lower conservation value that together form a coherent habitat complex[5] or that buffer the higher importance areas
- Habitats of Low Local conservation value that perform another significant ecosystem service, such as amenity, water regulation or carbon sequestration
- Habitat corridors or stepping stones of Low Local conservation value in an area surrounded by and dominated by habitats of negligible ecological value

[5] A coherent habitat complex for the purpose of this study is a group of habitats united by one or more common ecosystem or management features. Examples include: woodland, scrub and hedgerow forming a wooded habitat complex; wet woodland, marsh and wet grassland forming a wetland complex; or scrub, semi-natural grassland and abandoned agricultural grassland forming a complex of habitats with dense vegetation managed under low intensity.

In addition to the key Green Infrastructure areas, we also mapped two other types of Green Infrastructure that are of less ecological importance: agricultural land (Figure 3.2) and amenity grasslands (Figure 3.3). Agricultural land is mapped for its food production value. Amenity grassland can be of significant recreational and passive amenity value and, in urban situations where hard surfaces are abundant, can assist with surface water drainage; it may also be appropriate to manage some amenity grasslands or parts of them to improve their benefits for biodiversity.

The Kilkenny City Centre Local Area Plan urban design policy PUD 23 is to "promote 'pocket parks' as rest and reorientation points along [pedestrian] routes, with small play areas where appropriate". Also, PUD 25 promotes "greening the city and promoting improved air quality through reinforcement of natural heritage opportunities." Pocket parks can be another form of Green Infrastructure, assuming that these incorporate some green space, such as amenity grassland, flower beds, trees or shrubs. They can be particularly valuable in highly urbanised areas. As with amenity grassland in general, there is the potential for improving the value of pocket parks for biodiversity with sensitive management and care in choosing appropriate species for planting.

3.2 Kilkenny's Green Infrastructure

3.2.1 River Nore

The most important piece of Green Infrastructure is the River Nore and adjacent habitats. The Pococke and Breagagh Rivers, tributaries of the Nore, are also important pieces of Green Infrastructure and are described separately below. Much of the River Nore Green Infrastructure area has already been designated as being of international nature conservation importance as an SAC. In addition, the River Nore Linear Park is a major amenity for the City and is recognised as such in the Kilkenny City Centre Local Area Plan. The river bisects the City along a north-south axis. Water quality in the River Nore varies along its length, according to EPA monitoring data. Upstream of Green's Bridge, the EPA water quality rating based on the diversity and ecology of aquatic insects and other invertebrates is Q4[6] in 2010, which indicates good water quality. Further downstream at Ossory Bridge downstream of the city, 2010 EPA water quality data also yield a rating of Q4.

Plate 3.2 – River Nore adjacent to Kilkenny Castle grounds (Photo: G. Smith)

Beginning from the north, the river is fringed by areas of woodland, mostly areas of scattered and riparian woodland. Other habitats within the northernmost section include a considerable area of marsh, which is part of the Dunmore Complex pNHA, strips of wet grassland and calcareous species-rich grassland. The marsh is dominated by tall fescue, large sedges, and tall wetland herbs, including yellow loosestrife, yellow iris and valerian. A rare liverwort, *Riccia fluitans*, is also

[6] The EPA Q-rating system is based on assessing the diversity of aquatic invertebrate groups and their sensitivity to pollution. Ratings range from Q1, which indicates highly polluted water, to Q5, which indicates pristine water quality.

present here (R. Goodwillie, pers. comm.). Large areas of the river's floodplain that now support improved grassland pastures are also included in the Green Infrastructure, as these buffer the river and contribute to flood control. Immediately north of the city centre, there is a large, diverse area of natural wet grassland in which the rare water dock can be found (R. Goodwillie, pers. comm.) and some species-rich calcareous grassland that has been established recently by the Parks Department to diversify the Nore Linear Park.

This area of Green Infrastructure narrows considerably within the city centre and is largely confined to the River Nore, together with the fringing areas of trees. At Kilkenny Castle, the area broadens again to include areas of mixed broadleaved woodland, scattered trees, amenity grassland, wet grassland, improved grassland and smaller sections of semi-natural habitat, such as tall-herb swamps and artificial lakes and ponds. Kilkenny Castle is itself a significant amenity area and tourist attraction within the City. On the opposite side of the river from the Castle is a sizeable area of amenity grassland and riverside trees behind County Hall. The County Hall lands are one of the locations specifically mentioned in the Kilkenny City Centre Local Area Plan for reinforcing natural heritage.

Plate 3.3 – Nore Linear Park information sign (Photo: G. Smith)

Black Quarry, a disused and re-vegetating quarry comprises part of the southern boundary of this area. This area supports calcareous grassland and, where fenced off from grazing horses, rank grassy meadows and scrub. A number of orchid species can be found in the grasslands there (L. Scott, R. Goodwillie, pers. comm.). Muyllaert and Jennings (2009) found that it supports a good range of typical plant species in addition to orchids, such as lady's bedstraw, field scabious, marjoram and common fleabane. Immediately west of Black Quarry is an area of green open space dominated by improved grassland, but with patches of semi-natural calcareous grassland on sloping ground.

This site provides considerable ecosystem services within an area that supports high levels of human activity. Not only is it a wildlife habitat and amenity area in its own right, it also functions as a corridor, linking rural areas north and south of the City. In particular it allows mammals such as otter and Daubenton's bat and birds such as Kingfisher, Grey Heron, Grey Wagtail, Dipper, Mallard and Mute Swan navigate easily through the City centre. Other bird species such as Meadow Pipits and Stonechats are also known to occur within Nore Linear Park (P. Durkin, pers comm.).

Plate 3.4 – Kingfisher (Photo: L. Scott)

Potential threats to the River Nore Green Infrastructure area include potential developments, particularly on the improved grassland pastures on the river floodplains toward the north. (However, most of this land is currently zoned as Recreation, Amenity and Open Space in the Kilkenny City and Environs Development Plan 2008-2014.) Other threats include water quality

impacts associated with the more built-up areas of the city. The spread of invasive species such as Himalayan balsam and bamboo along the river corridor and the woodlands bordering the River Nore are also a threat to this area.

3.2.2 Lough Macask

Lough Macask is an isolated patch of Green Infrastructure within an intensive agricultural matrix. The main wetland on the west side of a small road is proposed for designation as an NHA (Lough Macask pNHA). The area identified as Green Infrastructure is slightly larger than this, as it also includes a small pocket of wet grassland on the east side of the road. Lough Macask itself is a wetland in two basins connected by a channel that was occupied by wet grassland at the time of surveying. The northern of the two basins is dominated by branched bur-reed emerging from open water, and the southern basin is dominated by pondweeds. The wetlands are surrounded by improved grassland grazed by cattle, and there is a small transition zone in between where the wetlands grade into marsh and then wet grassland. Frequently occurring wetland plants in the area include lesser and greater spearwort, water mint, water forget-me-not, fool's watercress, creeping buttercup, water plantain, common spike-rush and curled dock. Greater duckweed has also been reported from the site (Goodwillie, 1995; Tom Phillips & Associates, 2010), which is rare elsewhere in the county. We saw Mallard and Moorhen using the wetlands during the habitat survey, and information gathered at the public consultation meeting confirmed that Water Rail has been recorded in Lough Macask. The ecological survey for the Lough Macask Local Area Plan 2008-2014 reports that the lough regularly supports dragonflies in the summer and small numbers of wintering waterfowl (Biosphere Environmental Services, 2005). It is likely that the pond is suitable for spawning frogs and perhaps smooth newt.

Plate 3.5 – Lough Macask – northern basin (Photo: G. Smith)

The habitat classification of the Lough Macask wetlands is confused by the fact that water levels fluctuate over the course of a year, similar to turloughs (Goodwillie, 1995). Turloughs are lakes that empty and fill relatively quickly over the course of a year that are found in limestone country mainly in the west of Ireland. They support unique assemblages of plants and invertebrates, and are thus of very high ecological value. A habitat survey carried out as part of a recent Environmental Impact Statement for a nearby mixed-use development classified Lough Macask as turlough (Tom Phillips & Associates, 2010). We considered that it was not sufficiently similar to a "classic" turlough in that it does not drain and fill relatively quickly through underground channels joining the basin at a single point. Thus, we have classified the northern basin as reed and large sedge swamp (FS1) and the southern basin as a eutrophic pond (FL5).

Plate 3.6 – Lough Macask - southern basin (Photo: G. Smith)

The value of Lough Macask as Green Infrastructure is

recognised by the Lough Macask Local Area Plan 2008-2014, which includes policies for the conservation of the pNHA, provision of ecological linkages within the area, and proposes to develop the site as an environmental park. The proposed Kilkenny Central Access Scheme is likely to impact the Green Infrastructure area, as the proposed road will run through the wet grassland pocket to the east of the existing road. This would result in the loss of this habitat, and the proximity of the road to Lough Macask pNHA may impact on water quality and hydrology. However, the EIS prepared for the road scheme concludes that impacts are unlikely, provided suitable mitigation is implemented (MORSW, 2008).

3.2.3 St. Kieran's College and Environs

St. Kieran's College and surrounding neighbourhoods are not of high biodiversity value in and of themselves. Apart from buildings, the main habitats are amenity grassland lawns and mature lines of beech, copper beech and lime. However, this is one of the more significant areas of open space in the southwest part of Kilkenny City, and thus has the potential to act as a stepping stone between the River Nore and the River Breagagh. The private gardens in the area are mature, increasing their value for birds and invertebrates. In addition, there are a number of mature trees in the area, including beech, sycamore, lime and horse chestnut. There are no particular threats to the ecological value of this area, apart from ongoing management. There is significant potential for improving the ecological value of this area through sensitive management and habitat creation.

3.2.4 Newpark Marsh

This area of key Green Infrastructure area is located in the townlands of Newpark Lower and Seixeslough, approximately 2km north-east of Kilkenny City Centre. The core of the site is Newpark Marsh, a wetland approximately 10 ha in size located within a surface depression with the adjoining lands sloping downwards towards the marsh basin (Malone O'Regan, 2005). Newpark Marsh is proposed for designation as an NHA.

Plate 3.7 – Newpark Marsh (Photo: E. Delaney)

Newpark Marsh is made up of a three main habitat types including reed and large sedge swamp (FS1) and eutrophic lakes (FL5) with small sections of wet willow-alder-ash woodland (WN6) fringing the marsh habitat throughout. The swamp is dominated by tall plants emerging from the water, including an abundance of tufted sedge, yellow iris, branched bur reed, common club rush, purple loosestrife, bulrush and water dock. Malone O'Regan (2005) noted the increase in size the reedswamp at the expense of open water habitats due to the apparent lowering of the water table in the recent past. The margins of Newpark Marsh are fringed by wet willow-alder-ash woodland characterised by alder, grey willow, osier and aspen. The margins of the marsh also support large and mature white willow trees. The open areas of water area in and amongst the reed and large sedge swamp are dominated by common duckweed, which indicate nutrient-rich conditions within the marsh.

The other main habitat within this area of Green Infrastructure is a sizeable mixed broadleaved woodland located to the north of Newpark Marsh. The central section of the woodland supports a wetland, consisting of open water with abundant common duckweed. The majority of this woodland is situated within Kilkenny College grounds (formerly Newtown House) and was likely established as demesne woodland. The woodland itself is characterised by large mature deciduous trees species including pedunculate oak, ash, horse chestnut, sycamore, beech, wych elm and, within the wetter areas, alder, crack willow and grey willow (Malone O'Regan, 2005).

Plate 3.8 – Mallard at Newpark Marsh (Photo: E. Delaney)

The Newpark Marsh area provides a good diversity of semi-natural habitats, particularly for a site located within a suburban environment. Not only does it support a range of plant species common to semi-natural freshwater and terrestrial habitats, it also supports suitable habitats for wetland bird species such as Reed Bunting, Moorhen, Snipe and Water Rail. This Green Infrastructure Area also provides suitable habitat for mammals such as fox and badger. Furthermore a NPWS survey of Newpark Marsh confirmed the presence of common pipistrelle, Leisler's bat and brown long-eared bat (Comerford, 1990). Attendees at the public consultation meeting reported seeing pygmy shrew within Newpark Marsh in addition to smooth newt and common lizard.

Like the River Nore, this site provides considerable ecosystem services within an area that supports high levels of human activity. As already mentioned, the site supports a range of wetland plants and birds, and their value is increased by the scarcity of wetland habitats throughout the locality and indeed the county. The area also provides carbon sequestration with its relatively abundant trees and large area of reed swamp. In addition, Newpark Marsh is an important amenity area situated within proximity to the Kilkenny City centre, providing opportunities for bird watching and walking. The Newpark Marsh area also represents a very good location for youth education with its central location and ease of access.

Threats to Newpark Marsh include the potential for the further drying out of this habitat as evidenced by locals in recent years. Other activities such as unsociable drinking and associated localised littering represent threats to this Green Infrastructure area.

3.2.5 St Canice's Cathedral and Environs

St Canice's Cathedral, the Bishop's Palace (Heritage Council headquarters) and surrounding lands forms a key Green Infrstructure area located in the north-western part of Kilkenny City. The Green Infrastructure here consists of a series of older buildings, vegetated old stone walls, small patches of amenity grassland associated with private dwellings, and lines and groups of mature broadleaved trees. Notable archaeological features here are the round tower at St Canice's Cathedral and the graveyard.

Figure 3.9 - Painted lady butterfly on wall in the grounds of St. Canice's Cathedral (Photo: L. Scott)

The old stone walls in this area are especially notable; Fuller (2009), in her study of Kilkenny's old stone walls, highlighted a number of limestone walls bordering and comprising St Canice's Cathedral. As discussed above, old stone walls are important habitats for flowering plants, lichens, mosses and ferns which in turn provide food and shelter for insects and possibly birds, bats and small mammals. Many of the older buildings in the area are likely to support roosting bats. The mature trees in the area include lime, horse chestnut, beech and sycamore. Like the stone wall networks, these treelines and groups of trees provide suitable habitat for bird nesting and bat foraging and roosting.

This Green Infrastructure area also supports large areas of amenity grassland associated with Loreto College secondary school. These include playing pitches for outdoor field sports regularly used by the students of Loreto College. Although of lower ecological interest, these are an important recreational amenity and provide some foraging for thrushes and other birds feeding on worms, beetles and snails.

This Green Infrastructure area provides valuable habitats for flora and fauna at the edge of the built up parts of Kilkenny City centre. It may serve as a softer entryway for wildlife entering or passing through the city from the west and may have value as a stepping stone near the River Nore and the River Breagagh. St Canice's Cathedral, the associated round tower, graveyard and other features provide a valuable amenity for tourists and locals and demonstrate the potential interactions between natural and built heritage.

3.2.6 Breagagh River

The Breagagh River enters the study area near the north-western boundary before continuing south toward Kilkenny City along improved grassland and arable fields. At the time of the field survey, water levels in the river were low. Parts of the river supported healthy communities of aquatic plants dominated by common water crowfoot, corresponding to the protected Habitats Directive type, floating river vegetation. Along the northern stretches of the river, it is fringed by intermittent hedgerows and treelines before it reaches the Health Service Executive (HSE) buildings at Kilcreen. Here, it is adjoined by parcels of mixed broadleaved woodland (WD1) supporting abundant sycamore and large clumps of the invasive exotic Japanese knotweed. Wheatear is known from this part of the city environs (P. Durkin, pers.comm.). A tributary stream also joins the Breagagh at this point. The tributary is a smaller watercourse fringed by improved grassland, arable fields and recently completed or discontinued housing developments.

Along the main channel near the townland of Crokershill, the river is fringed by more mixed broadleaved woodland, a young pedunculate oak plantation and a linear strip of broadleaved woodland dominated by hybrid black poplar. The river continues to the east toward Kilkenny town centre and is fringed by linear strips of amenity grassland and areas of built land.

Plate 3.10 – Breagagh River the townland of Kilcreen, fringed by treeline (Photo: E. Delaney)

The Breagagh River represents a valuable habitat resource for birdlife within the study area, including Kingfisher, a species listed on the EU Birds Directive, whilst Dipper, Reed Bunting and Grey Wagtail are also often sighted there (P. Durkin, pers. comm.). Grey Heron and Moorhen have been identified along the river near the Dominic Street Bridge, whilst consistent pipistrelle bat activity also occurs within this area. Indeed some of the older houses in the area may currently act as bat roosts (O. Duggan, pers. comm.).

The Breagagh River provides valuable amenity services in the form of fishing and casual recreation. The Breagagh River is also a local water source and provides for the control of surface water in the surrounding areas. In addition to acting as a wildlife habitat in its own right, it has the potential to act as a corridor, allowing movement of plants and animals through an otherwise hostile landscape of intensive agriculture and built land.

During the habitat survey, threats identified to this Green Infrastructure area included diffuse pollution to surface waters. Indeed, 2010 EPA water quality data give the Breagagh a rating of Q3 – Poor at Brewery Bridge in Kilkenny City Centre. Large clumps of the highly invasive Japanese knotweed within the townland of Kilcreen and a small stand of Himalayan balsam on the western side of the bridge near Dominic Street (O. Duggan pers. comm.) are further threats to this Green Infrastructure area.

3.2.7 Pococke River

The Pococke River, a small depositional watercourse, runs along the eastern boundary of the study area, entering the study area at the townland of Garrincreen. Parts of this watercourse are located within and parts are outside of the study area. The areas outside of the study area are not mapped as key Green Infrastructure areas (Figure 3.1), but are nonetheless part of the river system and thus the same piece of Green Infrastructure.

The Pococke River near the townland of Garrincreen is fringed by an area of recolonising bare ground resulting from ring road construction. The River continues to the south of Garrincreen toward Blanchfieldsland. Along this stretch the river is fringed by improved grassland pastures, tillage and sections of treelines and hedgerows.

Plate 3.11 – Pococke River immediately downstream of the N10 road crossing (Photo: E. Delaney)

The Pococke River re-enters the study area immediately south of the N10 road crossing. Here, as the river continues to flow south, the shallow water has allowed the Habitats Directive habitat type floating water vegetation to develop. The river continues south and is fringed by an area of wet willow-alder-ash woodland that is mostly dominated by small ash trees. The river continues south, where at the townland of Purcellsinch, is fringed by linear section of mixed broadleaved woodland dominated by beech with frequent ash and sycamore and also an adjoining area of semi-natural grassland before leaving the study area.

Like the Breagagh, the Pockocke River is a valuable amenity resource for the Kilkenny area, in particular for activities such as fishing. Furthermore the river acts as a viable corridor for mammals and birds that, together with its parcels of fringing woodland, treelines, hedgerows and semi-natural grassland, provides suitable transport routes.

Threats to the Pococke River include siltation, as was noted along the stream to the south of the crossing with the N10 (Plate 3.11). Nonetheless, the most recent (2005) EPA water quality monitoring results rate the Pococke as Q3-4 east of Newpark Marsh, indicating moderate water quality status, and Q4 upstream of the confluence with the River Nore, indicating good water quality status.

Plate 3.12 – Japanese knotweed along the Pococke River (Photo: E. Delaney)

3.2.8 Kilkenny Golf Club

Kilkenny Golf Club is located near the north-east of the study area and is bounded to the north by the recently constructed N77 Kilkenny Ring Road. This Green Infrastructure area comprises a golf course that supports a large area of scattered trees and parkland with smaller parcels of mixed broadleaved and conifer woodland. A wide range of tree species are present, including Monterey cypress, field maple, sycamore, Lawson's cypress, hornbeam, hybrid black poplar, birches and pines. The golf course provides obvious amenity facilities for the Kilkenny City area and surrounds. Although of less value for wildlife than the more natural areas of Green Infrastructure, the golf course does provide some wildlife habitat. The parcels of woodland will become of greater value to wildlife, such as nesting birds and burrowing animals as they continue to mature. The field survey found a disused outlier badger sett within one of the woodland areas on the golf course, indicating that badgers use the area, at least occasionally.

Plate 3.13 – Kilkenny Golf Course (Photo: E. Delaney)

3.2.9 Springhill Quarry

An abandoned quarry is located at Springhill on the southern boundary of the study area at the interface between the suburbs and surrounding rural areas. The disused sand and gravel quarry and adjoining areas support recolonising bare ground habitats occurring in mosaic with patches of scrub. The area is currently grazed by horses and is occupied by a mixture of bare soil, tightly grazed vegetation, patches of rank pioneer species such as clovers, willowherbs, common ragwort, bindweeds, creeping thistle and red valerian. Patches of scrub are made up of butterfly bush, bramble and gorse.

This Green Infrastructure area includes some remnant bare quarry faces that may support bird nesting activity, particularly for species such as Sand Martin. Furthermore, the area supports a relatively diverse and abundant pioneer plant community that may sustain a diverse community of invertebrates attracted to the wide range of flowering plants present and the opportunities for nesting and basking provided by the bare soil. The areas of spoil and associated patches of scrub may also provide suitable refuge for small mammals and birds within the localised area.

Plate 3.14 – Springhill quarry (Photo: E. Delaney)

Potential threats to this Green Infrastructure area include overgrazing of the site by horses. Nonetheless, low intensity grazing levels will need to be maintained to keep this area from becoming totally encroached by bramble and gorse scrub. Under an appropriate grazing and management regime, this site has the potential to develop into a highly valuable semi-natural grassland. Dumping of household waste along the roadside margin is also an ongoing threat to this Green Infrastructure area.

3.2.10 Smaller Stepping Stones

A number of smaller locations have been identified as Green Infrastructure (Figure 3.1). These are able to provide biodiversity and ecosystem services on a smaller scale than those sites discussed above. They may also function as stepping stones, facilitating movement of wildlife among the larger sites and between the Green Infrastructure of Kilkenny City and Environs and the surrounding rural landscape.

St. Maul's Graveyard

St Maul's graveyard is an old graveyard on the northern outskirts of Kilkenny City centre. The graveyard currently supports dry meadow vegetation dominated by coarse or tussocky grass species such as false oat grass, cocksfoot and common couch grass. Other plants include creeping thistle, nettle, rosebay willowherb and bittersweet. The western boundary of the graveyard, which borders Greenbridge Street, supports a line of mature trees including ash, horse chestnut, Scots pine and European larch. The northern boundary of the site supports an unmanaged hedgerow of hawthorn, elder and sycamore.

Plate 3.15 – St. Maul's Graveyard (Photo: D. Ledwidge)

This Green Infrastructure area is of importance in its capacity to offer temporary refuge and cover for small mammals and birds in such a built up area. Furthermore, the mature trees, grasses and in particular the broadleaved herb component may also provide suitable habitat for invertebrate species. Its proximity to the River Nore makes it a potential stepping stone between it and other Green Infrastructure on the east side of the river.

Threats to this Green Infrastructure area include the presence of the invasive exotic plant species snowberry along the western and northern boundaries. The grassland is also under threat from the further spread and possible future dominance of bramble scrub. Sensitive management will be required to control scrub yet retain the ecological interest of the graveyard.

St. Mary's Church and Graveyard

The grounds of St. Mary's Church near John's Bridge in the city centre contain another old graveyard. As noted in Section 2.2.5 above, it formerly supported a locally high degree of biodiversity (Goodwillie, 1995), but this has been lost to unsympathetic management (MacGowan, 2005). It is currently occupied by improved amenity grassland and some mature trees, including silver birch, Norway maple, sycamore and ornamental cherry. Shrubs include cotoneaster, the invasive butterfly bush, and elder; the former was more abundant here previously, but most was cleared during graveyard restoration works (MacGowan, 2005). A number of broadleaved herbs typical of disturbed areas and moderately fertile grassland are present in and around the graves. The site is valuable for bats, as five species roost in the church, forage in the graveyard or both. St. Mary's Church and graveyard is identified as a Green Infrastructure area due to its value for bats, its amenity value, and its potential for ecological enhancement. It is identified as a pocket park in the Kilkenny City Centre Local Area Plan.

Lakeview Drive Ponds

This Green Infrastructure area is situated within the eastern margins of Kilkenny City centre, immediately north of Nowlan Park. This area supports a constructed or modified wetland area with fringing reed and large sedge swamp mainly made up of bulrush. This habitat also supports waterbirds including Moorhen and Mallard. The ponds are now surrounded by a recently constructed housing estate and act as an amenity and aesthetic facility for the neighbouring housing estate.

This small area of Green Infrastructure provides valuable green areas for local residents within a built up area of Kilkenny City. The ponds also provide suitable habitat for waterbird species such as Mallard and Moorhen whilst also providing a source of carbon sequestration and surface water control.

Plate 3.16 – Lakeview drive ponds and fringing reed and large sedge swamp (Photo: E. Delaney)

Castlecomer Road Trees

This Green Infrastructure pocket consists of the mature trees in the Castlecomer Road area from Lovers Lane north to the Glendine Inn. Some of the most notable trees fringe a private house on the east side of the Castlecomer Road. There is also a line of mature trees situated between and to the rear of houses facing onto the Castlecomer Road and houses facing onto Green's Hill. These areas of scattered and linear mature trees provide suitable refuge, nesting and roosting for birds, bats and other small mammals in the Kilkenny City area. This area may also provide a stepping stone or a link between the River Nore Green Infrastructure area and the River Nore Green Infrastructure area.

Oldpark Complex

This potential Green Infrastructure area is located on privately owned land that was not accessible during the field survey. It was observed from a distance and consists of a rough wet grassland field below a steep hillside occupied by scrub. This small area is likely to provide habitat for a range of wildlife; for example, the scrub appears to be highly suitable for badger setts. Its positioning makes it a potential stepping stone between the northern River Nore and the rural landscape to the west.

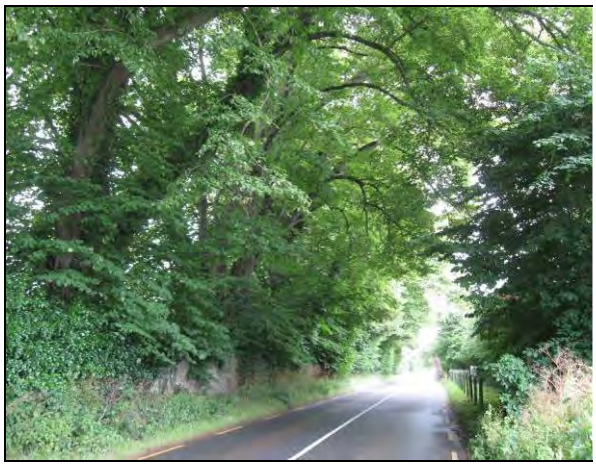


Plate 3.17 – Treelines bordering road at Rushbrook (Photo: E. Delaney)

4. Recommendations

Completing the habitat survey and preparing this report and the accompanying GIS database are only the first steps in conserving and enhancing the habitats of Kilkenny City and Environs. Below are recommendations for some next steps that arise from the habitat survey.

4.1 Planning

4.1.1 Strategic Planning for Green Infrastructure

The concept of Green Infrastructure should be further integrated into all levels of the planning process. As noted above (Box 1), the thinking behind Green Infrastructure is already incorporated into the Kilkenny City and Environs Development Plan 2008-2014 and the Kilkenny County Development Plan 2008-2014. Future strategic planning should build on this and identify different types and grades of Green Infrastructure for conservation and enhancement. The key Green Infrastructure areas identified in this report should be used as a baseline. As these have been identified with biodiversity as the primary concern, additional or overlapping Green Infrastructure areas may need to be identified to fully encompass the ecosystem services provided. Recent work by Comhar (2010) and by UCD Urban Institute Ireland *et al*. (2008) may be helpful in this.

Plate 4.1 – Riverbank restoration along the Nore (Photo: G. Smith)

Where appropriate, strategic planning should aim for synergies among ecosystem services provided by the same Green Infrastructure areas. This multi-functional approach is central to the Green Infrastructure concept and will help maximise the benefits provided by a given area. From a natural heritage perspective, a goal in strategic planning should be to reinforce and strengthen where necessary the biodiversity value of Green Infrastructure. For example, this can include improving the ecological value of public parks and other amenity areas or promoting biodiversity conservation in agricultural lands.

Ecological value should be an explicit criterion in the zoning of lands for Green Infrastructure, recreation or similar in strategic planning.

4.1.2 Mitigation Banking

Policy H69 of the Kilkenny City and Environs Development Plan 2008-2014 states that “where the loss of habitats and features of the wider countryside is unavoidable as part of a development, to ensure that appropriate mitigation and/or compensatory measures are put in place, to conserve and enhance biodiversity and landscape character.” In some cases, it may be more effective to carry out mitigation or compensatory measures in another location than where the development is taking place. For example, there may be insufficient scope for adequate compensation or the outcomes of mitigation may be uncertain. There may also be cases where off-site habitat creation or enhancement work may be more effective or beneficial for biodiversity than on-site works. Options for incorporating such a “mitigation banking” strategy should be explored and incorporated into planning. Where appropriate, off-site mitigation banking can be used to

contribute to enhancing ecological Green Infrastructure in strategic locations elsewhere in the City and Environs.

4.1.3 Strengthen Green Infrastructure Links to the River Nore

The River Nore is a strong piece of Green Infrastructure acting as an ecological corridor across the city from north to south. However, east to west ecological linkage across the city and to the River Nore is much weaker (Figure 3.1). Strategic planning should aim to strengthen east-west ecological linkages with the Nore where possible. The Breagagh River provides an opportunity for strengthening these linkages.

4.2 Management

4.2.1 Promote Best Practice in Conservation Management

Conservation management should follow best practice. There is a wealth of easily accessible information on conservation management available on the internet, in published books and magazines, from NGOs and from conservation professionals. Inappropriate conservation management can waste valuable resources and can impede progress towards meeting objectives.

Community groups have a strong role to play in managing Green Infrastructure. They should be consulted at an early stage and integrated fully into the planning and management processes. They have the advantage of being on the ground, close to the action, which facilitates monitoring progress and identifying problems at an early stage.

Plate 4.2 – New tree and shrub planting to extend a fragmented hedgerow along the River Nore Linear Walk (Photo: G. Smith)

Some general guidance on conservation management that arises from field observations and consultations during the habitat survey includes:

- Planting native species of native genetic stock as part of landscaping developments and public lands and as part of private gardens should be encouraged.
- Old stone walls should not be indiscriminately cleared of vegetation, as most plants growing in walls do not damage the fabric. Clearance of ivy or other dense growth should be carried out in September or October when the potential for damaging nesting birds and bats is lowest.
- A bat specialist should be consulted prior to repointing stone walls to ensure there are no bats located inside crevices. Erecting bat boxes or bat bricks can compensate for loss of roosting space.
- Semi-natural grasslands should be mowed once or twice a year as a rule of thumb. More frequent mowing enriches the soil by increasing recycling of organic matter and leads to changes in species. Autumn mowing should take place after flowering and seed set. If required, grasslands can be cut a second time in early spring prior to flowering.
- Use of “wildflower” seed mixes should be avoided, as these often contain non-native species or non-native genetic stock. When introducing wildflowers, native seed and autumn cuttings, preferably from a known local source, should be used (in compliance with the Wildlife Act)

4.2.2 Enhancing Amenity Grasslands

Ten percent of the Kilkenny City and Environs study area is amenity grassland, without counting that in the gardens in private dwellings. In comparison, 7.1% of Tralee is amenity grassland (O'Hora *et al.*, 2010) and only 1.2% of Westport is amenity grassland (Smith *et al.*, 2008). This represents a significant resource of green space, much of which could be improved for biodiversity without losing recreational amenity value. Possible measures for enhancing amenity grassland for biodiversity include:

- Planting native trees or areas of dense shrubs
- Establishing flowerbeds with a diverse range of flowering species to provide nectar and pollen at different times of year for a wide range of insects
- Establishing wildflower meadows
- Allowing areas to develop tall, grassy meadows
- Creating wildlife ponds or wetlands
- Planting low management intensity vegetable and herb gardens and leaving some space for weeds
- Supplementing the above with bird or bat boxes or building dens or hibernation areas for small animals, such as hedgehogs

Not all of the options above will be suitable for all areas, and some, such as wildflower meadows or wetlands, will require long-term management. In developed estates, more aesthetic options may be preferable, and public safety will be a greater concern, which may rule out ponds, for example. Native species should be used to enhance or replace amenity grassland areas whenever possible, as these tend to support a greater range of native insects and birds. While non-native flowering plants and shrubs can have some biodiversity value, the emphasis where possible should be placed on creating semi-natural wildlife habitats. A focus on "prettification" alone will have limited ecological benefits.

4.2.3 Managing Key Green Infrastructure

Management plans should be developed for key pieces of Green Infrastructure identified in this report, particularly those in public ownership. Drafting management plans should also be explored with other landowners, where appropriate. For many sites, appropriate management is required to conserve and enhance their biodiversity value; otherwise this value will be lost through neglect. Some sites will require removal of exotic species, and some will require regular management in the form of mowing or vegetation control. More detailed site-by-site advice is beyond the scope of this report, however. As noted above, management should follow best practice and should include community groups at all stages.

Plate 4.3 – Bird box (Photo: L. Scott)

Wetlands and calcareous grasslands were some of the most ecologically valuable habitats found in Kilkenny City and Environs. These habitats should be a priority for conservation management. The areas of these habitats should be expanded where possible. Areas of steeply sloping or rocky ground and quarries are some of the more suitable locations for creating or encouraging the

development of calcareous grassland. Localised depressions or riparian areas may be suitable for creating or expanding wetlands.

Mechanisms for promoting sustainable hedgerow management should be explored. For hedgerows on agricultural land, the Department of Agriculture will be required to play a lead role.

4.3 Research

4.3.1 Green Infrastructure

Where required to inform management, more detailed ecological surveys of key Green Infrastructure should be carried out. This habitat survey has provided the first steps towards a biodiversity inventory of Kilkenny City; however, more precise information on the species that occupy or use Green Infrastructure will help to increase the biodiversity benefits of management. For example, some areas may support sensitive species that require particular management measures. For other Green Infrastructure areas, their full biodiversity value may not be fully appreciated. In particular, invertebrates are a group that is poorly known throughout Ireland, and invertebrate surveys of Green Infrastructure areas may produce surprising results and inform targeted measures to increase Kilkenny's invertebrate biodiversity.

4.3.2 Ecological Corridors

The true value of different habitat types as ecological corridors and stepping stones for different groups of species is not fully understood. Some types of habitat may be good corridors for some species, but not for others. Such research would be applicable across Ireland and abroad, and is not strictly related to Kilkenny City and Environs. However, such research efforts should be supported at a local level where possible.

4.3.3 Old Stone Walls

Old stone walls are a significant built and natural heritage feature of Kilkenny City. Fuller (2009) has highlighted their value for flora and suggests they may be important for invertebrates and other fauna. A study on the value of old stone walls and their flora for invertebrates should be carried out and include their potential to act as ecological corridors.

4.4 Education

4.4.1 Public Awareness and Education

Public awareness of the natural heritage of Kilkenny City and Environs has been raised by this project and others in the recent past. Public education on natural heritage has also been enhanced by such activities as Heritage Week. This work should continue and should also emphasise links between built and cultural heritage and natural heritage, where appropriate.

The results of this habitat survey should be disseminated widely and made available in easily accessible formats, such as on the internet and in the form of a user-friendly brochure or other publication.

Plate 4.4 – Interpretive signboard at Newpark Marsh (Photo: E. Delaney)

4.4.2 Conservation Management

Programmes to educate the general public on gardening and small-scale habitat creation to enhance biodiversity should be supported and promoted. These should be as practical and hands-on as possible and could perhaps be linked with ongoing biodiversity enhancement of public Green Infrastructure.

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Appendices

Appendix A – Scientific Names of Species

Species found within Kilkenny City and Environs (unless otherwise noted) and named in this report are listed in the table below. Note that this is not a comprehensive species list for Kilkenny City and Environs.

Common Name	Species Name
Vascular Plants	
Alder	*Alnus glutinosa*
Ash	*Fraxinus excelsior*
Aspen	*Populus tremula*
Bamboo	*Sasa* sp.
Barley	*Hordeum vulgare*
Bee orchid	*Ophrys apifera*
Beech	*Fagus sylvatica*
Bindweed	*Calystegia* sp.
Bittersweet	*Solanum dulcamara*
Blackthorn	*Prunus spinosa*
Bramble	*Rubus fruticosus* agg
Branched bur reed	*Sparganium erectum*
Bulrush	*Typha latifolia*
Bush vetch	*Vicia sepium*
Butterfly bush	*Buddleja davidii*
Charlock	*Sinapis arvensis*
Cherries	*Prunus* spp.
Cleavers	*Galium aparine*
Clovers	*Trifolium spp*
Cocksfoot	*Dactylis glomerata*
Common club rush	*Schoenoplectus lacustris*
Common couch grass	*Elytrigia repens*
Common duckweed	*Lemna minor*
Common fleabane	*Pulicaria dysenterica*
Common marsh bedstraw	*Galium palustre*
Common ragwort	*Senecio jacobaea*
Common reed	*Phragmites australis*
Common spike-rush	*Eleocharis palustris*

Common Name	Species Name
Common valerian	*Valeriana officinalis*
Common water crowfoot	*Ranunculus aquatilis*
Copper beech	*Fagus sylvatica* var *purpurea*
Corn poppy	*Papaver rhoeas*
Cotoneaster	*Cotoneaster* sp.
Crack willow	*Salix fragilis*
Creeping buttercup	*Ranunculus repens*
Creeping thistle	*Cirsium arvense*
Curled dock	*Rumex crispus*
Daisy	*Bellis perennis*
Dandelion	*Taraxacum officinalis* agg.
Docks	*Rumex* spp.
Dog rose	*Rosa canina*
Elder	*Sambucus nigra*
English elm	*Ulmus procera*
European larch	*Larix decidua*
False oat grass	*Arrhenatherum elatius*
False wood brome	*Brachypodium sylvaticum*
Field maple	*Acer campestre*
Field scabious	*Knautia arvensis*
Fool's watercress	*Apium nodiflorum*
Goat willow	*Salix caprea*
Gorse	*Ulex europaeus*
Great willowherb	*Epilobium hirsutum*
Greater duckweed	*Spirodela polyrhiza*
Greater spearwort	*Ranunculus lingua*
Grey willow	*Salix cinerea*
Hard rush	*Juncus inflexus*
Hawkweeds	*Hieracium* spp.

Common Name	Species Name
Hawthorn	*Crataegus monogyna*
Hazel	*Corylus avellana*
Herb robert	*Geranium robertianum*
Himalayan balsam	*Impatiens glandulifera*
Hogweed	*Heracleum sphondylium*
Horse chestnut	*Aesculus hippocastanum*
Hybrid black poplar	*Populus x canadensis*
Ivy	*Hedera helix*
Ivy leaved toadflax	*Cymbalaria muralis*
Japanese knotweed	*Fallopia japonica*
Knapweed	*Centaurea nigra*
Lady's bedstraw	*Galium verum*
Large bindweed	*Calystegia silvatica*
Lawson's cypress	*Chamaecyparis lawsoniana*
Lesser pond sedge	*Carex acutiformis*
Lesser spearwort	*Ranunculus flammula*
Lime	*Tilia cordata*
Lodgepole pine	*Pinus contorta*
Maize	*Zea mays*
Maples	*Acer* spp.
Marjoram	*Origanum vulgare*
Meadow vetchling	*Lathyrus pratensis*
Meadowsweet	*Filipendula ulmaria*
Monterey cypress	*Cupressus macrocarpa*
Nettle	*Urtica dioica*
Nettle-leaved bellflower	*Campanula trachelium*
Norway maple	*Acer platanoides*
Oat	*Avena sativa*
Osier	*Salix viminalis*
Pedunculate oak	*Quercus robur*
Perennial ryegrass	*Lolium perenne*
Polypody fern	*Polypodium vulgare*
Pondweeds	*Potamogeton sp*
Potato	*Solanum tuberosum*
Primrose	*Primula vulgaris*

Common Name	Species Name
Purple loosestrife	*Lythrum salicaria*
Purple loosestrife	*Lythrum salicaria*
Red valerian	*Centhrantus ruber*
Reed canary grass	*Phalaris arundinacea*
Rest harrow	*Ononis repens*
Rosebay willowherb	*Chamerion angustifolium*
Scarlet pimpernel	*Anagallis arvensis*
Scots pine	*Pinus sylvestris*
Sheep's fescue	*Knautia arvensis*
Silver birch	*Betula pendula*
Sitka spruce	*Picea sitchensis*
Snowberry	*Symphoricarpos albus*
Sycamore	*Acer pseudoplatanus*
Tall fescue	*Schedonorus arundinaceus*
Thistles	*Cirsium* spp.
Tufted sedge	*Carex elata*
Tufted vetch	*Vicia cracca*
Valerian	*Valeriana officinalis*
Water dock	*Rumex hydrolapathum*
Water forget-me-not	*Myosotis scorpioides*
Water horsetail	*Equisetum fluviatile*
Water mint	*Mentha aquatica*
Water plantain	*Alisma plantago-aquatica*
Wheat	*Triticum aestivum*
White clover	*Trifolium repens*
White willow	*Salix alba*
Whitebeam	*Sorbus aria* agg.
Wild cherry	*Prunus avium*
Wild privet	*Ligustrum vulgare*
Willowherbs	*Epilobium* spp.
Willows	*Salix* spp.
Yarrow	*Achillea millefolium*
Yellow iris	*Iris pseudacorus*
Yellow loosestrife	*Lysimachia vulgaris*
Yellow rattle	*Rhinanthus minor*

Common Name	Species Name
Mammals	
Badger	*Meles meles*
Brown long-eared bat	*Plecotus auritus*
Common pipistrelle	*Pipistrellus pygmaeus*
Daubenton's bat	*Myotis daubentonii*
Fox	*Vulpes vulpes*
Grey squirrel	*Sciurus carolinensis*
Irish hare	*Lepus timidus hibernicus*
Leisler's bat	*Nyctalus leisleri*
Otter	*Lutra lutra*
Pygmy shrew	*Sorex minutus*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Birds	
Barn Owl	*Tyto alba*
Dipper	*Cinclus cinclus*
Grey Heron	*Ardea cinerea*
Grey Wagtail	*Motacilla cinerea*
Kingfisher	*Alcedo atthis*
Mallard	*Anas platyrhynchos*
Meadow pipit	*Anthus pratensis*
Moorhen	*Gallinula chloropus*
Mute Swan	*Cygnus olor*
Reed Bunting	*Emberiza schoeniclus*
Sand Martin	*Riparia riparia*
Stonechat	*Saxicola torquata*
Water Rail	*Rallus aquaticus*
Wheatear	*Oenanthe oenanthe*
Amphibians and Reptiles	
Common frog	*Rana temporaria*
Common lizard	*Lacerta vivipara*
Smooth newt	*Lissotriton vulgaris*
Fish	
Atlantic salmon	*Salmo salar*
Brown trout	*Salmo trutta*

Common Name	Species Name
Invertebrates	
Green veined white	*Artogeia napi*
Nore freshwater pearl mussel[7]	*Margaritifera margaritifera durrovensis*
Painted lady	*Vanessa cardui*
Ringlet	*Aphantopus hyperantus*
Speckled wood	*Parage aergeria*
Wall brown	*Lasiommata megera*
White clawed crayfish	*Austropotamobius pallipes*

[7] Found within the River Nore, but not in Co. Kilkenny.

Appendix B – Habitat Classification According to Fossitt (2000)

The table below outlines the classification of terrestrial and freshwater habitats according to the Heritage Council classification system (Fossitt, 2000). Level 1 of the hierarchy is indicated by a single-letter code, level 2 is indicated by a two-letter code, and level 3 is indicated by a three-character alphanumeric code.

Table B.1 – Heritage Council habitat classification system (Fossitt, 2000)

F FRESHWATER	
FL Lakes and Ponds	FL1 Dystrophic lakes
	FL2 Acid oligotrophic lakes
	FL3 Limestone/marl lakes
	FL4 Mesotrophic lakes
	FL5 Eutrophic lakes
	FL6 Turloughs
	FL7 Reservoirs
	FL8 Other artificial lakes and ponds
FW Watercourses	FW1 Eroding/upland rivers
	FW2 Depositing/lowland rivers
	FW3 Canals
	FW4 Drainage ditches
FP Springs	FP1 Calcareous springs
	FP2 Non-Calcareous springs
FS Swamps	FS1 Reed and large sedge swamps
	FS2 Tall herb swamps
G GRASSLAND AND MARSH	
GA Improved grassland	GA1 Improved agricultural grassland
	GA2 Amenity grassland (improved)
GS Semi-natural grassland	GS1 Dry calcareous and neutral grassland
	GS2 Dry meadows and grassy verges
	GS3 Dry-humid acid grassland
	GS4 Wet grassland
GM Freshwater marsh	GM1 Marsh
H HEATH AND DENSE BRACKEN	
HH Heath	HH1 Dry siliceous heath
	HH2 Dry calcareous heath
	HH3 Wet heath

	HH4 Montane heath
HD Dense bracken	HD1 Dense bracken
P PEATLANDS	
PB Bogs	PB1 Raised bogs
	PB2 Upland blanket bog
	PB3 Lowland blanket bog
	PB4 Cutover bog
	PB5 Eroding blanket bog
PF Fens and Flushes	PF1 Rich fen and flush
	PF2 Poor fen and flush
	PF3 Transition mire and quaking bog
W WOODLAND AND SCRUB	
WN Semi-natural woodland	WN1 Oak-birch-holly woodland
	WN2 Oak-ash-hazel woodland
	WN3 Yew woodland
	WN4 Wet pedunculate oak-ash woodland
	WN5 Riparian woodland
	WN6 Wet willow-alder-ash woodland
	WN7 Bog woodland
WD Highly modified/non-native woodland	WD1 (Mixed) broadleaved woodland
	WD2 Mixed broadleaved/conifer woodland
	WD3 Yew woodland
	WD4 Conifer plantation
	WD5 Scattered trees and parkland
WS Scrub/transitional woodland	WS1 Scrub
	WS2 Immature woodland
	WS3 Ornamental/non-native shrub
	WS4 Short rotation coppice
	WS5 Recently-felled woodland
WL Linear woodland/scrub	WL1 Hedgerows
	WL2 Treelines
E EXPOSED ROCK AND DISTURBED GROUND	
ER Exposed rock	ER1 Exposed siliceous rock
	ER2 Exposed calcareous rock
	ER3 Siliceous scree and loose rock
	ER4 Calcareous scree and loose rock
EU Underground rock and caves	EU1 Non-marine caves
	EU2 Artificial underground habitats

ED Disturbed ground	ED1 Exposed sand, gravel or till
	ED2 Spoil and bare ground
	ED3 Recolonising bare ground
	ED4 Active quarries and mines
	ED5 Refuse and other waste
B CULTIVATED AND BUILT LAND	
BC Cultivated land	BC1 Arable crops
	BC2 Horticultural land
	BC3 Tilled land
	BC4 Flower beds and borders
BL Built land	BL1 Stone walls and other stonework
	BL2 Earth banks
	BL3 Buildings and artificial surfaces

In this report, Heritage Council habitat types were grouped into broad habitat groups according to the system outlined in Table B.2 below. Where habitats occur in mosaics, the habitat area has been categorised in a broad habitat group according to the dominant habitats, with the exception of BL3 – buildings and artificial surfaces. All habitats containing habitat type BL3 have been included in the Buildings and Gardens group, except for a few mosaic types as noted below.

Table B.2 – Kilkenny broad habitat group equivalencies with the Heritage Council classification system

Broad Habitat Group	Heritage Council Habitat Types
Buildings and Gardens	BL3 – Buildings and artificial surfaces WS3 – Ornamental / non-native shrub
Intensive Agriculture	BC – Cultivated land GA1 – Improved agricultural grassland (including mosaics with BL3)[8]
Amenity Grassland	GA2 – Amenity grassland (improved)[9]
Disturbed Ground	ED2 – Spoil and bare ground (including mosaics with BL3)[10] ED3 – Recolonising bare ground (including mosaics with BL3)[10]
Semi-natural Grassland	GS – Semi-natural grassland
Woodland and Scrub	W – Woodland and scrub[9]
Rivers	FW – Watercourses
Wetlands	FS1 – Reed and large sedge swamps FS2 – Tall herb swamps GM1 – Marsh FP – Springs
Lakes and Ponds	FL – Lakes and ponds

[8] The mosaic GA1 \ BL3, sometimes including ED3 as a minor constituent, was rarely used for agricultural grassland in which a farm outbuilding or other structure was situated.

[9] Except for the golf course, which is classified as scattered trees and parkland (WD5) but assigned to the Amenity Grassland group.

[10] These mosaic types were used for construction sites or similar areas where the area of buildings or hard surfaces such as concrete or tarmac is small relative to disturbed soil.

Appendix C – Methods

C.1 Consultation

Information about habitats and species in Kilkenny City and Environs was obtained from various individuals and bodies. Detailed discussion was held with the project Steering Group as to previous studies commissioned and sources of local data, such as Environmental Impact Statements, ecological assessments or targeted ecological surveys which may contain data on habitats within the study area.

Key groups consulted included: -

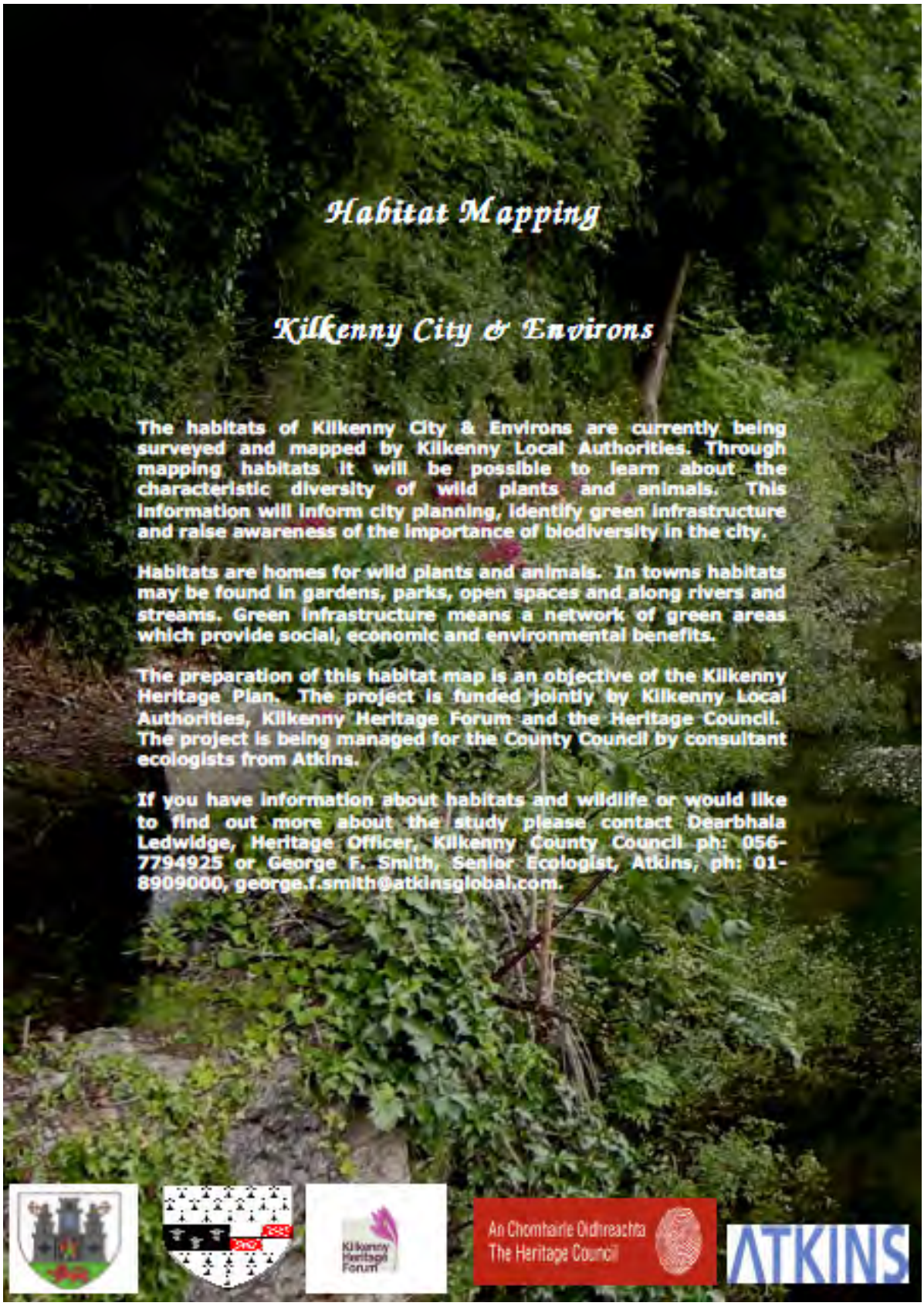
- Kilkenny County Council
- Kilkenny Borough Council
- National Parks and Wildlife Service
- Bat Conservation Ireland
- BirdWatch Ireland
- Irish Wildlife Trust
- Consultant ecologists with local knowledge
- Botanical Society of the British Isles
- Office of Public Works (Kilkenny Castle)
- An Taisce
- Keep Kilkenny Beautiful

In addition, the Kilkenny Heritage Officer prepared and circulated a leaflet (Figure C.1) to local groups introducing the project and requesting those with information about wildlife and habitats to contact the Heritage Officer or Atkins project staff. A number of individuals and organisations responded with information or queries about the project.

A public meeting was held on 14th July, 2010 in City Hall at which we requested any information members of the public could provide on habitats and biodiversity. The meeting also served to raise awareness of the project and Kilkenny's natural heritage. The meeting was advertised directly to local organisations, through KCLR local radio, and through the local newspapers *Kilkenny People, Kilkenny Reporter* and *Kilkenny Advertiser*. At the meeting, the Kilkenny Heritage Officer introduced the project, after which Atkins gave a short presentation outlining the results of the desktop research and field surveys carried out to date. This was followed by a wide ranging discussion on habitats of conservation interest in the study area and their management. Approximately 20 people attended the meeting.

A second public meeting will be held to present the findings of the survey.

Figure C.1 – Kilkenny habitat survey information leaflet



C.2 Desktop Research

A desktop review was carried out focusing on collection of all available data on the identity, abundance, location, quality, connectedness and other attributes of habitats present, particularly those of high international, national or local importance or that have the potential to support species of importance according to: -

- EU Habitats Directive (92/43/EEC)
- EU Birds Directive (79/409/EEC; as recently codified 2009/147/EC)
- Relevant legislation (e.g. Flora (Protection) Order, 1999), and
- Red Data books and lists (e.g. Curtis and McGough 1988, Kingston 2005 and Lynas et al., 2007).

Sites designated as being of conservation value (together with consideration of their associated qualifying interests and non-qualifying habitats and species of note) were reviewed including: -

- Special Areas of Conservation
- Special Protection Areas for Birds
- Natural Heritage Areas and former Areas of Scientific Interest (Young, 1972)

GIS shapefiles for the above designated areas within Co. Kilkenny were downloaded from the NPWS website.

A review of published and unpublished literature was undertaken in order to collate data on habitats and species of note in the study area. Documents or data sources reviewed are listed in Chapter 5 – References.

C.3 Initial Desktop Mapping

Prior to commencing field-based habitat mapping, a baseline assessment of previously recorded data was undertaken. Baseline information on the location, extent and distribution of habitats, has previously been recorded in an ad-hoc manner and compiled in a variety of different formats, including GIS datasets, other digital datasets, and published and unpublished literature (c.f. Chapter 5). Habitat data from these sources were compiled to prepare a preliminary habitat map in MapInfo v9.5 GIS. Ordnance Survey Ireland (OSi) vector mapping supplied by Kilkenny County Council was used to create a base map in combination with aerial photographic coverage. Baseline mapping used included: -

- OSi vector mapping (1:1000, 1:2500 and 1:5000 scales)
- OSi Discovery Series (1:50,000) mapping
- OSi aerial photographs (2005 and 2006 for Kilkenny City)

Preliminary habitat mapping made use of OSi vector mapping, converting polyline features to polygon features. Where necessary, open polyline features were manually digitised so that a complete coverage of polygons could be obtained for the study area. Once this baseline polygon map was complete, habitat types according to Fossitt (2000) were assigned to the polygons on a preliminary basis using the above desktop data and other information obtained from literature review and consultations.

Where digitising was necessary, this was done to existing OSi vector mapping features where possible. Where there was no corresponding OSi mapping feature present, then interpretation was done at a scale appropriate to the resolution of the base map.

Each dataset was constructed in such a way that makes the data easy to manipulate and amalgamate with other datasets. The production of standardised attribute data was designed by

Atkins in agreement with Kilkenny, making sure to follow *Best Practice Guidance* (Smith *et al.*, 2010). For example, habitats that cover a two-dimensional area, such as woodlands, fields, and built land, were represented by a polygon feature in the GIS dataset. Linear habitats, such as narrow watercourses, hedgerows and treelines, were represented by polylines in the GIS dataset. Each of these spatial feature types was stored as a separate layer in the dataset in an archivally stable format. The structure of the attribute table was designed so that the results of the survey can be mapped spatially by creating a thematic map (i.e. a map in which habitats are assigned a colour or fill pattern based on habitat type or other attribute value).

Habitat attributes included in the GIS datasets are listed in Tables C.1 and C.2 below. These attributes were taken from the minimum attribute fields list provided by Smith *et al.* (2010) supplemented by others as required by the objectives of the habitat survey.

Habitat mapping was undertaken using the ITM Coordinate Reference System and metadata were compiled following the EU INSPIRE Directive.

Table C.1 – Attributes in the GIS polygon dataset

Attribute	Description
OBJECT_ID	Unique numeric identifier for each polygon, polyline or point in the dataset.
FOSS_CODE	Alphanumeric habitat code as per the *A Guide to Habitats in Ireland* (Fossitt, 2000).
FOSS_NAME	Habitat name as per the *Guide to Habitats* (Fossitt, 2000).
BROAD_HABITATS	Broad habitat group, as per Table B.2 in Appendix B
DATA_QUALITY	Indication of data quality. Codes follow Smith *et al.* (2010). S = surveyed in field, V = validated in field (but not surveyed in detail), DA = recent high quality desktop data, DB = older high quality desktop data, DC = information from aerial photography review supplemented by other desktop data, DD = information from aerial photography only.
DATE	Date of field survey
ANNEX_CODE	Alphanumeric habitat code as per Annex I of the Habitats Directive (European Commission, 2007).
FOSSIT_QUALIFI	Habitat qualifier code identifying transitional habitats, subtypes or variants of *Guide to Habitats* types. Codes follow Smith *et al.* (2010).
AREA	Total area (m^2) of polygon
RARE_SPP	Presence (0 or 1) of species listed on any Irish Red Data book or list or species listed in Annex II of the Habitats Directive or Annex I of the Birds Directive
EVALUATION	Conservation evaluation as per NRA (2009) (see Table C.3)
THREAT_1 [11]	Threats to habitats of conservation interest following codes in Appendix E of Smith *et al.* (2010)

[11] Where more than one threat to habitat conservation was noted for a particular habitat polygon, individual threat codes have been listed separately in the GIS dataset to facilitate querying the data. No habitat polygon was noted to have more than three threats.

Attribute	Description
THREAT_2 [11]	Threats to habitats of conservation interest following codes in Appendix E of Smith *et al.* (2010)
THREAT_3 [11]	Threats to habitats of conservation interest following codes in Appendix E of Smith *et al.* (2010)
KEY_GI	Is the polygon a key area of Green Infrastructure identified as discussed in Chapter 3 (0 or 1)?
INVASIVE_EXOTICS	Invasive exotic species present (1) or absent (0). Species named under SPECIES.
PHOTO_ID	Photo ID numbeR
NOTES	Any other comments that are of relevance to the survey
SPECIES	Characteristic, notable or invasive species recorded during field survey or identified in desk study or consultations.

Table C.2 – Attributes in the GIS polyline dataset

Attribute	Description
OBJECT_ID	Unique numeric identifier for each polyline in the dataset
FOSS_CODE	Alphanumeric habitat code as per the *A Guide to Habitats in Ireland* (Fossitt, 2000). See Appendix B for codes
DATA_QUAL	Indication of data quality. Codes follow Smith *et al.* (2010).
DATE	Date of field survey (year.month.day)
FOSS_NAME	Habitat name as per the *Guide to Habitats* (Fossitt, 2000). See Appendix B for codes
LENGTH	Total length (m) of polyline
CONNECTIVITY	Connectivity of hedgerow with other hedgerows (See Table C.4 for scoring system). Evaluating using aerial photography.
_6_INCH	Is the hedgerow present on OSi 6 inch mapping
HEIGHT	Height of hedgerow (See Table C.4 for scoring system)
WIDTH	Width of hedgerow (See Table C.4 for scoring system)
GAPS	Gappiness of hedgerow (See Table C.4 for scoring system)
STRUCTURE	Structure of hedgerow (See Table C.4 for scoring system)
STRUCTURE_DIV	Structural diversity of hedgerow (See Table C.4 for scoring system)
BIRDVAL	Value of hedgerow for birds (See Appendix D for scoring system)
MANAGE	Is the hedgerow managed (See Table C.4 for scoring system)
NATIVE_SP	Number of native shrub species (See Table C.4 for scoring system)

Attribute	Description
PHOTO_ID	Photo ID number. Corresponds with OBJECT_ID number for each polygon
EVALUATION	Conservation evaluation as per NRA (2009) (see Table C.3)
KEY_GI	Key areas of Green Infrastructure identified as discussed in Chapter 3. Presence of "0" = not a green infrastructure area. Presence of "1" indicates a green infrastructure area.
NOTES	Any other comments that are of relevance to the survey
SPECIES	Characteristic or notable species recorded during field survey; also rare or notable species identified in desk study or consultations.

C.4 Field survey

Field surveys were carried out following preliminary mapping to validate the preliminary mapping and to survey habitats in more detail. Field surveys covered most of the study area, with the exception of some locations where good quality survey data were available from a recent survey. Private lands were only entered with permission of the landowner. This was obtained by personal contact on the day of the field survey, with the exception of the Kilkenny Castle grounds where permission was sought and obtained beforehand by correspondence with the OPW. A letter of introduction was provided to field surveyors by Kilkenny County Council to facilitate access (Appendix E). Where access was not possible, habitats were viewed from adjacent land, using binoculars where required; this is indicated in the GIS dataset by the entry "V" in the DATA_QUAL field.

Field surveys were carried out on 13th – 16th July and on 18th August, 2010.

The objectives of the field survey were to: -

- Validate preliminary desktop habitat mapping and correct habitat identification and boundaries where needed.
- Gather more detailed information as needed on ecological features of habitats, including species composition, conservation value and condition of habitats on the ground.
- Collect data on protected or rare species of outstanding interest.
- Collect information to allow for the identification of Green Infrastructure.
- Record alien invasive plant species.
- Take photographs of representative habitats.
- Evaluation conservation value and identify threats to natural heritage.

Prior to field survey, a customised field survey datasheet was prepared to facilitate error free data collection and assist the GIS specialist at a later stage with data entry (Appendix D). Data on habitats were collected using the field survey datasheets in conjunction with preliminary habitat maps. The latter were annotated in the field as required. Field surveyors were fully apprised of field methodology and data to be collected prior to survey.

We evaluated the nature conservation value of habitats according to the scale in the National Roads Authority's ecological impact assessment guidelines (NRA, 2009), reproduced in Table C.3 below.

In addition to mapping hedgerows throughout the study area, more detailed information was collected on a subset of townland boundary and roadside hedgerows. We used the methodology

employed by Tubridy and Muyllaert in their 2010 habitat surveys carried out to inform LAPs in Co. Kilkenny. This methodology was based on hedgerow assessments by Lyons & Tubridy (2006), Murray and Foulkes (2005) and Clements and Tofts (1992). Data were collected on woody species present, the average height and width of hedgerows, their gappiness, biodiversity value, age, number of layers, structural features, management and other features of ecological interest. Field data were collected using a standardised data sheet (Appendix D). Hedgerow connectivity was determined by inspection of aerial photography.

Following the Tubridy and Muyllaert methodology, a conservation value score was produced for each hedgerow according to the scale detailed in Table C.4. Under this scale, the minimum score is 5 and the maximum is 30:

- Score 5-10 indicates a hedgerow of *Low* conservation value
- Score 11-19 indicates a hedgerow of *Moderate* conservation value
- Score 20-30 indicates a hedgerow of *High* conservation value

Table C.3 – Ecological evaluation scale from NRA *Guidelines* (2009)

Ecological valuation: Examples
International Importance: ☐ 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. ☐ Proposed Special Protection Area (pSPA). ☐ Site that fulfills the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). ☐ Features essential to maintaining the coherence of the Natura 2000 Network.[4] ☐ Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. ☐ Resident or regularly occurring populations (assessed to be important at the national level)[5] of the following: ☐ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or ☐ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. ☐ Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). ☐ World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972). ☐ Biosphere Reserve (UNESCO Man & The Biosphere Programme). ☐ Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). ☐ Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). ☐ Biogenetic Reserve under the Council of Europe. ☐ European Diploma Site under the Council of Europe. ☐ Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).[6]
National Importance: ☐ Site designated or proposed as a Natural Heritage Area (NHA). ☐ Statutory Nature Reserve. ☐ Refuge for Fauna and Flora protected under the Wildlife Acts. ☐ National Park. ☐ Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. ☐ Resident or regularly occurring populations (assessed to be important at the national level)[7] of the following: ☐ Species protected under the Wildlife Acts; and/or ☐ Species listed on the relevant Red Data list. ☐ Site containing 'viable areas'[8] of the habitat types listed in Annex I of the Habitats Directive.

Table C.3 – cont'd

County Importance:

- Area of Special Amenity.[9]
- Area subject to a Tree Preservation Order.
- Area of High Amenity, or equivalent, designated under the County Development Plan.
- Resident or regularly occurring populations (assessed to be important at the County level)[10] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.
- County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP,[11] if this has been prepared.
- Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.
- Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

Local Importance (higher value):

- Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;
- Resident or regularly occurring populations (assessed to be important at the Local level)[12] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;
- Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (lower value):

- Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;
- Sites or features containing non-native species that are of some importance in maintaining habitat links.

Table C.4 – Hedgerow survey conservation value scoring system. Values in table cells are the criteria for assigning points for each hedgerow variable.

Variable	Points					
	0	1	2	3	4	5
Height		<1.5m	1.5-2.5m	2.5-4m	>4m	
Width		<1m	1.2m	2-3m	3m+	
Gaps	50%+	25-50%	10-25%	5-10%	<5%	no gaps
Number of native trees and shrubs		1-2	3	4 or more		
Structure		Shrub layer only	Shrub + herbs	Tree, shrub + herbs, open base	Tree, shrub + herbs, dense base	
Structural diversity	No bank/ditch	Bank only	Bank + ditch	Bank, ditch, stagnant water	Bank, ditch, flowing water	
Connectivity	No direct connections	Connection by water (ditch only)	1 connection	2 connections	3 connections	4 or more connections
Cultural value		Not on 1840s 6-inch map	On 1840s 6-inch map (but not townland boundary)		Townland boundary	

C.5 Data Entry and Finalising the GIS Dataset

Upon completion of field survey work, the preliminary GIS dataset was updated to include information gathered during the field survey. Field data were entered into the GIS habitat database as soon as possible after fieldwork. Digital field data from GNSS units and digital cameras were uploaded onto the server in Atkins' Dublin office. Photographs were given a unique ID reference number for entry into the GIS attribute table.

The final dataset was audited for quality control by thorough review of subsets of the data and by systematic analysis of the full dataset. The latter was carried out by compiling summaries of the data and identifying outliers and errors and by automated checking for errors in mapping polygons, such as overlaps, slivers and gaps.

INSPIRE Directive compliant metadata were produced for GIS datasets using the on-line metadata editor produced by the INSPIRE Metadata Drafting Team[12].

C.6 Constraints

There were no significant constraints on carrying out this study. During the field survey, access to some land was not possible. Where access was not possible, habitats were identified from a nearby vantage point if feasible, using binoculars if necessary. Otherwise, habitats were identified and mapped based on the results of previous survey or inspection of aerial photography. Level of field survey is indicated in the DATA_QUAL field in the GIS dataset.

[12] http://www.inspire-geoportal.eu

Appendix D – Field Survey Datasheets

Kilkenny Habitat Mapping 2010 Field Data Sheet										
Surveyor:				**Date:**						
Map Number:				**Survey Conditions:**						
Hab No	**Data Quality**	**Fossitt Code**	**IR Qualifer**	**Annex I Code**	**Rare Spp? (0 or 1)**	**Eval**	**Threats**	**Photo_ID**	**Green Infrastr (0 or 1)**	**Alien Species (0 or 1)**
Data Quality: V = simple validation in field (+/- remotely) **S** = survey- walkover										
Annex I Code: code as per interpretation manual										
Annex Spp?: Protected or Red Data species at global, European or national level. **0 =** No or **1 =** Yes and name under species column on underside										
Evaluation: I = International **N** = National **R** = Regional/ County Importance **HL** = Local Importance (Higher value) **LL** = Local Importance (Lower value) **0** = Negligible										
Threats: codes as per Natura 2000 codes **Corridor: 0** = No or **1** = Yes										

Kilkenny Habitat Mapping 2010 -Hedgerow Survey Methodology								
Surveyor:				**Date:**				
Map No:				**Surveyor Conditions:**				
Hedgerow No.	**Height**	**Width**	**Gaps**	**Structure**	**Structural Diversity**	**Bird Value**	**Management**	**Notable trees and shrubs**

Height: **1** <1.5m; **2** 1.5-2.5m; **3** 2.5 - 4m; **4** > 4m

Width: **1** <1m; **2** 1.2m; **3** 2-3m; **4** 3m+

Gaps: **0** 50%+; **1** 25-50%; **2** 10-25%; **3** 5 -10%; **4** <5% **5** no gaps

Structure: **1** Shrub layer only; **2** Shrub + herbs; **3** Tree, shrub and herbs, open base; **4** Tree, shrub and herbs, dense base

Structural Diversity: 0 No bank ditch; **1** Bank only; **2** Bank and ditch; **3** Bank, ditch, stagnant water; **4** Bank,ditch, flowing water

Bird Value: **1** Roosting habitat only; **2** Roosting feeding habitat; **3** Roosting feeding, nesting habitat

Management: 1 Short term unmgd (5 years); **2** Long term unmgd; **3** Box profile; **4** Cut one side; **5** Cut both sides; **6** A shape

Appendix E – Field Survey Letter of Introduction

Comhairle Chontae Chill Chainnigh
Halla an Chontae Sraid Eoin Cill Chainnigh

Kilkenny County Council
County Hall John Street Kilkenny

11th June 2010

Re: Habitat Assessment of Kilkenny City.

A Chara,

This is to confirm that Atkins consultants have been appointed by Kilkenny Local Authorities to carry out a Habitat Assessment of Kilkenny city.

In order to carry out the survey work, access will be required onto certain lands within the city and environs between June and August 2010. Survey work will be carried out by George Smith and Eamonn Delaney of Atkins. Kilkenny Local Authorities is seeking, and would appreciate your co-operation with regard to, access onto lands for the purpose of the study.

If you have any further queries please do not hesitate to contact me at 056-7794925.

Mise le Meas,

Dearbhala Ledwidge
Heritage Officer

Telephone: 056 7794000 Fax: 056 7794004 Email: info@kilkennycoco.ie Webpage: www.kilkennycoco.ie

LEGEND:

Study Boundary

Client:	Kilkenny County Council
Project:	Habitat Survey and Mapping of Kilkenny City
Title:	Study Area

Designed/Drawn:	Checked:	Authorised:
KOH	GS	JN
Date: 23.11.10	Date: 23.11.10	Date: 23.11.10

Drawing No: 2954 Figure 1.1

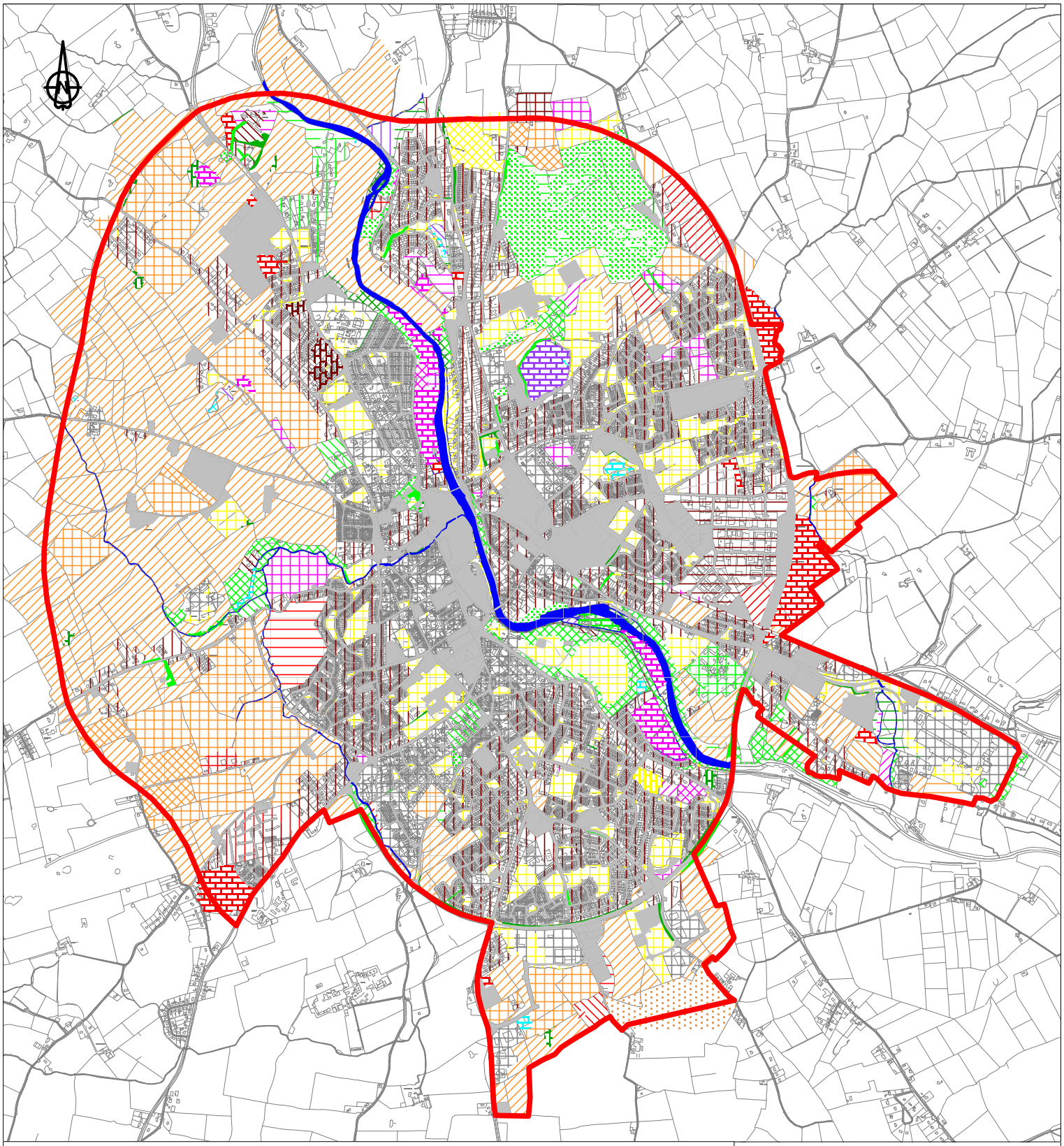
Rev: 1

ATKINS

An Chomhairle Oidhreachta The Heritage Council

The Councils of the City and County of Kilkenny

Kilkenny Heritage Forum



LEGEND: Habitats by Fossitt Code (Refer to appendix B for more details)

- BL3
- BL3 \ ED2
- BL3 \ ED3
- BL3 \ GA2
- BL3 \ GA2 \ WS3
- BL3 \ GS2
- BL3 \ WD5
- BL3 \ WS3
- BL3 \ WS3 \ GA2
- GA2 \ BL3
- GA2 \ BL3 \ ED2
- GA2 \ BL3 \ WL2
- GA2
- GA2 \ GS1
- ED2
- ED2 \ BL3
- ED3
- ED3 \ ED2
- ED3 \ GA1
- ED3 \ WS1
- FP1
- FS1
- FS1 \ FL5
- FS2
- GM1
- FW2
- FW4
- FL5
- FL8
- BC1
- BC2
- BC3
- GA1
- GA1 \ BL3 \ ED3
- GA1 \ ED3
- GA1 \ WS1
- GS1
- GS2
- GS2 \ BL3
- GS2 \ ED3
- GS2 \ WS1
- GS4
- WD1
- WD1 \ BL3
- WD2
- WD5
- WD5 \ BL3
- WD5 \ BL3 \ GA2
- WD5 \ BL3 \ WS3
- WL1
- WL2
- WN2
- WN5
- WN6
- WS1
- WS1 \ ED3
- WS1 \ GS2
- WS3
- Study Boundary

Client: Kilkenny County Council

Project: Habitat Survey and Mapping of Kilkenny City

Title: Habitat Map

Designed/Drawn:	Checked:	Authorised:
KOH	GS	JN
Date: 23.11.10	Date: 23.11.10	Date: 23.11.10

Drawing No: 2954 Figure 2.1 Rev: 1

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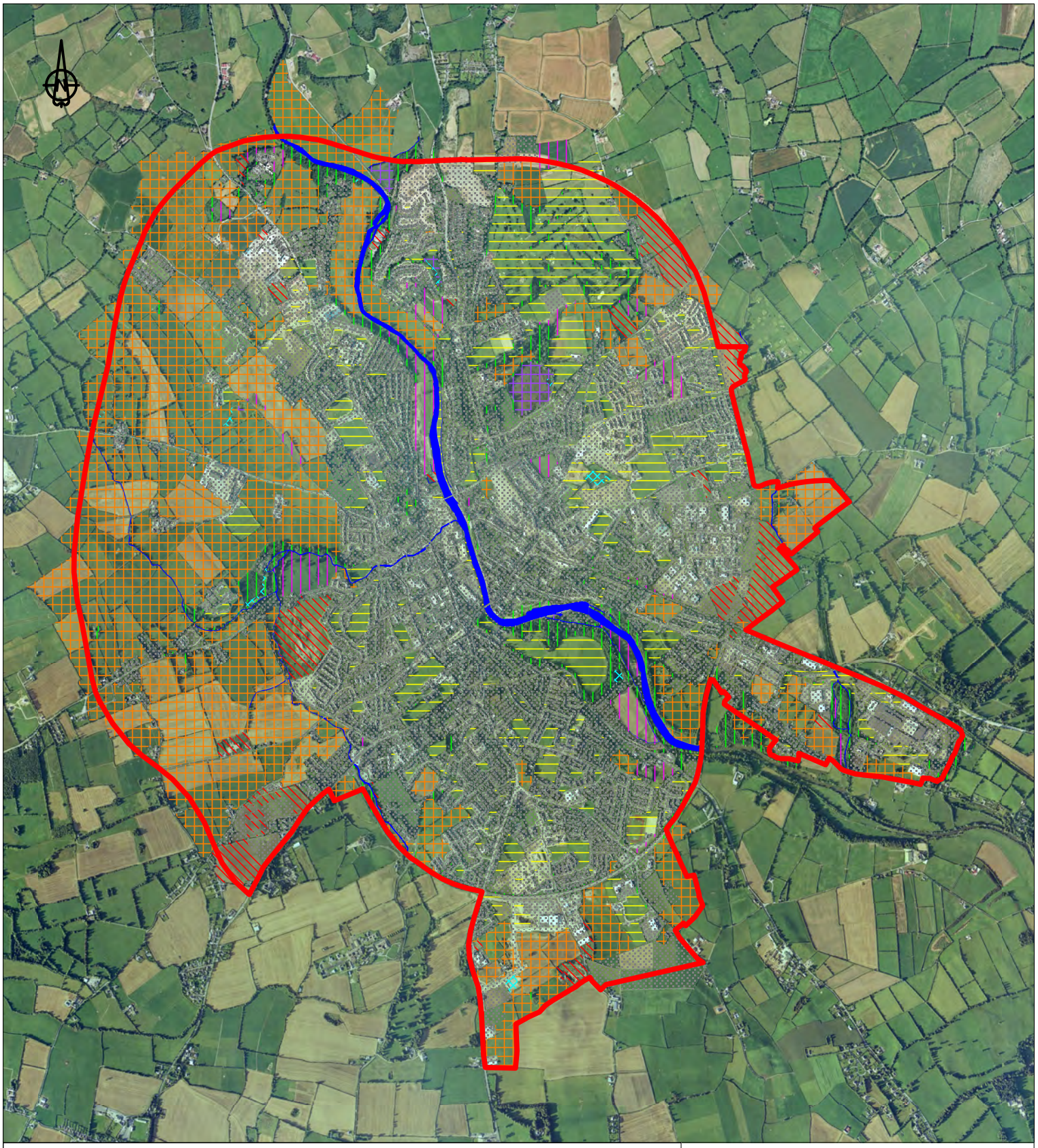
An Chomhairle Oidhreachta The Heritage Council

Kilkenny Heritage Forum

The Councils of the City and County of Kilkenny



LEGEND:

- Amenity Grassland
- Buildings & Gardens
- Disturbed Ground
- Intensive Agriculture
- Lakes & Ponds
- Rivers
- Semi-natural Grassland
- Wetlands
- Woodland & Scrub
- Study Boundary

Client:	Kilkenny County Council
Project:	Habitat Survey and Mapping of Kilkenny City
Title:	Broad Habitat Groups

Designed/Drawn:	Checked:	Authorised:
KOH	GS	JN
Date: 23.11.10	Date: 23.11.10	Date: 23.11.10
Drawing No: 2954 Figure 2.2		Rev: 1

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Kilkenny Heritage Forum

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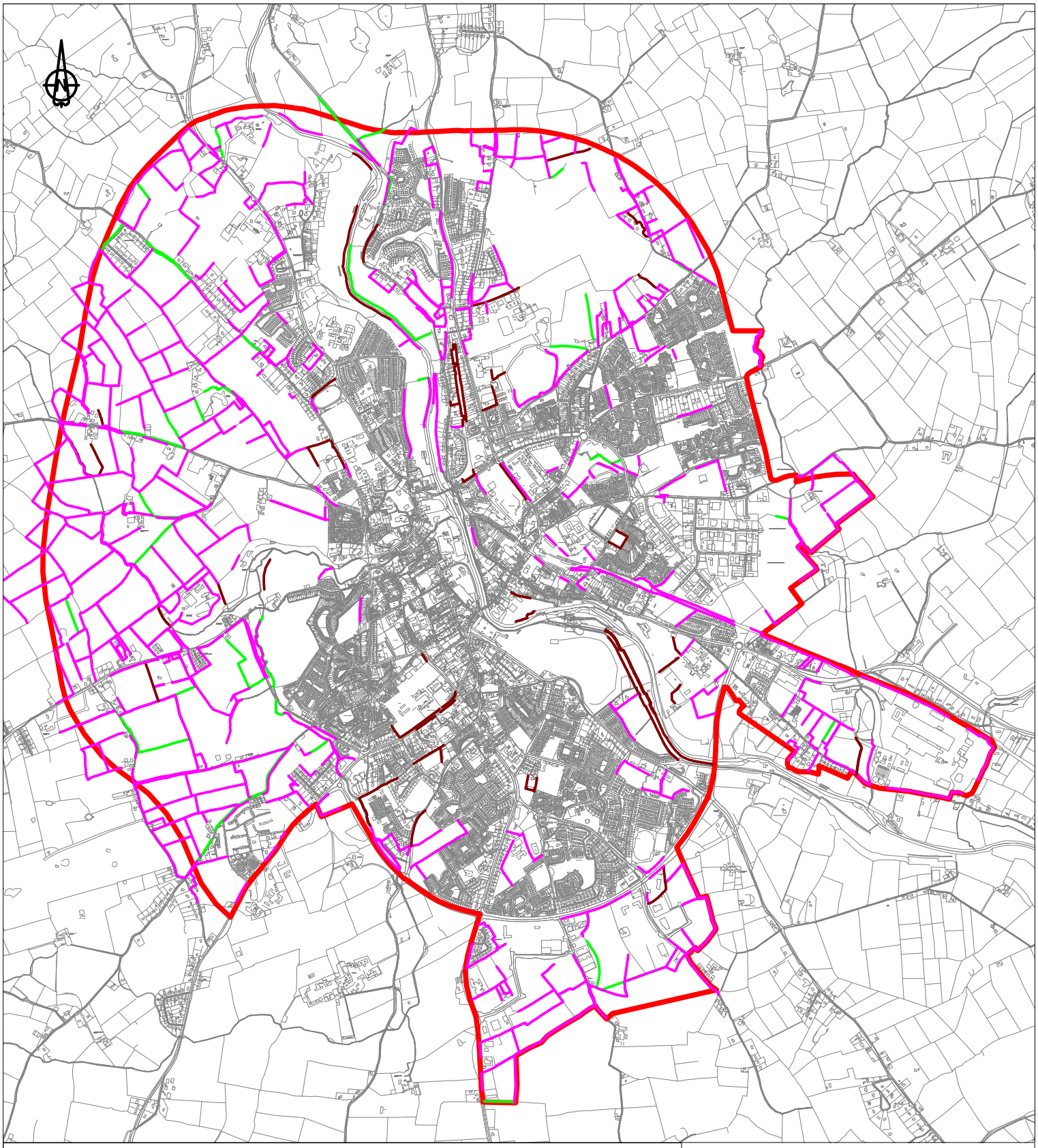

LEGEND:

- Study Boundary
- Surveyed Hedgerows (WL1)
- Hedgerows (WL1)
- Treelines (WL2)

Client:	Kilkenny County Council
Project:	Habitat Survey and Mapping of Kilkenny City
Title:	Hedgerows and Treelines

Designed/Drawn:	Checked:	Authorised:
KOH	GS	JN
Date: 23.11.10	Date: 23.11.10	Date: 23.11.10
Drawing No: 2954 Figure 2.3		Rev: 1

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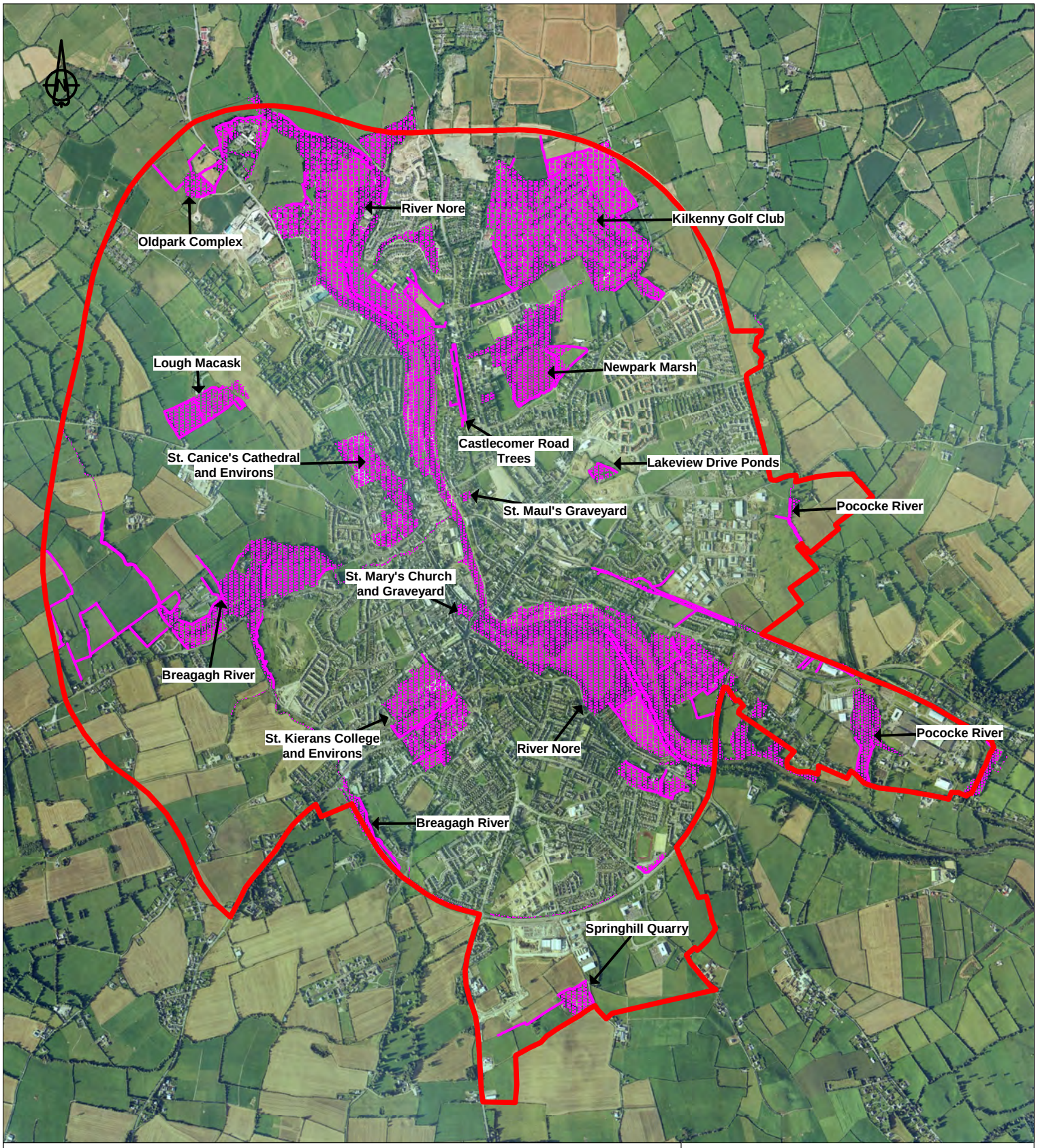

LEGEND:

Study Boundary

Key Green Infrastructure

Key Linear Green Infrastructure

Green Infrastructure Areas:
- River Nore
- Lough Macask
- Newpark Marsh
- St. Canice's Cathedral and Environs
- Breagagh River
- Pococke River
- Kilkenny Golf Club
- Springhill Quarry
- St. Maul's Graveyard
- St. Mary's Church and Graveyard
- Lakeview Drive Ponds
- St. Kierans College and Environs
- Castlecomer Road Trees
- Oldpark Complex

Client: Kilkenny County Council		
Project: Habitat Survey and Mapping of Kilkenny City		
Title: Key Green Infrastructure		
Designed/Drawn: KOH	Checked: GS	Authorised: JN
Date: 23.11.10	Date: 23.11.10	Date: 23.11.10
Drawing No: 2954 Figure 3.1		Rev: 1

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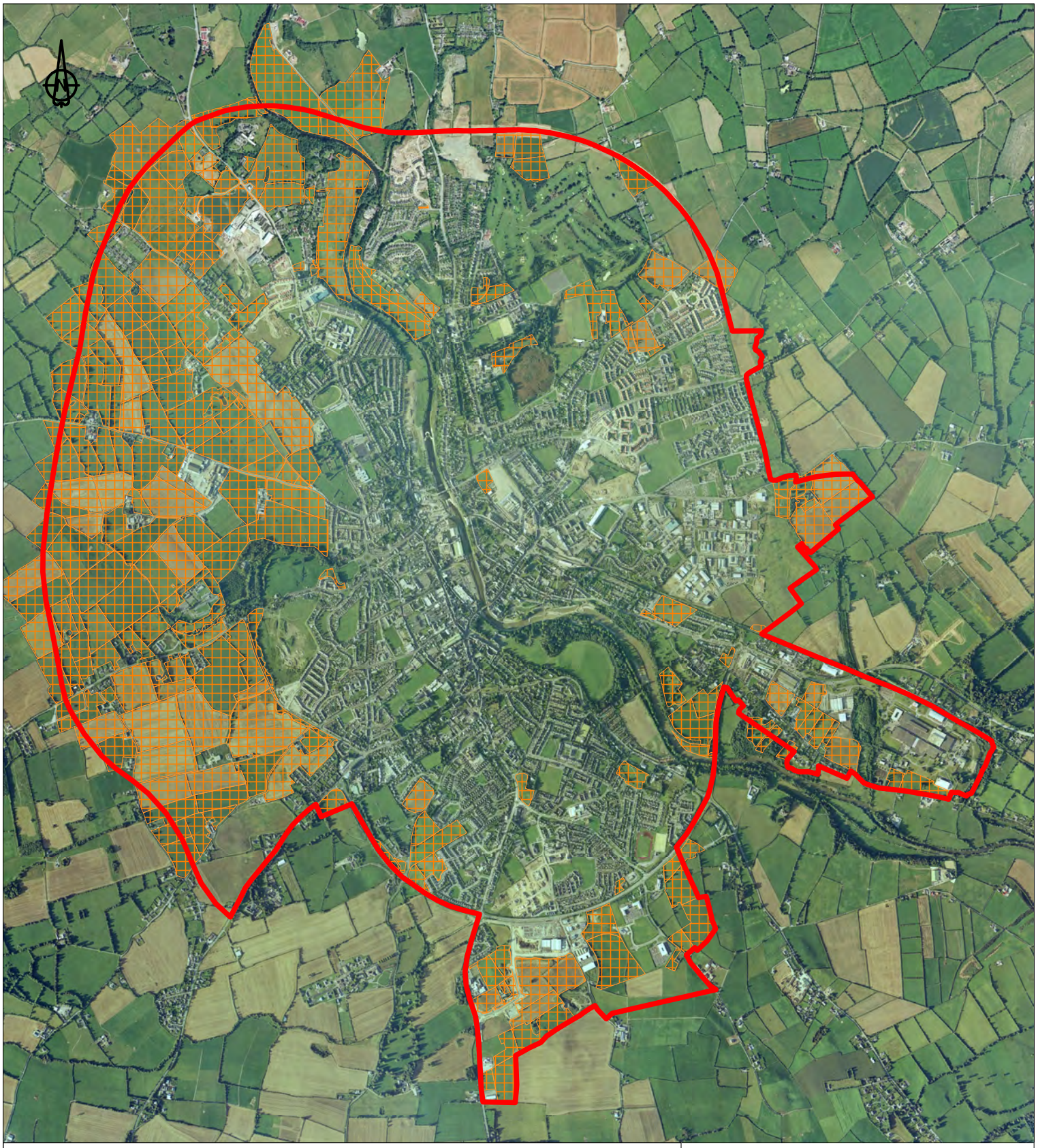

LEGEND:

Study Boundary

Green Infrastructure: Intensive Agriculture

Client:	Kilkenny County Council
Project:	Habitat Survey and Mapping of Kilkenny City
Title:	Green Infrastructure: Intensive Agriculture

Designed/Drawn:	Checked:	Authorised:
KOH	GS	JN
Date: 23.11.10	Date: 23.11.10	Date: 23.11.10
Drawing No: 2954 Figure 3.2		Rev: 1

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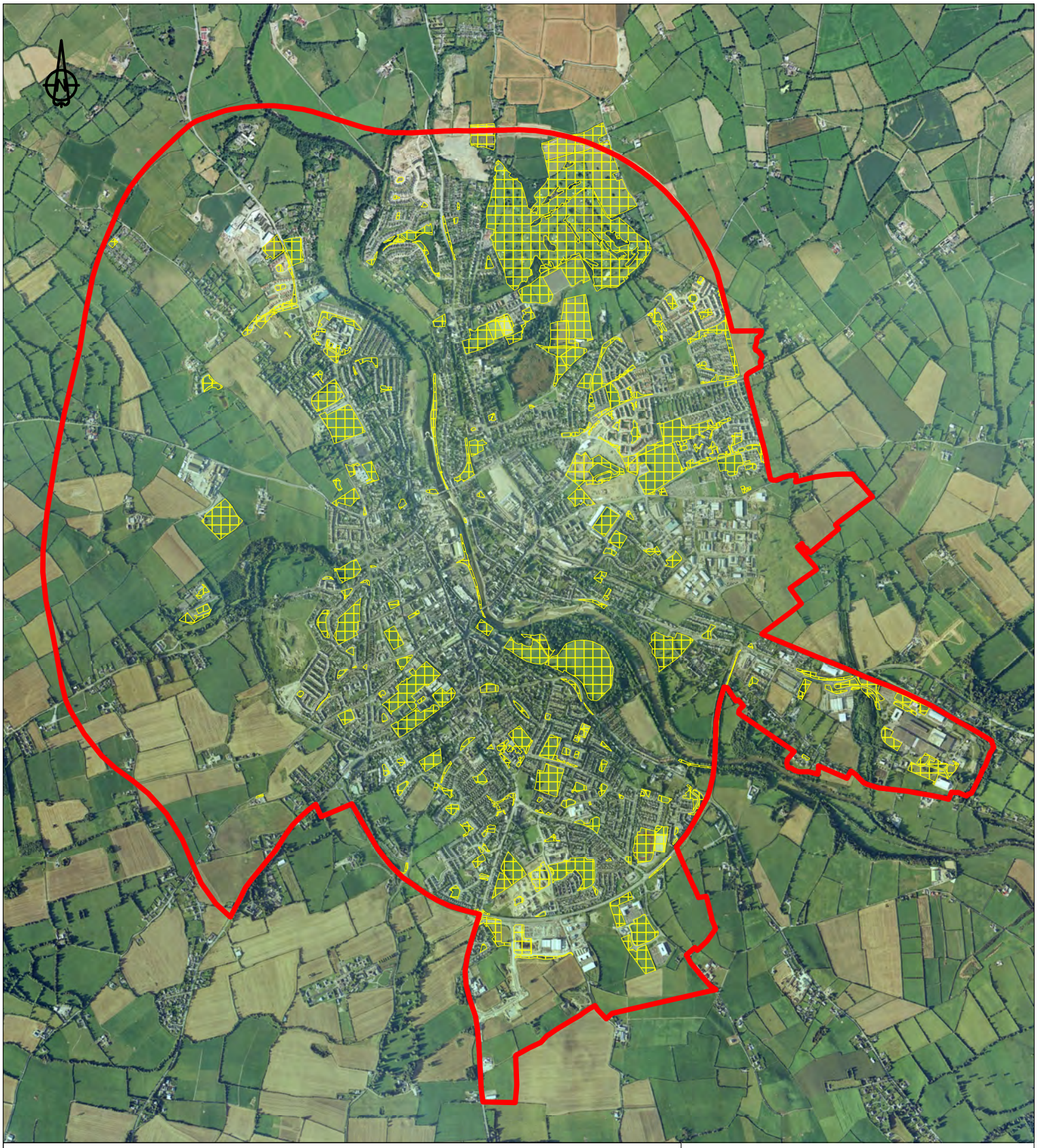

LEGEND:

Study Boundary

Green Infrastructure

Amenity Grassland

Client:	Kilkenny County Council
Project:	Habitat Survey and Mapping of Kilkenny City
Title:	Green Infrastructure: Amenity Grassland

Designed/Drawn:	Checked:	Authorised:
KOH	GS	JN
Date: 23.11.10	Date: 23.11.10	Date: 23.11.10

Drawing No:	Rev:
2954 Figure 3.3	1

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Atkins is one of the world's leading providers of professional, technology based consultancy services. With over 15,600 staff worldwide, Atkins has expanded in recent years from its historical base in traditional engineering into related technological consultancy services. In Ireland, Atkins can deliver the full range of services to clients in both the public and private sector.

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- Rail
- Water
- Architecture & Design
- Engineering
- Environment & Landscape
- Cost Management and Quantity Surveying

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