



Northwest Regional Development Agency

**The economic benefits of green
infrastructure – an assessment
framework for the NWDA**

April 2008



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1 Introduction

1.1 Background to the study

The vision for the North West, as outlined within the Regional Economic Strategy (RES), is that of *“a dynamic, sustainable international economy which competes on the basis of knowledge, advanced technology and an excellent quality of life for all”*. The Northwest Regional Development Agency (NWDA), within the RES, has recognised the importance of developing and enhancing the region’s green infrastructure as part of achieving this vision. Actions driving the development of green infrastructure include:

- Action 113 - To *“develop the economic benefit of the region’s natural environment through better alignment of environmental activities and economic gain.”* Developing a strategy for green infrastructure and transport corridors is advanced under this action;
- Action 116 - To *“create and manage the following regional parks:*
 - Mersey Waterfront;
 - East Lancashire;
 - Weaver Valley;
 - Ribble Estuary;
 - Northwest Coastal Trail; and
 - Wigan Greenheart.”
- Action 119 - To *“invest in quality public realm, green space and environmental quality”* in urban centres and in tourism focused project areas.

Despite its recognised importance, there is a need to provide a better understanding of the benefits that can be achieved through investment in green infrastructure and its potential contribution to RES priorities and target outputs and outcomes, including Gross Value Added (GVA). AMION Consulting has therefore been commissioned by the NWDA to research the economic value of green infrastructure.

1.2 Purpose of the research

The purpose of the research is, as such, to provide:

- an estimate of the benefits arising from investment in green infrastructure and regional parks in the North West context;
- an assessment framework and methodology which can be used to demonstrate the GVA benefits of proposals submitted to the NWDA and other public funding bodies; and
- a persuasive argument and headline figure that captures the value of green infrastructure and assists in promoting the value of investing in green infrastructure to others.

This report summarises the initial findings of the research, drawing on a comprehensive review of the literature and evidence base regarding the economic value of green infrastructure. It also presents an emerging assessment framework that provides a basis for the impact of green infrastructure projects and programmes to be appraised.

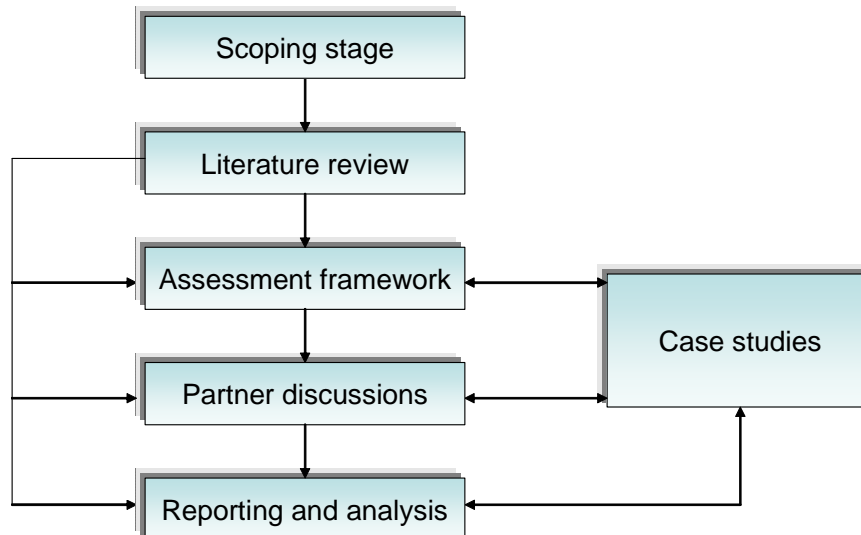
1.3 Research methodology

Our method of approach to the research comprises six main stages, which are described in turn below:

- scoping stage – an initial inception meeting has been held with representatives from the NWDA to discuss the requirements of the study and establish a common understanding of the issues to be addressed;
- literature review – a review of the literature with regard to the overall potential economic value of green infrastructure has been undertaken, encompassing the identification of the key economic, social and environmental benefits that can be generated through investing in green infrastructure;
- assessment framework – an assessment framework has been developed, consistent with that set out within the Economic Value of Urban Design report¹, that seeks to establish how to measure the impact of green infrastructure;
- case studies – the assessment framework will be applied to a number of case studies, demonstrating the benefits of green infrastructure and how the framework might be applied in practice;
- partner discussions / peer-review - discussions will be held with representatives from the NWDA and an expert reference group to ensure that the assessment framework meet the Agency’s and key partner’s requirements; and
- analysis and reporting – the initial results of the research are set out within this report. A final report will also be prepared that brings the results of the preceding stages together.

The approach is shown diagrammatically in Figure 1.1, below.

Figure 1.1: Approach



1.4 Structure of the report

The report presents the results of the research and continues in four sections as follows:

¹ AMION Consulting (2007)

- Section 2 – defines what is meant by green infrastructure and outlines the context to green infrastructure in the North West region;
- Section 3 – sets out the findings of the literature review, identifying the key benefits associated with investment in green infrastructure;
- Section 4 – describes the overall assessment framework, as well as a series of worked examples; and
- Section 5 – outlines the conclusions of the research.

2 Understanding green infrastructure

2.1 Introduction

This Section of the report focuses on defining the concept of green infrastructure. It firstly describes what is meant by green infrastructure, along with a typology of its various forms. The strategic role of green infrastructure is then outlined, in terms of both the national and regional policy context. Following this, the rationale for public sector intervention and green infrastructure's potential contribution to NWDA's key priorities, outputs and outcomes is identified. Lastly, an overview of the Regional Parks and Newlands programme, and how they fit into a network of green infrastructure, is provided.

2.2 What is meant by green infrastructure?

Green infrastructure comprises a large number of different physical environmental components such as open spaces, water courses and waterways, landscape features, green routeways, parks, gardens and natural habitats. Specific definitions of green infrastructure are therefore often wide ranging and relatively broad. The North West Green Infrastructure Guide defines it as:

"the region's life support system – the network of natural environmental components and green and blue spaces that lies within and between the North West's cities, towns and villages which provides multiple social, economic and environmental benefits".²

It can be inferred from this definition that green infrastructure encompasses both public and private assets and spans the breadth of the North West, ranging from inner urban areas to remote rural parts of the region. The function of these green infrastructure assets will differ depending upon their scale, form and location, with many elements of green infrastructure having multi-functional purposes. For instance, within an urban setting, the role of green infrastructure may be to complement the built environment and/or stimulate economic activity, whilst in a rural location the purpose of green infrastructure may be more closely linked to environmental concerns, such as biodiversity.³

The multi-functional nature of green infrastructure is such that it is necessary when developing an assessment framework to determine the different typologies of green infrastructure. A comprehensive green infrastructure typology has been outlined by ECOTEC Research and Consulting, as part of a review of the evidence base concerning the possible links between investment in green infrastructure and economic benefit.⁴ The typology, set out in Box 2.1 overleaf, is broadly consistent with that identified within the North West Green Infrastructure Guide.

A broad spectrum of economic, social and environmental benefits can be attributed to each individual type of green infrastructure, based on the varying functions of the green infrastructure in question. These are discussed in more detail in Sections 3 and 4. The nature of their contribution to achieving identified regional priorities will also vary, along with the scale of impact. Nevertheless, each component of green infrastructure, including those with less tangible benefits, form an integral part of the region's environmental offer.

² North West Green Infrastructure Think Tank (2007)

³ EMRA (n.d.)

⁴ Ecotec (2008)

Box 2.1 – Green infrastructure typology⁵

Type of Green Infrastructure	Sub-sets (examples)
▪ parks and public gardens	
▪ general amenity space	village greens, doorstep greens
▪ outdoor sports facilities	golf courses, sports pitches, playing fields
▪ woodland	copses
▪ water courses	rivers, streams, canals, wetlands, lakes and ponds
▪ mountain, moor, heath and downland	
▪ coastal habitat	dunes
▪ agricultural land	arable, pasture, horticulture, non-food crops
▪ allotments	community gardens/orchards and urban farms
▪ cemeteries	churchyards and burial grounds
▪ derelict land	derelict, under utilised and neglected land
▪ private gardens	
▪ street trees	trees with preservation orders
▪ transport corridors	roadside verges, railway embankments

2.3 Strategic role of green infrastructure

The importance of green infrastructure in achieving sustainable economic growth and in creating attractive communities in which people want to live, work and visit is reflected in its increasingly prominent role in regional and national policy. A summary of the key policies and strategies that support the development and enhancement of green infrastructure is set out below.

(i) National policy

The **Urban White Paper**, ‘*Our Towns and Cities: the future*’, committed the Government to putting people first and easing the pressure on the countryside by bringing people back into town and city centres. Among the central issues raised in the Paper was the development of brownfield land so that it is fit for new purposes such as clean open recreational space. The Paper also promoted the provision of well-managed public open spaces as part of improving the local environment. A key focus of the White Paper in on achieving sustainable economic growth through engaging local people in partnerships to help tackle problems such as poor environments.

The Government’s strategy on the future of the countryside has been set out in the **Rural White Paper**, ‘*Our Countryside: The Future – A Fair Deal for Rural England*’. This Paper identifies a substantial urban fringe agenda covering green space, social inclusion and

⁵ Ecotec (2008)

landscape improvement measures in recognition of the opportunities provided by the urban fringe to secure major benefits to urban and rural populations. The Government's rural policy objectives, as set out in the Paper, include the need to "conserve and enhance rural landscapes and the diversity and abundance of wildlife" and "increase opportunities for people to get enjoyment from the countryside".

The **Sustainable Communities Plan**, '*Sustainable Communities: Building for the Future*', is the Government's action plan for developing sustainable communities. The Plan sets out a vision to create strong and sustainable communities which are places where people want to live and work. Within this vision, creating attractive towns, cities and public places in order to encourage people and investment back into deprived areas is seen as fundamental. The Plan advocates well designed public spaces and improvements in the local environment to revitalise communities and create attractive places with a high level of liveability.

The **Urban Green Spaces Taskforce Report**, '*Green space, Better Places: Final Report of DTLR Urban Green space Task Force*', highlighted the need for an effective national framework for urban parks and green spaces. The report emphasised how the decline in the quantity and quality of urban green spaces across England has brought about a weakening of community coherence and a reduced quality of life. The importance of increasing the provision of greenspaces was seen as crucial in bringing forward significant economic and social benefits including tangible improvements in health, social cohesion, education and environmental sustainability.

A strategy for sustainable development has been produced by Government that identifies new shared priorities for sustainable development across the UK. The **UK Sustainable Development Strategy**, '*Securing the Future – delivering UK sustainable development strategy*', highlights four main priorities: sustainable consumption and production; climate change; natural resource protection; and sustainable communities. The enhancement of green infrastructure will contribute to achieving each of these priorities. In particular, the Strategy promotes the protection of natural resources and the enhancement of the environment, highlighting the need for effective and accountable management of environmental resources.

(ii) Regional Policy

The **Climate Change Action Plan** for the North West sets out a vision for the region and associated outcomes to be achieved by 2020. The vision is for a low carbon, well adapted region, with key actions to advance the vision attributed to a range of stakeholders. A key action set out in support of this vision is the preparation of a scoping study to assess the potential for green infrastructure, including regional parks, to adapt and mitigate for climate change impacts. It indicates that the findings should influence future strategy and implementation. As such, green infrastructure is identified as an integral part of a coordinated response to mitigate climate change within the North West region.

The **Regional Economic Strategy** (RES) for the North West sets out the 20 year vision for the region and the priorities and objectives for economic growth. Within the RES green infrastructure is identified as an important resource with a role in facilitating the three identified strategic drivers:

- *improve productivity and grow the market*, increasing the GVA per person employed by promoting enterprise, including social enterprise, and working with companies to invest in product, process and market innovation, internationalisation, leadership and management, ICT and sustainable production, as well as working with individuals to develop higher level skills;

- *grow the size and capability of the workforce*, getting more people working and encouraging all forms of economic activity within the most deprived communities in the region; and
- *sustainable growth*, investing in the regions environment, culture and infrastructure, improving quality of life, tackling deprivation, valuing diversity and social inclusion, and recognising the wider social and environmental implications of economic growth.

The RES also sets out specific actions required to advance the vision over a three year period. The development of a strategy for green infrastructure is promoted through transformational action 113, to: “*Develop the economic benefit of the region’s natural environment through better alignment of environmental activities and economic gain*”. The development of regional parks is advanced through action 116, with six parks identified including Mersey Waterfront and the Weaver Valley.

The **Regional Spatial Strategy** (RSS), which sets out the broad planning framework for the North West, also highlights the importance of green infrastructure. Policy EM3 indicates that all plans and strategies should promote green infrastructure networks, along with the implementation of new green spaces through development and regeneration schemes. Further to this Policy EM4 promotes the development of the regional parks agenda, seeking to identify and advance viable parks where they will assist the urban renaissance agenda. More generally, the RSS sets out a range of policies seeking to enhance the environment and facilitate its management. It includes policies relating to land management, integrated water management, energy conservation and renewable energy.

The **North West Green Infrastructure Guide** has been prepared in support of policy EM3 of the RSS. This guide defines the concept of green infrastructure in the context of the North West and identifies the key benefits associated with an integrated and coordinated approach to planning green infrastructure. It provides a detailed step by step guide to planning green infrastructure, setting out a number of case studies to illustrate best practice in the planning process. It is particularly focused at planning authorities, seeking to inform the process of preparing the local development framework.

2.4 The need for public sector intervention

The rationale for public sector intervention will normally involve justifying an activity in terms of its expected impact on economic efficiency, or in terms of stated Government policy objectives (such as social objectives), or some combination of the two. In the case of environmental projects the rationale is often based upon the correction of a market failure⁶ and the enhancement of the quality of life of specific groups (equity).

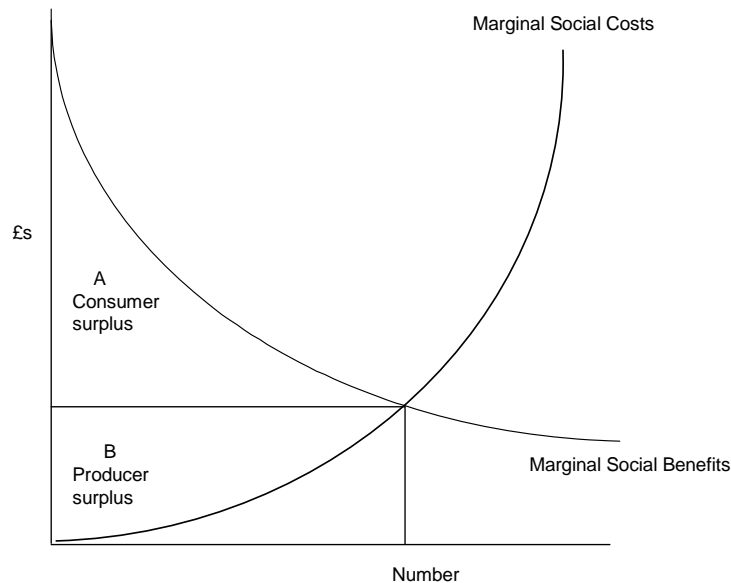
Improvements in economic efficiency involve the allocation of scarce resources in order to enhance utility – in other words, to secure the highest possible net social welfare. This will be greatest where consumer surplus⁷ and producer surplus⁸ are maximised, as shown in Figure 2.1. The market system reconciles the allocation of the factors of production and commodities through the price mechanism. The economically efficient level of output is that where marginal social benefits equal marginal social costs.

⁶ Market failures can arise as a result of: externalities, imperfect information, market power and public goods.

⁷ **Consumer surplus**: the extra utility gained by consumers from paying the actual price for a good, which is lower than that which they would have been prepared to pay.

⁸ **Producer surplus**: the additional earnings obtained by producers for a good that is at a price higher than they would be prepared to sell.

Figure 2.1: Marginal social costs and benefits



In many situations, the equilibrium outputs determined through the market mechanism (including the provision of green infrastructure) will be the economically efficient level of output. However, there are circumstances where market prices are a poor indicator of social costs and benefits, such as:

- where market failures occur – in terms of green infrastructure, the principal sources of market failure will include:
 - negative externalities – a rationale for public sector intervention is provided by the negative externalities associated with neglected land. Neglected land can lead to a downward spiral of environmental and economic conditions, increasing hazards to health and deterring new economic activity. Market failure exists because the market does not reflect these costs. Owners do not pay for the environmental and economic degradation inflicted on others by neglected land and, therefore, do not factor these costs into the decisions they make. Consequently, an efficient outcome cannot occur;
 - positive externalities – a further cause of market failure is provided by the existence of positive externalities, external benefits that would not be fully retained by a private developer or landowner. The development and enhancement of green infrastructure will result in significant positive externalities, including the benefits derived from improving the image of a particular area, as well as potential health, educational and wider environmental benefits. These benefits would not be fully taken into account by private developers or land owners and, as such, there is likely to be an under supply of green infrastructure in the absence of public sector investment;
 - risk, uncertainty and imperfect information – there is a degree of uncertainty regarding the benefits of green infrastructure. This is partly due to the intangible nature of many of the benefits generated by green infrastructure, although even where there is a readily available market price, such as changes in property values, it may not be clear what the impact of green infrastructure will be due to a limited evidence base. The private sector is

likely to be deterred from investing in green infrastructure where such uncertainty exists.

- where government failures occur – the government itself may not efficiently allocate goods and/or resources; and
- where goods are not traded in markets and their benefits can be experienced by users and non-users – because greenspaces can be seen as a public good⁹, without public sector intervention, the market may not provide a sufficient supply.

In the absence of public sector intervention to correct market failures and address missing markets, economic value will not necessarily be maximised. That is, where market failures exist, the allocation of resources will not be economically efficient and, as such, there is the potential to increase social welfare through public sector intervention. Consequently, there is a rationale for intervention by the NWDA and/or its key partners to develop and enhance the region's green infrastructure.

The other rationale for public sector intervention is based upon arguments about equity or the unequal distribution of wealth. The rationale for much regeneration activity is based upon such equity arguments. Whilst the need for public sector intervention in terms of economic efficiency is supported by the existence of market failures and the presence of missing markets, even when the market mechanism is working perfectly there is no guarantee that the outcome will be considered an equitable one. The role of the public sector, from this viewpoint, is to intervene in order to improve justice or fairness in the way goods and services are distributed.

Investment in green infrastructure can assist in addressing high levels of deprivation. As described in more detail in Section 3, it can help to, for example, stimulate economic activity, attract greater levels of inward investment and improve the external image of an area. Green infrastructure can also generate a range of social benefits, such as improved community cohesion and an enhanced quality of life. There is therefore an equity rationale for public sector investment in green infrastructure, particularly within areas suffering from severe levels of deprivation.

2.5 Contribution to NWDA's key priorities, outputs and outcomes

Green infrastructure's overall strategic importance, including its contribution to the vision set out in the RES, is highlighted by the above policy context section. More specifically, the development and enhancement of green infrastructure supports the key priorities for the region and NWDA's core outputs and outcomes. For example, investment in the development and enhancement of green infrastructure can help to achieve the regional targets set out within the RES. These are shown in Table 2.1.

⁹ Public goods are 'non rival' – in other words, consumption of a good by one individual does not reduce the amount of the good available for consumption by others. Pure public goods are also non-excludable; thus it is not possible to exclude individuals from the good's consumption. "An example of an environmental public good is public open space, which nobody would provide on their own, even through everybody benefits from it being available" (HM Treasury, November 2002, Tax and the environment: using economic instruments).

Table 2.1: Regional targets set out in the RES		
	Target over the period 2006 - 2009	Longer term ambition (2026 or earlier)
1. GVA growth	Achieve GVA growth above the England average	Close the GVA/head gap with the England average
2. Job creation	Create 150,000 net new jobs, 80,000 of which should be in 'knowledge' occupations to bring the proportion of people working in these occupations up to the England average	To have a higher proportion of people in 'knowledge' occupations than the England average
3. Firm formation (measured by VAT registrations)	Raise the firm formation rate to 21,000 per annum	To have the same firm formation rate and business stock as the England average
4. No. qualifications	Reduce the number of working age people with no qualifications by 80,000 and ensure no district has more than 29% with no qualifications	To have the same proportion of the population with no qualifications as the England average, and to eliminate major sub-regional variations and variations between key groups
5. Graduate qualifications	Increase the number of people in the workforce with graduate qualifications by 120,000 in order to meet the England average	To have a higher proportion of people in the workforce with graduate qualifications than the England average
6. Employment rate	Increase the number of people in the workforce by 83,000 in order to meet the England average employment rate, and ensure no district has an employment rate less than 68%	To achieve a regional employment rate of 80% by 2020, and eliminate major sub-regional variations and variations between key groups
7. Deprivation	Reduce the number of areas in the worst 5% deprived, nationally	To have less than 20% of people with a household income of less than 60% of the GB median by 2020
8. CO ₂ emissions	Reduce CO ₂ emissions per unit (£) of GVA	To meet Kyoto targets by 2012, to reduce CO ₂ emissions to 12.5% below 1990 levels

As detailed in Section 3, green infrastructure has the potential to generate a range of benefits, stimulating increased economic activity, employment growth and business development. The enhancement of green infrastructure can also help to address problems of deprivation and worklessness, as well as contribute towards improved climate change mitigation and adaptation. In addition, a number of key priority actions contained within the RES will be supported by a strategic coordinated approach to developing the region's green infrastructure, including:

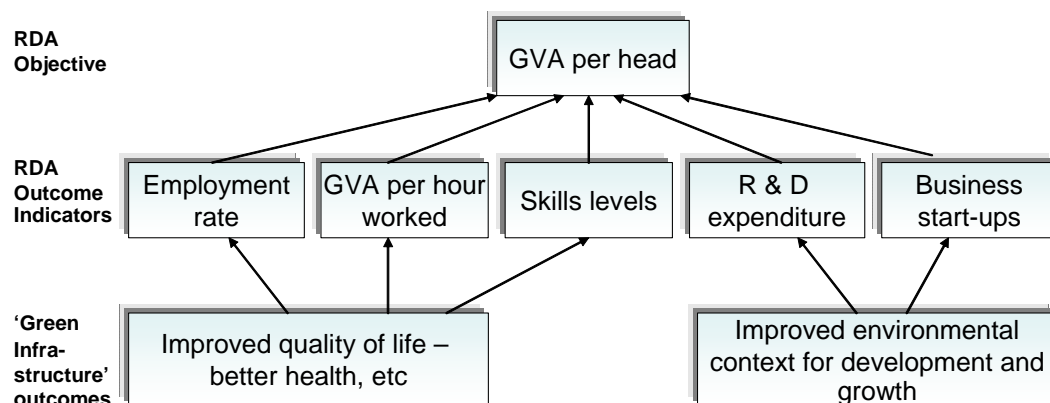
- PA51: diversify the economic base and support sectors with growth potential in the rural economy, focusing on the lagging rural areas of Allerdale, Copeland, Lancaster and West Lancashire. The development of green infrastructure will, for example, allow markets to develop in renewable energies and strengthen the tourism market;
- PA56: implement plans to ensure ongoing growth in the rural economy as part of the Regional Rural Delivery Framework. Through the development and enhancement of green infrastructure opportunities will be provided in rural economies for growing the renewable energy and tourism sectors;
- PA57: identify, and contribute to minimizing or removing, the major causes of ill health in the region. Green infrastructure is a valuable resource for physical activity and can therefore provide significant health benefits;
- PA59: promote access to support and physical activity to improve health, employee fitness and increase productivity. The provision of green infrastructure will help to ensure that physical activity levels increase;

- PA84: develop new uses for brownfield land, including the creation of new strategic greenspace;
- PA91: develop and implement the Northwest Energy Strategy with a focus on, among others, alternative sources of energy. Green infrastructure can provide an important source of renewable energy;
- PA101: improve the product associated with the region's tourism 'attack brands' and 'signature projects'. Green infrastructure is a significant element within the North West's visitor experience;
- PA113: develop the economic benefits of the region's natural environment through better alignment of environmental activities and economic gain. Green infrastructure offers opportunities for economic benefits through, for example, the leisure economy;
- PA115: deliver sustainable growth through use of the region's heritage environments and assets. Green infrastructure is an important asset to the region and can play a key role in achieving sustainable growth;
- PA116: create and manage Regional Parks;
- PA117: implement the Regional Forestry Framework;
- PA119: invest in quality public realm, greenspace and environmental quality; and
- PA122: protect existing areas of high economic value from flooding. Green infrastructure offers protection against flooding and can reduced the requirements for costly engineering solutions (see Section 3).

The Review of Sub-National Economic Development and Regeneration¹⁰ identified RDAs as the principal delivery agents for increasing regional GVA per head. This measure therefore needs to be the 'ultimate' quantified outcome for assessment of RDA interventions. The Review also identified five 'underpinning' outcome-focused performance indicators – namely, GVA per hour worked; employment rate; skills levels; R&D expenditure; and business start-up rates. The current RDA Tasking Frameworks are due to be replaced with a simplified outcome and growth-focused framework, defined by a single overarching growth objective – GVA per head.

A major challenge for this assessment framework, while recognising the 'legitimacy' of other impacts and outcomes, is to relate green infrastructure interventions, where possible, to the overall RDA outcome measures. An overview of the possible relationships is provided by Figure 2.1.

Figure 2.1: Green infrastructure outcomes and RDA objectives: Indicative relationships



¹⁰ HM Treasury (2007)

Furthermore, the development and enhancement of green infrastructure will contribute to the achievement of a range of emerging NWDA objectives and outcomes. The most relevant of which are set out in Table 2.2 below.

Table 2.2: NWDA objectives and outcomes		
RES factor	Objectives	Outcomes / Indicators
Health	<ul style="list-style-type: none"> ▪ Fewer working days lost to sickness and fewer people prevented from working by ill health. ▪ Reduced numbers of claimants of invalidity benefit. 	<ul style="list-style-type: none"> ▪ Reduction in days lost per employee per year through sickness absence. ▪ Proportion of the working age population claiming Incapacity Benefit.
Land Use	<ul style="list-style-type: none"> ▪ Develop new uses for brownfield land to improve effective land use and the appearance of our region. 	<ul style="list-style-type: none"> ▪ Reduced amount of previously developed land that has been vacant or derelict for more than 5 years
Culture and Image	<ul style="list-style-type: none"> ▪ Promote the image of the region, maximising cultural and major event opportunities and the quality of the visitor and resident experience. 	<ul style="list-style-type: none"> ▪ Increased GVA value of the visitor economy to the region. ▪ Improved performance in business survey regarding the region as a good place to operate/invest.
Environment	<ul style="list-style-type: none"> ▪ Realise and nurture the natural and built heritage assets. ▪ Improve the physical environment. 	<ul style="list-style-type: none"> ▪ Improved ratings in ENCAMS' Local Environmental Quality survey, with a lift in the overall 'target index' score. ▪ Increased GVA of the natural environment. ▪ Increased average rental levels in the three cities, five growth centres and four areas remote from growth.

2.6 NWDA's Regional Parks and Newlands programme

In response to objectives set out within the regional policy framework, two strategic green infrastructure responses have been developed within the North West. Whilst these projects have not been rolled out within the context of an over-riding green infrastructure framework, they have been advanced at a regional level and seek to achieve social and economic value through investment in environmental quality.

(i) Regional Parks

The establishment and development of regional parks was initiated through the 1999 RES. The development of the regional parks has since been identified as a priority action through both the RES and RSS. The 2006 RES seeks to advance the creation and management of six regional parks: the Mersey Waterfront; East Lancashire; East Lancashire; Weaver Valley; Ribble Estuary; Northwest coastal Trail; and Wigan Greenheart. It is anticipated that investment in regional parks will deliver image and regeneration benefits, primarily through increasing visitor numbers.

The Mersey Waterfront Regional Park has been in operation since 2002, and comprises over 70 miles of coastline extending across the city region. The park encompasses Liverpool City centre waterfront, and extends from Southport to the River Dee. The identified ambition of the park is "...to become a local, national and internationally renowned location – where communities and commerce thrive together in an inspiring natural setting". The Regional Park encompasses and attempts to connect a diverse range of environments, from the urban landscape of the city centre to areas of internationally significant habitat. It links zones of high population density with high quality green spaces. The strategy for the park is advanced along three themes: regeneration; recreation; and preserving and protecting the environment.

Understanding the real value of green infrastructure will provide a supporting rationale for investment in other regional parks. It will also enable the development of the proposed regional parks to be shaped to ensure that investment in the quality of the environment across the park zones results in key economic and social benefits.

(ii) The Newlands programme

Newlands has become one of the largest green regeneration schemes in the UK following total investment of £59 million. It is a unique scheme reclaiming large areas of derelict and underused land across England's North West, transforming it into thriving community woodlands. The programme was initially focused within the Mersey Belt, but following additional funding allocated in 2007 it has been rolled out across the region. It is anticipated that this investment will result in the remediation of more than 900 hectares of brownfield land.

The programme seeks to maximise key benefits from investment in environmental remediation, chiefly through the Public Benefit Recording System. This system gives a public benefit score across a range of social, economic and environmental factors and attributes. Newlands is identified as having an impact at both the local and the regional level, including increased land values, the improvement of Housing Market Renewal areas and deprived wards, and the attraction of businesses to some of the key hubs of the North West region.

Box 2.2: The Newlands programme at Moston Vale

The Newlands site at Moston Vale in Harpurhey, Manchester (an area within the most deprived 5%, as identified by the Index of Deprivation), received £1.7 million in August 2005. Its development, including the remediation and re-landscaping of the former landfill site, the creation of extensive solar powered floodlit pathways, woodland areas, and sports facilities, is intended to drive significant added investment to the area; enhancing the adjacent Central Park Business Park and adding value to the local Housing Marketing Renewal area.

3 Economic value of green infrastructure

3.1 Introduction

The focus of this section of the report is on the economic value of green infrastructure. It discusses what is meant by economic value and how it can be measured through the use of various techniques. The economic, social and environmental benefits of green infrastructure are then identified, drawing upon the findings of the literature review. Whilst much of this literature is qualitative in nature, the potential quantitative impacts of green infrastructure are highlighted where evidence is available.

3.2 Defining economic value

The term 'economic value' can mean different things to different people. For example, it can be used to describe the additional Gross Value Added (GVA) arising from a project or be related to the profit achieved from a given development. For the purposes of this framework though we have used the broad definition of economic value as a measure of welfare or utility.

The welfare of both society and the individual are dependant upon a number of economic factors, but also a range of other concerns. Whilst the income earned by an individual or the GVA created within a society will represent a significant element of the level of welfare achieved, additional issues, such as health and the environment, will also have an important impact on welfare. Furthermore, the public sector invests regeneration funding in projects in order to reverse social and physical decay, as well as economic decline. The 'return' it is seeking from its investment is therefore normally in the form of a number of different benefits, including for example:

- **economic** – job creation, business formation and confidence building / market renewal;
- **social** – community cohesion and educational or health related benefits; and
- **environmental** – biodiversity, energy efficiency and sustainability.

Regeneration funding bodies will therefore be interested in the wider social and environmental impacts of a project or programme, in addition to the narrowly defined economic impact. On this basis, it is helpful to structure an impact assessment using the framework of sustainable development, where economic value is defined as comprising of not only purely economic concerns but also social and environmental factors.

Moreover, the total benefits of a good or service to all relevant individuals and groups make up its economic value. These may include benefits to nearby communities as well as to people within a wider spatial area. Users of green infrastructure, for example, benefit through a number of direct and indirect effects, such as the consequential positive impact on health (see Section 3.4). Non-users may also benefit from green infrastructure. For instance, people in urban areas may not actively use the countryside, but will often still attach a value to its continued existence.¹¹

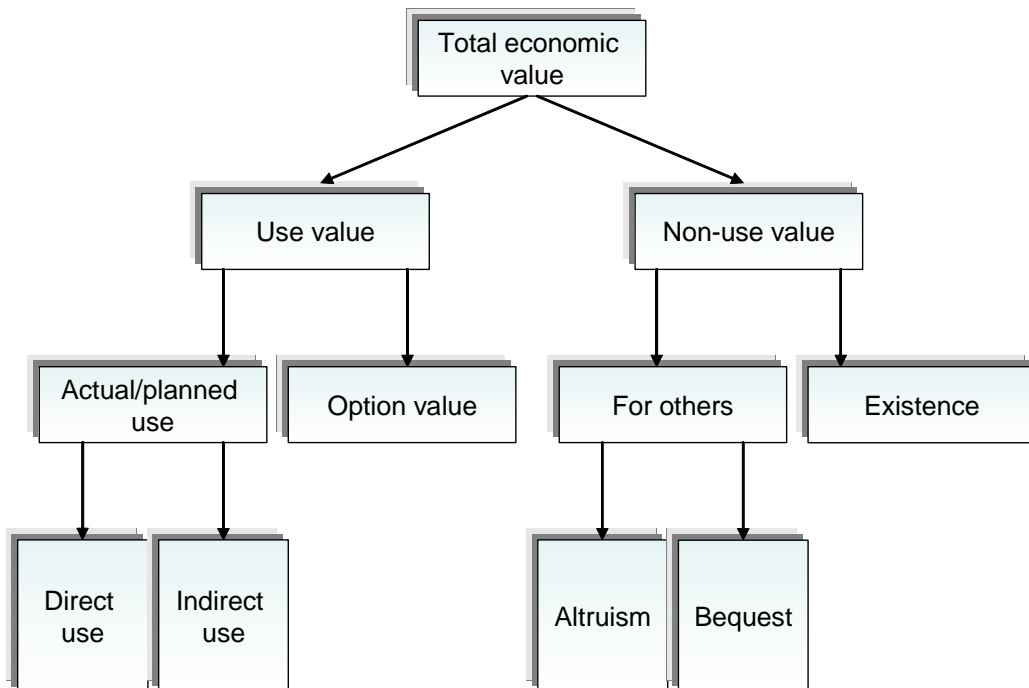
¹¹ Jacobs (2004)

The Department for Environment, Food and Rural Affairs (Defra) have identified various types of use and non-use value, including¹²:

- **use value:**
 - direct use value – the benefit to an individual from their actual or planned use of a good or service, such as for recreational use;
 - indirect use value – the benefit to an individual from the output/s of a good or service, rather than from directly using it, such as flood amelioration; and
 - option value – the value an individual places on the option to use a good or service in the future, such as an outdoor sports facility.
- **non-use value:**
 - bequest value – the value an individual attaches to the fact that future generations will benefit from a good or service, such as climate change mitigation;
 - altruistic value – the value an individual attributes to the availability of a good or service to others in the current generation, such as a particular habitat or species of wildlife; and
 - existence value – the value an individual places on the continued existence of a good or service, even though they do not benefit from it, such as the countryside.

Defra's total economic value framework combines all of these different forms of value, as shown in Figure 3.1. The total economic value of a given good or service will therefore equal the sum of both its use and non-use values.

Figure 3.1: Defra total economic value framework



¹² Defra (2007)

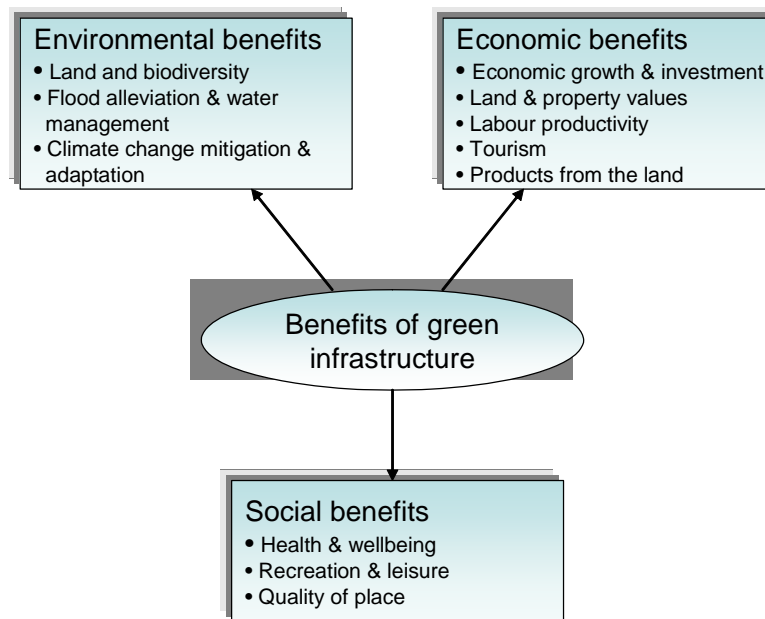
3.3 Benefits of green infrastructure

3.3.1 Overview

A review of evidence into the value of green infrastructure has been undertaken. This review includes relevant regional, national and international literature, and seeks to explore the potential economic value of green infrastructure and the justification for public sector intervention. Much of the evidence is anecdotal and qualitative and there is a scarcity of robust quantitative data, particularly in relation to the less tangible social and environmental benefits associated with green infrastructure.

Nevertheless, the literature is consistent in its message that in general good quality green infrastructure can add economic value. Specifically, the literature indicates that green infrastructure adds value through a diverse range of mechanisms, including by generating a number of economic, social and environmental benefits. Based upon the evidence contained within the literature a range of different economic, social and environmental impacts of green infrastructure can be identified. These are set out in Figure 3.2 and further information is provided on each in turn below.

Figure 3.2: Benefits of green infrastructure



3.3.2 Economic benefits

The literature reviewed in preparing this study suggests that a number of economic benefits are associated with green infrastructure. Greenspaces have an important role to play in attracting inward investment and stimulating economic growth. The value of green infrastructure is also reflected in higher property prices and improved labour productivity. In addition, the image benefits of green infrastructure can be linked to increased tourism and visitor activity. Each of these benefits is discussed in turn below.

(i) Economic growth and investment

Investment in green infrastructure can promote investment in an area and improve the economic performance of the local economy. It can therefore contribute to the economic regeneration of deprived areas. For example, there is significant anecdotal and qualitative evidence that high environmental quality, in both the urban centre and at the urban fringe,

acts as an important factor in determining investment location decisions – the Park Life Report indicates that 82% of residents believed that high quality green parks encourage people and businesses to locate to an area.¹³

The impact and value of high quality green infrastructure is illustrated by the example of Chattanooga, Tennessee. The local economy flourished following collaboration by local government, business and community groups to rebuild deteriorating quality of life and fight rising unemployment and crime. The environmental improvement project cost \$356 million. Between 1988 and 1996 the number of business and full-time jobs in the district more than doubled and assessed commercial property values rose by 130%, whilst property tax revenues increased by 99%.¹⁴ Similar benefits were experienced at Riverside Park Industrial Estate in Middlesbrough.

Box 3.1: Riverside Park Industrial Estate, Middlesbrough

The green development of Riverside Park Industrial Estate in Middlesbrough created a setting that in turn stimulated economic development and business growth. Improvements have encouraged business growth, new investment and relocation to the area, and have resulted in a significant reduction in brownfield land through the continued development of the park. The environmental enhancements saw occupancy grow from 40% to 78%, leveraging over £1 million of private sector investment. This increase in investment has created employment for local people and generated additional opportunities for business growth. It has also helped to regenerate and re-claim riverside areas.

Source: CLES & Groundwork (2007)

Within the UK, a study of companies relocating to South West England revealed that over 35% quoted environmental attractiveness as a key reason for their move.¹⁵ Similar results were evidenced in the West Midlands where 33% of investors in the region considered the attractiveness of the region to be an important factor in location decisions.¹⁶ Further to this, a survey of corporate CEOs in the USA indicated that quality of life for employees is the third most important factor in deciding where to locate a business, behind access to domestic markets and availability of skilled labour.¹⁷

(ii) Land and property values

A number of empirical studies have been undertaken, both within the UK and overseas, which identify a positive relationship between proximity to greenspace and property prices. Higher property and land prices can be seen as indicative of the overall value local residents attach to being located close to green infrastructure. It is also a direct benefit in itself to property and land owners.

The findings of a RICS commissioned analysis into the degree to which greenspace affects property values illustrated that the level of uplift experienced is dependent upon the nature of both the greenspace and the property, as shown in Table 3.1. On average city parks are the most highly valued, with an average premium across all house types of 10.1%. This is followed by local parks (9.0%) and amenity green spaces (2.6%). The study also suggests that the shape of greenspace has a bearing on the value impact of green infrastructure, with long narrow parks preferable to square or circular parks.¹⁸

¹³ Greenspace (2007)

¹⁴ Trust for Public Land (1999)

¹⁵ Plymouth Business School (1996)

¹⁶ AWM (2001)

¹⁷ Kelly & Zieper (2000)

¹⁸ Dunse et al. (2007)

Table 3.1: Cumulative effect of greenspace over 450m¹⁹

	Detached	Flat	Non-detached
City park	19.97%	7.54%	2.93%
Local park	9.62%	7.92%	9.44%
Open space	2.71%	4.70%	0.44%

The Greater London Authority report, 'Valuing Greenness', assessed the value of greenspaces in London. The study established a positive relationship between property value and proximity to greenspace. It also found a positive relationship between property value and the amount of greenspace in the area, positing that a 1% increase in greenspace in a typical ward can be associated with a 0.3 to 0.5% increase in average house prices.²⁰

A study of the impact of parks undertaken at various locations across the UK indicates that improving the quality of urban greenspaces has had a positive impact of property prices, with the level of value uplift ranging from 0% to 34%, as set out in Box 3.2. This study controls a range of other factors such as proximity to schools and services, and investigates the impact of public realm on properties immediately facing the park, those not facing but approximate to the park, and those in the same general area as the park. The study concluded that that the economic value of greenspace is closely related to its design and, in particular, its overall quality.²¹

Box 3.2: Property value impact 'on' and 'off' park

	On-park	Off-park
Queen Square, Bristol	16%	1%
Boston Square Sensory Park, Hunstanton	7%	0%
Hulme Park, Manchester	7%	3%
Mowbray Park, Sunderland	34%	34%
Mesnes Park, Newton-le-Willows	19%	19%
King George Recreation Ground, Bushey	6%	2%
Mile End Park, London	7%	3%
Lister Park (North)	5%	4%
Lister Park (South)	3%	0%
Jubilee Park, Canary Wharf, London	9%	n.a

There is also a body of evidence from overseas, particularly North America, on the impact of green infrastructure on property values. A review of this evidence determined that: "developing outdoor recreation amenities is likely to lead to a rise in proximate property values which will generate more revenue than is lost by removing the land from the tax base" (Crompton, 2001). Much of the evidence from the USA suggests that communities where parks, open space and outdoor recreation are prioritised have enhanced property prices. For example, in Oakland, California a 3 mile belt of greenspace is estimated to have added \$41 million to surrounding property values.²²

¹⁹ Ibid.

²⁰ GLA (2003)

²¹ CABE Space (2005)

²² Kelly & Zieper (2002)

Research has also been undertaken investigating the impact of other forms of greenspace on property prices. A study carried out in Indianapolis examined the impacts within half a mile of 14 greenway routes. It found that the heavily used trails had a significant impact on the value of adjacent properties, equating to approximately 15% of average sales value. In comparison, properties adjacent to conservation corridors experienced a 2% uplift in value.²³ A range of studies have also looked at the effect on property prices of trees and woodland, as summarised in Box 3.3.

Box 3.3: The impact of trees, as a part of green infrastructure, on property values in the UK

- the creation of a community woodland on the Bold Colliery site resulted in an uplift in existing property values totalling approximately £15 million;²⁴
- street trees and views of natural landscapes can increase property values by between 6% and 18%;²⁵
- broad leaved tree cover can uplift property values by up to 20%;²⁶
- research indicates that residents in suburban settings are willing to pay £7,680 per household for views of broad leaved forests, equating to £4.2 billion across the UK;²⁷

The extent of the effect on land and property values will be dependent, in part, on the quality of green infrastructure provided. A study undertaken in South Carolina looked at the comparative effect of parks that were classed as small and medium sized, and those classed as basic and attractive. The study found that condition and size both have a bearing on the level of property value uplift of adjacent property.²⁸

(iii) Products from the land

Investment in green infrastructure can create productive spaces. Principally this relates to the use of agricultural land for food production, with around 40,000 people employed in agriculture within the North West²⁹, but allotments and community gardens can also allow local people to grow healthy produce and meet a proportion of their food needs. In addition, greenspaces can be used for the creation of urban farms, which can act as a further source of local food production. Overall, it has been estimated that economic activities linked to the management of the natural environment, including food production, contribute around £67.6 billion per annum in GVA to the national economy.³⁰

Furthermore, areas of green infrastructure, particularly woodland areas, offer the opportunity to exploit the market for wood as a renewable fuel. The promotion of such biofuels can act as an incentive for businesses in the agricultural sector to diversify their activities. It has a positive economic and environmental impact, promoting the renewables sector within the region, whilst offering an alternative energy source that can be renewed through careful woodland management.

(iv) Labour productivity

The presence of attractive green infrastructure can be a key element of creating a productive working environment. A number of examples from the literature are presented in Box 3.4. The wider positive effects of green infrastructure on the health and wellbeing

²³ Nicholls (2002)

²⁴ Bold Colliery Community Woodland (2005)

²⁵ TCPA (2004)

²⁶ Garrod & Willis (1992)

²⁷ Cited in Ecotec report

²⁸ Espey & Owusu-Edusei (2001)

²⁹ GONW (2008)

³⁰ Land Use Consultants (2006)

of the workforce, as well as the community as a whole, are dealt with separately in Section 3.4.2.

Box 3.4: The impact of green infrastructure on labour productivity

- more than 60% of staff indicated that their surroundings and external views had the greatest impact on how they felt at work;³¹
- anecdotal evidence suggests that the working environment has a positive impact on motivation and productivity;³²
- greenspaces are a key factor in recruiting and retaining highly skilled staff, with environment identified as a high priority when making location decisions;³³ and
- university staff rated their situational design (external views and surroundings) as the most important feature in retaining them at their work place.³⁴

The role of green infrastructure in improving labour productivity is of particular importance for the development of commercial space, where occupiers would be likely to benefit from the inclusion of open spaces and public realm within development projects. Green infrastructure can therefore complement and enhance the built environment, particularly within urban settings³⁵, although the impact of green infrastructure will be very much dependent on its quality and form.

(v) *Tourism*

The development and enhancement of green infrastructure can also help to attract new visitors to the region. The tourism sector is estimated to be worth approximately £10.9 billion to the North West economy, and supports some 200,000 FTE jobs. Research investigating the environmental economy of the North West indicates that environmental tourism sustains approximately 26% of the regions tourism sector, with rural tourism supporting 37,500 jobs and making a contribution to regional GVA of £770 million.³⁶ Furthermore, a large proportion of the income generated by tourism stays within local communities and supports local jobs – *“tourism tends to be highly localised, characterised by many small operators served by local suppliers drawing on a flexible local workforce”*.³⁷

A significant aspect of the regional tourism offer lies in the quantity and quality of its urban and rural landscape and green infrastructure. The quality of the environment is therefore of significant importance, with the National Trust estimating that 40% of tourism related employment is dependent upon high quality environment.³⁸ Further research indicates that approximately 33 million people make over 2.5 billion visits to urban greenspaces each year in England.³⁹ This level of use could confer considerable economic benefit through spending in the local economy, as evidenced in Box 3.5.

³¹ CABE (2005)

³² CABE (2004)

³³ McIntyre (2006)

³⁴ CABE (2005)

³⁵ EMRA (n.d.)

³⁶ NWDA

³⁷ UK statutory countryside and environment agencies (2006)

³⁸ National Trust (2004)

³⁹ Goode, D. (2006)

Box 3.5: The tourism value of forests

- it is estimated that woodland recreation in England has a value of between £1.66 and £2.78 per visit;⁴⁰
- an additional 330,00 visitors to the National Forest since 1995 have contributed an additional £128 million annually, creating and supporting more than 500 full time equivalent jobs;⁴¹
- the annual value of forests in the UK in terms of recreation and landscape value equates to some £400 million. In the North West the annual value was estimated to be £35 million;⁴² and
- research indicates that residents in suburban settings are willing to pay £7,680 per household for views of broad leaved forests, equating to £4.2 billion across the UK.⁴³

3.3.3 Social benefits

Within the literature greenspaces are identified as offering multiple social benefits for individuals and communities, many of which are interrelated.⁴⁴ For example, a recent study published for the Joseph Rowntree Foundation outlined the positive impact public open space could have on social relations and individual wellbeing.⁴⁵ Overall, green infrastructure is seen as having the potential to generate health improvements, provide a valuable resource for recreation and leisure and contribute towards enhancing quality of place. These benefits are discussed in turn below.

(i) Health and wellbeing

Green infrastructure provides significant benefits in terms of health and wellbeing through its utilisation as an asset for physical activity. However, green infrastructure also offers other health and well-being benefits, including reduced incidence of respiratory illness and improved mental health. The value of the environment in terms of health and wellbeing has been the subject of a number of studies conducted in the UK.

For example, research has shown that in East London greenspaces were perceived as having a positive influence on well-being, helping to improve the mental health and reduce the stress levels of local residents⁴⁶ and there is a widening evidence base to support the belief that the environment is of importance in promoting emotional and mental health. For instance, stress levels have been shown to reduce when a highly stressed person moves into a leafy environment.⁴⁷ There is also research that compared the recovery of hospital patients, demonstrating that patients with views of a natural environment recovered more quickly, with fewer complications and required less pain relief, than those with views of other buildings.⁴⁸

Greenspaces also provide health benefits through encouraging activity. A report commissioned by the RSPB in October 2004 identified links between good physical health and access to the natural environment – being in contact with nature is judged to encourage people to take exercise and sustains participation in activity better than more

⁴⁰ Eftec (2005) cited in Ecotec, 2007

⁴¹ GFA Race & GHK (

⁴² Willis et al. (2003)

⁴³ Cited in Ecotec report

⁴⁴ Landuse Consultants (2004)

⁴⁵ Dines and Cattell (2006)

⁴⁶ Ibid.

⁴⁷ Trees Matter (2006)

⁴⁸ Ulrich (1984), quoted in Goode (2006)

structured regimes.⁴⁹ The same study estimated that the value of a park in an urban area, in terms of avoided inactivity, can be between £0.8 million and £2.7 million per year to the national economy.⁵⁰ The health benefits of daily exercise are summarised in Table 3.2.

Potential Illness	Level risk reduced by
Heart Attack	15%
Diabetes	50%
Colon Cancer	30%
Femur Fracture	40%

In addition, Green infrastructure provides benefits in terms of improving local air quality. Government estimates suggest that approximately 24,000 people die prematurely each year as a result of air pollution⁵², with the impact of fine particulates being a particular concern. A study undertaken in the West Midlands suggests that doubling tree cover across the region would reduce the concentration of fine particulates by 25%, and in so doing could prevent 140 pollution related premature deaths in the region each year.⁵³

(ii) Recreation and leisure

Whilst there is a limited amount of quantitative evidence regarding green infrastructure's value as a recreational asset, the literature does suggest that this is a key benefit associated with greenspaces. Indeed, EMRA's Green Infrastructure Scoping Study argues that *"one of the most widely recognised functions of greenspace is to provide a setting for recreation and amenity"*. Investment in green infrastructure can enhance access to accessible natural greenspace and provide opportunities for various forms of leisure activity. For example, Thames Gateway green infrastructure guidance⁵⁴ highlights a range of recreational functions:

- active recreation – including the provision of outdoor sports facilities for formal and informal activities;
- passive recreation – including walking and cycling routes;
- quiet enjoyment – including greenspaces that provide the opportunity for relaxation and stress relief; and
- cultural/event value – including greenspaces within which to hold events or display, for example, public art.

The development and enhancement of green infrastructure can, therefore, help to attract and retain people within the region, as well as providing a beneficial resource for existing residents. Evidence of the attraction of greenspace as a recreational and cultural asset tends to be focused upon its impact on tourism, as detailed above. Whilst this does not directly relate to the social benefit of green infrastructure for the local community it does provide an indication of the value people attach to greenspaces. A further example is the regeneration of Mesnes Park in Newton-le-Willows, where the number of users increased from 15,000 to 180,000 people per year.

(iii) Quality of place

⁴⁹ Bird (2004)

⁵⁰ Bird (2004)

⁵¹ CABE (2004)

⁵² Trees matter (UK environmental accounts 1998)

⁵³ Stewart, H., Owen, S., Donovan, R., MacKenzie R. & Hewitt, N. (2003)

⁵⁴ Greening the Gateway Partnership (n.d.)

It is recognised throughout the literature that green infrastructure can contribute to enhancing quality of place, as highlighted by CABE: “public spaces are open to all, regardless of ethnic origin, age or gender, and as such they represent a democratic forum for citizens and society...they bring communities together, provide meeting places and foster social ties of a kind that have been disappearing in many urban areas. These spaces shape the cultural identity of an area...and provide a unique sense of place for local communities”⁵⁵. The development of green infrastructure can improve civic pride and place vitality. It can also provide opportunities for social interaction, helping to increase community cohesion.

The literature indicates that green infrastructure, particularly parks, has value within a community as a shared resource and a place where social interaction can take place. A Chicago study found that people living in apartments tended to use nearby public spaces more if they were ‘natural’ rather than ‘man made’, leading to greater levels of socialising amongst neighbours.⁵⁶ The conclusion that parks and greenspaces facilitate interaction is supported by a range of studies, where ‘sociability’ is a key asset provided by greenspaces, as they are free public areas where people can meet.⁵⁷

Parks and greenspaces also offer physical access to all members of the community, helping to promote social inclusion.⁵⁸ This can be further enhanced by providing opportunities for communities to respond to local issues, working together in partnership. For example, green infrastructure brings the potential for nature conservation to urban centres and provides a resource to some of the poorest communities in the country. This can increase the feeling of ownership of greenspace amongst local people⁵⁹, as well as engendering feelings of civic pride within these communities. Evidence as to the value of green infrastructure to a community is summarised in Box 3.6.

Box 3.6: Quality of place – evidence from the research

- correlation exists between urban areas with a low number of greenspaces and higher levels of deprivation;⁶⁰
- availability of greenspace helps to build communities through participation in local nature activities;⁶¹
- an absence of green infrastructure is frequently highlighted as the worst feature about urban neighbourhoods;⁶²
- a public satisfaction survey into Britain’s parks and greenspaces found that 97% of respondents believed that parks and greenspaces help to create nicer places to live;⁶³ and
- the top ranking response in a 2004 CABE study concerning the reasons why people believe public space is important is that it gives a sense of community.⁶⁴

⁵⁵ CABE (2005)

⁵⁶ Kuo, 1998, cited in McIntyre (2006)

⁵⁷ Landuse Consultants (2004)

⁵⁸ Landuse Consultants (2004)

⁵⁹ Ibid.

⁶⁰ GLA (2003)

⁶¹ Bird (2004)

⁶² Parks and Green Space study (1999)

Educational benefits can also be linked to green infrastructure. For instance, urban areas with a large amount of greenspace were found to have better educational performance.⁶⁵ In addition, research into the value of open spaces reveals that areas with trees and grass help cognitive development, whilst young children playing in natural environments have been found to have more advanced coordination and balance than children constrained to a traditional playground.⁶⁶

Furthermore, investment in green infrastructure can help to improve community safety. The presence of nearby natural areas is linked to reduced crime, aggression and violence.⁶⁷ A report commissioned for Scottish Natural Heritage identifies a growing number of greenspace projects which are taking on the community safety agenda, and illustrates the role that parks and their services can play in tackling crime and disorder.⁶⁸ The reclamation of poor quality public space through considered design solutions has been shown to have safety impacts that extend beyond the boundaries of the greenspace.⁶⁹

3.3.4 **Environmental benefits**

As well as a range of economic and social benefits, the development of green infrastructure can also clearly lead to the generation of a number of positive environmental impacts. These can include the effective management of land as a resource for the wider community and the provision of wildlife habitat as part of enhancing biodiversity. In addition, green infrastructure can play an important role in issues such as flood alleviation and climate change mitigation and adaptation. Each of these benefits is discussed in turn below.

(i) Land and biodiversity

Investment in green infrastructure can lead to better management of land by bringing it back into active use. A significant proportion of brownfield sites within the North West suffer from contamination, resulting from a legacy of industrial use, waste disposal and mineral extraction. Evidence suggests that conversion of contaminated land to green infrastructure represents an effective land remediation strategy. For example, a key part of the remit of the Land Restoration Trust (LRT) has been the remediation of derelict sites and the management of these sites as greenspace.

Tree planting, in particular, can be an effective form of land management. Some trees have the capacity to grow in hostile conditions and can, over time, enable the reclamation of heavily contaminated sites. Trees are capable of absorbing pollutants as part of biological processes. Through repeated felling and removal of the timber the level of contamination can be reduced, whilst the rate of leaching of pollutants within groundwater can also be lowered.⁷⁰ This means of remediation has the benefit of providing green amenity space for the local community and enhancing the value to local wildlife.

Greenspaces are in themselves an important environmental resource, providing habitat for a wide variety of species. For example, a study of four urban areas on Merseyside revealed that the greatest influence on their ecology was the proportion of greenspace, particularly trees.⁷¹ Investment in green infrastructure is, as such, a key component of reversing habitat fragmentation and increasing biodiversity to restore functioning ecosystems. In supporting ecosystems, a wider range of species will inhabit urban areas,

⁶³ GreenSpace (2007)

⁶⁴ CABE (2004)

⁶⁵ GLA (2003)

⁶⁶ CABE Space (2005)

⁶⁷ Bird (2004)

⁶⁸ CABE Space (2005c)

⁶⁹ Landuse Consultants (2004)

⁷⁰ Trees for cities (2005)

⁷¹ CABE Space (2005)

with consequential benefits for local communities in terms of providing access to natural greenspaces.

Different types of green infrastructure have different levels of ecological value. The literature indicates that a broad view needs to be taken when considering the value of green infrastructure with regard to biodiversity on the basis that: *“within Urban locations the most valuable habitats are invariably found within the diverse range of greenspace; the woodlands, urban forests, ponds, rivers and riverbanks, parks and gardens, allotments and cemeteries, providing a rich variety of habitats for mammals, birds, insect, aquatic and plant life.”*⁷² Biodiversity is also related to the size of the greenspace. Research suggests that to be effective as a greenspace a site needs to be of sufficient size to support its own ecosystem.⁷³

A number of approaches have been developed to place a monetary value on biodiversity, including survey-based contingent valuation techniques and the visitor-based Travel Cost method. Attaching a monetary value on biodiversity resources is both controversial and imprecise, but it does give an indication of the public's willingness to pay for environmental improvements. Research seeking to value environmental features places a monetary figure of £906 per hectare on biodiversity. This represents the average estimated willingness to pay from a variety of studies⁷⁴. The figure is considered to be reasonable as existence values are the predominant value in biodiversity. It is assumed that people will apply similar values to these non-use aspects regardless of location.

A further economic benefit derived from enhanced biodiversity can include reduced management costs. Studies indicate that traditional intensive management strategies require significant and costly inputs in the form of nutrients, herbicides and pesticides. Landscapes that are ecologically balanced and self sustaining can significantly reduce the need for these inputs.⁷⁵

(ii) Flood alleviation and water management

Recent experience of flooding in the UK, in combination with the climate change agenda, has brought the economic impact of flooding to the forefront of social, environmental and economic policy. The Carlisle floods resulted in claims of £24.5 million from one insurer alone, with the total cost of the flooding running into hundreds of millions of pounds. Around 2 million properties in the UK are located in flood risk areas, putting the safety and well-being of some 5 million people at risk. The Environment Agency's spending on flood protection amounts to approximately £400 million per annum. Within the North West, approximately 212,500 properties are at risk of flooding, with Environment Agency spending on flood protection amounting to approximately £40 million per annum.

By 2080 increasing emissions of CO₂ and other greenhouse gasses could result in an increase of 30% in winter rainfall and a decrease of 50% in summer rainfall. There could also be a global rise in sea levels of 67cm, threatening 430 km of coastline and 95,000 people living in coastal floodplains in the North West region. It has been estimated that the annual cost of flooding in the UK could reach £22 billion by this point.⁷⁶ There are as such a number of economic costs associated with flood risk, including:

- inhibiting growth in property prices;
- increased insurance premiums for all, and limited availability of insurance for those in high risk areas;
- clean up costs for local and central government;

⁷² X1 World Forestry Congress (1997) cited in Landuse Consultants, 2004.

⁷³ Landuse Consultants (2004)

⁷⁴ Estimating the Value of Environmental Features, MAFF, 1999

⁷⁵ TCPA (2004)

⁷⁶ Environment Agency (2002)

- inhibited economic activity as flood risk a consideration in investment decisions; and
- costs associated with engineering solutions and implementation of SUDS.

These costs fall on individuals and businesses located in areas susceptible to flooding, as well as resulting in higher insurance premiums and an increased burden on the taxpayer. Examples of the use of green infrastructure to mitigate for the increased risk of flooding are summarised in Box 3.7.

Box 3.7: Community acquisition of floodplains in the USA⁷⁷

Flooding of the **Napa River in California** resulted in approximately \$10 million damage to homes and businesses per year. Multiple engineering solutions have been implemented, however these have failed to control seasonal flow peaks. As a solution 500 acres of land, accommodating 17 homes, a trailer park, and a number of businesses, was purchased and reinstated as flood plain. This solution cost \$160 million, but resolved a flooding problem that had resulted in approximately \$500 million in damage since 1960.

Over 8,000 acres of wetlands along the **Charles River near Boston** have been protected, through purchase and easement, capable of containing over 50,000 acre/ft of water as an alternative to a \$100 million dam and levee network. It is estimated that losing these wetlands would cause approximately \$17 million annually in flood damage.

The retention of flood plains as greenspace can reduce requirements for engineered flood defences further down river, giving open space within river valleys an important role in flood alleviation. This can result in significant economic saving, as illustrated by examples from the USA set out in Box 3.7. Research indicates that the protection and creation of wetlands in up-stream areas reduces peak stream flows downstream. Evidence from Illinois quantifies this benefit, suggesting that for a 1% increase in the area of protected wetlands along the river channel, peak stream flows decreased by 3.7%.

(iii) Climate change mitigation and adaptation

Climate change is expected to have severe consequences for the UK, with temperatures increasing by up to 5°C, and sea levels rising by between 9cm and 69cm by 2080. Green infrastructure can play a significant role in mitigating these effects through its role as a carbon sink. For instance, plants, particularly mature trees, absorb greenhouse gasses, including Carbon Dioxide from the local atmosphere. Green infrastructure can also lower temperatures locally and reduce energy consumption.

Natural vegetation absorbs and holds atmospheric carbon, thereby ameliorating a proportion of the impact from the combustion of carbon based fuels. Research indicates that vegetation has a significant value as a carbon sink, with Willis et al estimating that the capitalised value of woodland resources across Great Britain amounts to approximately £2.7 billion.⁷⁸ Other research indicates that the value of woodland in terms of carbon sequestration is between £86 and £190 million in 2002 prices.⁷⁹ Moreover, a significant proportion, approximately 25%, of the CO₂ emitted annually comes from the burning of trees and, therefore, the management of forests is one of the most important climate change factors.

⁷⁷ The Trust for Public Land (1999)

⁷⁸ Willis et al (2003)

⁷⁹ Ibid.

Furthermore, green infrastructure can result in environmental cost savings for individuals. Research suggests that the impact of trees in terms of carbon storage, air cleaning, and water catchment can result in savings in terms of storm water and soil erosion control, air quality improvement, and lower heating and air conditioning costs.⁸⁰ Green infrastructure can also have a positive impact by reducing humidity and temperature within urban locations. Trees play a particularly prominent role, with daytime temperatures in large urban parks found to be 2-3°C lower than in surrounding streets.⁸¹ The cooling effects from the network of green infrastructure can have a significant benefit in terms of mitigating the impact of climate change on temperatures.⁸²

The sheltering impact of vegetation in urban areas can also generate significant benefits. Vegetation can result in savings of 10% to 50% in cooling expenses and 4% to 22% in heating costs by providing shading and acting as a windbreak.⁸³ Other research indicates that the sheltering impact of a belt of urban woodland can cut energy costs by 10%⁸⁴, as shelter and shade reduce the heating and cooling costs for buildings. This reduces the amount of carbon based fuel required to regulate the environment in buildings, delivering reductions in greenhouse gas emissions.

3.3.5 Total economic value

The above literature review reveals evidence from a large body of research to suggest that investment in green infrastructure can generate a number of economic, social and environmental benefits. An assessment of the total economic value of green infrastructure will therefore comprise of an analysis of a wide range of impacts. However, as discussed in Section 3.2, due to the nature of these impacts the overall value of green infrastructure can be difficult to quantify.

Some studies have sought to determine the economic value of green infrastructure by exploring the impact of different types of greenspace on property values, which can be used as a proxy for welfare effects (see Section 3.3.2). Other more qualitative work has focused on the various functions of greenspaces and the benefits associated with these. For example, within Green Future⁸⁵ five broad function types of greenspace are identified, along with the rationale for each of these functions in terms of the benefits that they generate, as shown in Table 3.2.

Table 3.2: 'CLERE' model for multi-functional greenspace	
Function	Rationale
As an agent for Community development and education	Local parks and green spaces help to strengthen the spirit of community amongst resident population who share an interest in their welfare. Community involvement brings social benefits and, through an engagement with local politics, helps to conserve the quality and multi-functional use of the greenspace system. Children, in particular, are able to learn about the natural environment and develop skills through play.
As Landscape to be conserved	Parks and green spaces are cultural landscapes and an integral part of the built form of urban settlements. Landscapes help to define a sense of place, local character and identity. Whole 'Cityscapes' are celebrated and action is taken to conserve their quality. More than 200 public parks are on the English Heritage Register of Historic Parks and Gardens as distinct landscapes. Fine landscapes such as the eight Royal Parks of London and Central Park, New York, feature as case studies in this report. Natural features within the city are often conserved as landscape in their own right.

⁸⁰ Ecotec (2007)

⁸¹ DTLR (2002)

⁸² Shaw et al (2007)

⁸³ Relf (1996) cited in Landuse Consultants (2004)

⁸⁴ Jones (2003) cited in Landscape Consultants (2004)

⁸⁵ Barber (2005)

As an Ecosystem providing urban services	Green spaces provide services to the urban environment through sustaining natural process. This includes delaying flood water, moderating urban temperatures and humidity, reducing air and water-borne pollution and supporting wildlife. Their proximity for recreation and community activity helps to reduce air pollution and energy consumption generated by motor traffic.
As a Recreational resource for health and well-being	Recreation is the use of leisure time to refresh and regenerate mind, body and spirit. Greenspace systems enable a wide range of recreational activity for urban dwellers, local and largely free to users. Parks and green spaces provide an escape to tranquility and access to the healing powers of the natural world within the urban environment.
As a contributor to the local Economy	Good quality greenspace enhances property prices, and the value of the taxable urban asset base. Recreational use contributes to raising productivity, saving on the cost of medical care, and promoting domestic and social harmony. Increasing community involvement and programming diversionary activity can reduce crime. Greenspace can help to promote tourism and create a favourable image of place to encourage inward investment and improve recruitment and retention of staff. It can help to nurture skills such as food production, horticulture and nature conservation craft skills.

A DTLR commissioned study has sought to attach a monetary value to different forms of greenspace. The study sets out the total economic value of various types of undeveloped land including public realm, greenbelt, urban and rural forested land, agricultural land, and natural and semi-natural land (see Table 3.3). Green infrastructure in the urban core (public realm) was calculated as having a considerably greater economic value than the other forms of greenspace. Agricultural land was deemed to have the lowest total economic value.

Table 3.3: Land types and external benefits⁸⁶

Land Type	Coverage of benefits									£ha/yr (2001)	Present value
	R	L	E	C	H	A	T	A ₂	S		
Urban core (public space)										£54,000	£10,800,000
Urban fringe (greenbelt)										£889	£177,800
Urban fringe (forested land)										£2,700	£540,000
Rural (Forested land)										£6,626	£1,325,200
Agricultural land (extensive)										£3,150	£630,000
Agricultural land (intensive)										£103	£20,600
Natural and semi-natural land (wetlands)										£6,616	£1,323,200

R= recreation; L= landscape; E= ecology; C= cultural heritage; H= hydrology; A= air quality and climate; T= tranquillity; A₂= Accessibility; S= Soil

Overall, the research into the impact of green infrastructure, and its different forms, indicates that it can potentially add economic value. However, it should be noted that the extent of this value will depend upon the type of green infrastructure as well as external factors, such as the market context, location and performance of the local economy. Furthermore, as noted by CABI, the economic value of greenspace is closely related to

⁸⁶ EFTEC (2002)

the quality of the space created.⁸⁷ In general though, good quality green infrastructure is likely to result in a range of economic, social and/or environmental benefits.

3.4 Beneficiaries of green infrastructure

There are, as evidenced by the literature review, a number of beneficiaries from investment in green infrastructure, with differing groups and individuals benefiting from the multi-functional nature of green infrastructure and the positive economic, social and environmental impacts associated with green infrastructure. Table 3.4 sets out the main beneficiaries and the value they can obtain through the development and enhancement of greenspaces.

Table 3.4: The beneficiaries of green infrastructure	
Beneficiary	Value
Local community	<p>Where communities are located adjacent to high quality green infrastructure, local residents can enjoy a range of benefits including:</p> <ul style="list-style-type: none"> ▪ better quality of life and improved mental health; ▪ greater social inclusivity and a more accessible environment; ▪ higher levels of civic pride; ▪ increased property prices; ▪ reduced pollution; ▪ better security and less crime; and ▪ improved access to amenity greenspace for leisure activities.
Local business	<p>Image quality attributable to green infrastructure offers prestige to local businesses. Actively used greenspaces attract greater numbers to participate in leisure and recreation activities, with potential economic benefits for adjacent businesses.</p> <p>A high quality environment is likely to improve staff retention and facilitate the recruitment of skilled employees.</p>
User groups	<p>Improved access to quality greenspaces for leisure and recreation groups including, for example, nature groups.</p> <p>Health benefits to users from improved access to cycling and walking opportunities.</p> <p>Increased amenity value to users from the provision of higher quality, attractive greenspaces.</p>
Local authority	<p>High quality green infrastructure improves the area's image and increases regenerative potential.</p> <p>Green spaces within communities also have the potential to reduce public expenditure on crime prevention, management of urban spaces and health issues associated with inactivity.</p> <p>Green infrastructure increases the economic viability of adjacent sites by uplifting site and potentially development values.</p> <p>Increased local tax revenue can also be generated as a result of higher property values.</p>
Investors and developers	<p>Investments in locations adjacent to greenspaces are more likely to provide a return, offering lower risk and greater security to both investors and developers.</p> <p>The asset, once developed, has greater value in locations adjacent to greenspaces, enabling the stakeholder to borrow more on the value of the asset.</p> <p>Reduced heating and air conditioning costs in some instances due to the sheltering effects of vegetation.</p> <p>The image of a development adjacent to high quality greenspace will be improved, and the quality of tenants is likely to be higher.</p>

⁸⁷ CABE Space (2005)

4 Assessing the value of green infrastructure

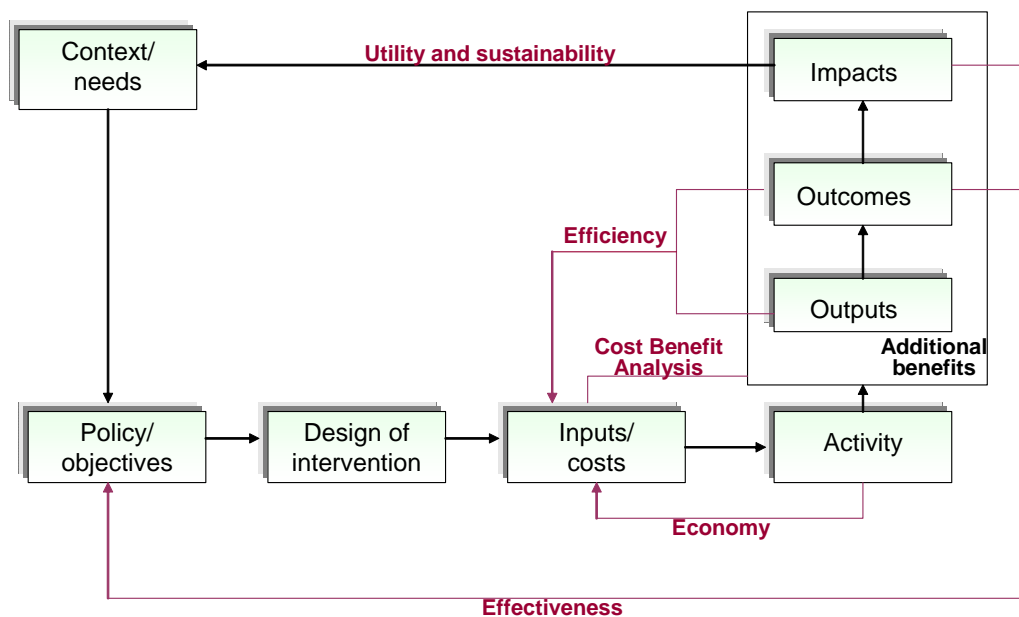
4.1 Introduction

This Section outlines the emerging assessment framework, which seeks to provide a basis against which the economic value of green infrastructure can be measured. An overview of the proposed assessment framework is presented, drawing upon the review of evidence undertaken as part of this study. Each of the key components of the framework is then described in more detail.

4.2 The assessment framework – an overview

As the benefits of green infrastructure can potentially be wide ranging and include a number of impacts that are difficult to quantify, calculating its economic value is a complex process. Moreover, there is not a single, simple equation that can be used in order to determine whether public sector investment, specifically support from the Agency, is justified for a given intervention. In reality, determining the economic value of green infrastructure will require the assessment of a range of different factors, as outlined in Figure 4.1.

Figure 4.1: Assessment framework



The proposed assessment framework attempts to take account of these various factors by incorporating four inter-related components, as follows:

- (i) development of logic chains – an analysis of the linkages between inputs, activities, outputs, outcomes and impacts and the rationale for intervention;
- (ii) assessment of costs – an analysis of the various costs associated with enhancing and developing green infrastructure;
- (iii) assessment of benefits – an analysis of the different economic, social and environmental benefits generated by green infrastructure; and
- (iv) assessment of value for money (VFM) – an analysis of the VFM of investing in green infrastructure.

In order that the full economic value of green infrastructure can be assessed, a range of measurement techniques are encompassed within the proposed framework, including the use of a scoring system and the benefits transfer method. The assessment framework also highlights the relationship between the different types of green infrastructure and potential benefits, such that the investment priorities for the NWDA can be determined. In applying the assessment framework, consideration will need to be given to the additionality of any benefits generated (see Appendix A).

4.3 Development of logic chains

Logic chains, as highlighted within OffPAT's Core Outputs Technical Note and the, then, Dti Impact Evaluation Framework, are seen as an essential element of the approach to assessing RDAs' projects and programmes. They are a valuable tool in demonstrating how RDA activities, and the inputs these entail, deliver key outputs and outcomes and how they contribute to regional priorities and target impacts. In particular, the development of logic chains can serve as a useful framework for assessing:

- the causal connections between inputs, activities, outputs, outcomes and impacts – this is important in determining the extent to which benefits can be attributed to investment in green infrastructure;
- the rationale for the intervention(s) by consideration of its/their context – in terms of, for example, contextual environmental conditions and the extent to which they are having adverse consequences for quality of life and the overall competitiveness of the region; and
- the intervention's design – in other words, the relevance of the chosen activities to achievement of the desired outcomes.

A detailed logic chain is an important part of the assessment of any proposed green infrastructure investment. Table 4.1 sets out an exemplar logic chain, based upon the three main areas of benefit identified in Section 3 (economic, social and environmental). This draws out the general issues that will need to be considered in relation to green infrastructure activities.

Table 4.1: Generic logic chain – green infrastructure			
Policy area	Economic	Social	Environmental
Contextual conditions	<ul style="list-style-type: none"> ○ Contaminated land and waterways ○ Poor quality public realm ○ Lack of open space 		
Policy context	<ul style="list-style-type: none"> ○ Regional Economic Strategy ○ Regional Spatial Strategy ○ Local planning policies 		
Design of intervention – Objectives and targets	<ul style="list-style-type: none"> ○ Intervention design to address market failure/equity issues ○ Specific economic, social and environmental objectives, including potentially: <ul style="list-style-type: none"> ● Improving productivity and growing the market ● Promoting conditions for sustainable growth ● Increased biodiversity ● Enhanced activity and health benefits 		
	<ul style="list-style-type: none"> ○ GVA growth ○ Job creation ○ Firm formation 	<ul style="list-style-type: none"> ○ Qualifications ○ Employment rate ○ Deprivation 	<ul style="list-style-type: none"> ○ CO₂ emissions ○ Waste production ○ Recycling rates
Inputs	<ul style="list-style-type: none"> ○ Land resources – public and private assets ○ Human resources – public and private skills and time ○ Financial resources – public and private capital and revenue ○ International resources – ideas and endeavour 		

Activities	<ul style="list-style-type: none"> ○ Realise economic potential of green infrastructure ○ Enterprise development ○ Regional competitiveness ○ Sustainable production ○ Mixed-use development 	<ul style="list-style-type: none"> ○ Health and well-being ○ Responses to population change ○ Culture and image ○ Community cohesion ○ Skills, qualifications and education ○ Place making 	<ul style="list-style-type: none"> ○ Better use of natural environment ○ New use for brownfield land ○ Sustainable agriculture ○ Sustainable energy strategy ○ Protection of the countryside
Outputs	<ul style="list-style-type: none"> ○ Jobs created and jobs in priority sectors ○ Increase in visitor numbers ○ Businesses assisted 	<ul style="list-style-type: none"> ○ Increased physical activity rates ○ Increase in educational attainment ○ Increase in community usage 	<ul style="list-style-type: none"> ○ Brownfield land reclaimed/developed ○ Public realm developed/enhanced ○ Biodiversity/habitat protected
Outcomes	<ul style="list-style-type: none"> ○ Enhanced GVA growth ○ Increased employment rates ○ Improved business performance 	<ul style="list-style-type: none"> ○ Increased health and well-being ○ Reduction in deprivation levels ○ Increased community cohesion 	<ul style="list-style-type: none"> ○ Reduced CO₂ emissions ○ Increased access to environment ○ Reduction in insurance premiums
Impacts	<p>A dynamic, sustainable, international, economy consistent with:</p> <ul style="list-style-type: none"> ○ Increased GVA per capita ○ Sustainable consumption and production ○ Climate change and energy ○ National resource protection and environmental enhancement ○ Sustainable communities 		

The construction of logic chains should form part of the integrated assessment of costs, benefits and VFM. Specifically, it will be important that the development of logic chains are used to highlight how investment in green infrastructure will contribute to the objectives of the Agency and, as noted above, the degree to which any benefits created can be attributed to green infrastructure activities. In doing so, consideration will need given to the type of green infrastructure being developed (see Section 4.5 – Table 4.4).

4.4 Assessing the costs of green infrastructure

As part of estimating the economic value of a green infrastructure project or programme, the costs to the NWDA and other parties should be assessed. These are likely to include a range of capital and revenue costs associated with the development and long-term management and maintenance of green infrastructure.

It will often be necessary for assistance to be sought from external consultants in calculating the costs of green infrastructure. In addition, as well as the overall cost, the cost to the Agency will need to be identified.

4.5 Assessing the benefits of green infrastructure

Based upon a review of the existing literature and evidence regarding the impacts of green infrastructure, a number of potential economic, social and environmental benefits have been identified, as described in detail in Section 3. These benefits are summarised in Table 4.2 and form the impact criteria against which the economic value of green infrastructure will need to be assessed. Other benefits may accrue for certain green infrastructure investments and these should be highlighted where appropriate.

Table 4.2: Economic value – impact criteria		
Economic	Social	Environmental
<ul style="list-style-type: none"> ○ Economic growth and inward investment ○ Land and property values ○ Products from the land ○ Labour productivity ○ Tourism 	<ul style="list-style-type: none"> ○ Health and wellbeing ○ Quality of place ○ Recreation and leisure 	<ul style="list-style-type: none"> ○ Land and biodiversity ○ Flood alleviation & water management ○ Climate change mitigation and adaptation

As set out below, it is proposed that the assessment of benefits should be carried out under four separate, complementary strands. Firstly, an initial impact checklist should be constructed. The various outputs, outcomes and impacts attached to each impact criterion will then need to be quantified, in order to determine the contribution to NWDA's strategic priorities and targets. Following this, the value of the benefits should be derived by calculating a monetary value under each impact criterion, where this is feasible. Lastly, a score should be attached to each impact criterion to provide an overall assessment of the effect of green infrastructure.

In appraising the impact of a project or programme it will also be important that the extent to which its impact is additional is considered. The additional impact of a project is the difference between the reference case position (what would have happened anyway) and the position achieved by the project (intervention option) once it has been implemented. In order to calculate the additionality of project outputs, a number of adjustments need to be made to both the project itself and the reference case, (see Appendix A).

4.5.1 **Impact checklist**

As the appraisal of green infrastructure projects can be relatively resource intensive and time consuming, it is useful to first construct an initial qualitative impact checklist, as outlined in Table 4.3.⁸⁸ For each impact criterion, it should be indicated whether the project being assessed is expected to have a negative, neutral or positive effect and comments should be provided as to the potential scale of this effect, where this is possible. Any gaps in the evidence base should also be highlighted within the checklist.

In estimating what the impact of a project might be, consideration should be given to the type of green infrastructure investment proposed. Different forms of green infrastructure are likely to result in differing benefits – for example, the improvement of parks and public gardens will probably generate more significant economic benefits than the development of coastal habitat, which in turn is more likely to have higher environmental benefits. The potential strength of relationship between the economic, social and environmental benefits and the types of green infrastructure are shown in Table 4.4.

When determining the priorities for Agency investment, resources should be targeted at the types of green infrastructure that are likely to have the greatest impact in terms of economic development and regeneration. It is important to note though that these relationships will not always be the same and will depend, in part, on contextual conditions. Where the potential benefits of a project are deemed to be sufficient, further quantitative analysis should then be undertaken of its expected outputs, outcomes and impacts.

⁸⁸ The checklist has been adapted from that used by Defra to value ecosystem services (Defra 2007).

Table 4.4: Relationship between types of green infrastructure and benefits

	Economic					Social			Environmental		
	Economic growth and investment	Products from the land	Land and property values	Labour productivity	Tourism	Health and wellbeing	Recreation & leisure	Quality of place	Land and biodiversity	Flood alleviation and water management	Climate change mitigation & adaptation
Parks and public gardens	Strong	Moderate - weak	Strong	Strong	Moderate	Strong	Strong	Strong - moderate	Moderate	Moderate - weak	Moderate - weak
General amenity space	Strong - moderate	Moderate - weak	Strong	Moderate	Strong - moderate	Strong - moderate	Strong - moderate	Strong	Moderate - weak	Weak	Moderate - weak
Outdoor sports facilities	Strong	Weak	Strong - moderate	Strong - moderate	Strong	Strong	Strong - moderate	Strong - moderate	Moderate - weak	Moderate - weak	Moderate - weak
Woodland	Moderate - weak	Strong	Moderate	Moderate	Moderate - weak	Strong - moderate	Moderate	Moderate	Strong	Moderate	Strong
Water courses	Moderate	Weak	Strong - moderate	Moderate	Strong - moderate	Moderate	Moderate	Moderate	Strong	Strong	Moderate - weak
Mountain, moor, heath and downland	Weak	Moderate - weak	Moderate - weak	Weak	Moderate - weak	Moderate	Moderate - weak	Weak	Strong - moderate	Strong	Moderate - weak
Coastal habitat	Weak	Moderate - weak	Moderate	Weak	Moderate - weak	Moderate	Moderate - weak	Weak	Strong - moderate	Strong	Moderate - weak
Agricultural land	Moderate	Strong	Moderate - weak	Moderate - weak	Moderate	Weak	Weak	Moderate - weak	Moderate	Moderate	Moderate - weak
Allotments	Weak	Strong - moderate	Moderate - weak	Moderate - weak	Moderate - weak	Strong - moderate	Moderate	Strong	Moderate	Moderate	Moderate
Cemeteries	Weak	Weak	Weak	Weak	Moderate - weak	Moderate - weak	Moderate - weak	Moderate	Strong - moderate	Moderate	Moderate
Derelict land	Weak	Moderate - weak	Weak	Weak	Weak	Moderate - weak	Moderate - weak	Moderate - weak	Strong	Moderate	Strong - moderate
Private gardens	Weak	Moderate - weak	Strong - moderate	Moderate - weak	Moderate - weak	Moderate	Moderate	Moderate - weak	Moderate	Weak	Moderate
Street trees	Moderate	Weak	Moderate	Moderate	Moderate	Moderate - weak	Weak	Strong - moderate	Moderate	Weak	Strong - moderate
Transport corridors	Strong - moderate	Weak	Strong - moderate	Moderate - weak	Moderate - weak	Weak	Weak	Strong - moderate	Moderate - weak	Weak	Weak

Key – strength of relationship: Strong  Strong – moderate  Moderate  Moderate – weak  Weak 

Table 4.3: Impact checklist		
Impact criteria	Assessment of impact	Comment
<i>Economic benefits</i>		
Economic growth and investment		
Land and property values		
Products from the land		
Labour productivity		
Tourism		
<i>Social benefits</i>		
Health and wellbeing		
Recreation and leisure		
Quality of place		
<i>Environmental benefits</i>		
Land and biodiversity		
Flood alleviation and water management		
Climate change mitigation and adaptation		
- = negative impact 0 = neutral impact + = positive impact ? = gaps in evidence		

4.5.2 Outputs, outcomes and impacts

Quantifying the outputs and, if possible, the outcomes and impacts of an investment in green infrastructure is an important task in assessing the overall effect of such investment. This will enable the Agency to assess individual projects and programmes, as well as its own performance, against its strategic priorities and targets outlined within the RES. Table 4.5 outlines examples of the outputs, outcomes and impacts that can be associated with each of the identified green infrastructure impact criteria.

Table 4.5: Outputs, outcomes and impacts			
Impact criteria	Outputs	Outcomes	Impacts
<i>Economic value</i>			
Economic growth and investment	<ul style="list-style-type: none"> ▪ gross new jobs created / safeguarded ▪ gross new businesses created ▪ number of business relocations to the area ▪ gross private sector investment levered in (£) 	<ul style="list-style-type: none"> ▪ net additional new jobs created / safeguarded ▪ net additional new businesses created ▪ net additional private sector investment levered (£) 	<ul style="list-style-type: none"> ▪ increase in employment rate ▪ reduction in unemployment ▪ increase in GVA
Land and property values	<ul style="list-style-type: none"> ▪ no. of properties positively affected ▪ ha of land positively affected 	<ul style="list-style-type: none"> ▪ increase in property values (%) ▪ increase in land values (%) ▪ availability and take-up of accommodation 	<ul style="list-style-type: none"> ▪ net additional increase in property values (%) ▪ net additional increase in land values (%)
Products from the land	<ul style="list-style-type: none"> ▪ gross new jobs created / safeguarded ▪ ha of productive 	<ul style="list-style-type: none"> ▪ net additional new jobs created / safeguarded ▪ increase in 	<ul style="list-style-type: none"> ▪ increase in employment rate ▪ reduction in unemployment

	spaces created	production	<ul style="list-style-type: none"> increase in GVA
Labour productivity	<ul style="list-style-type: none"> no. of workers affected 	<ul style="list-style-type: none"> GVA per worker / business productivity staff recruitment and turnover rates health and satisfaction of the workforce 	<ul style="list-style-type: none"> increase in GVA improved health of the labour force
Tourism	<ul style="list-style-type: none"> number of visitors to the area and visitor spend number of positive media citations gross new tourism jobs created / safeguarded gross new tourism businesses created gross private sector tourism investment levered in (£) 	<ul style="list-style-type: none"> net additional new tourism jobs created / safeguarded net additional new tourism businesses created net additional private sector tourism investment levered (£) 	<ul style="list-style-type: none"> increase in employment rate reduction in unemployment increase in GVA
<i>Social value</i>			
Health and wellbeing	<ul style="list-style-type: none"> number of users increase in physical activity rates 	<ul style="list-style-type: none"> increase in physical activity rates Improved health – days lost through sickness 	<ul style="list-style-type: none"> reduction in benefit claimants reduced mortality rate savings to the NHS Increased GVA
Recreation and leisure	<ul style="list-style-type: none"> number of users new green infrastructure created (ha) increase in access to natural greenspace 	<ul style="list-style-type: none"> increased well being 	<ul style="list-style-type: none"> increased well being
Quality of place	<ul style="list-style-type: none"> community usage 	<ul style="list-style-type: none"> residents satisfied with the area as a place to live (%) 	<ul style="list-style-type: none"> increase in house prices reduction in anti-social behaviour / crime
<i>Environmental value</i>			
Land and biodiversity	<ul style="list-style-type: none"> remediation of brownfield land (ha) new habitat created/safeguarded (ha) 	<ul style="list-style-type: none"> area of land in active green use no. of animal/plant species present 	<ul style="list-style-type: none"> increase in long term natural use of land. existence value user value
Flood alleviation and water management	<ul style="list-style-type: none"> no. of flood alleviation projects area of flood alleviation (ha) 	<ul style="list-style-type: none"> protected dwellings/ businesses new dwellings/ businesses 	<ul style="list-style-type: none"> reduction in insurance premiums higher property values saving in flood defence/ disaster management costs
Climate change mitigation and adaptation	<ul style="list-style-type: none"> area and density of greenspace created (ha) 	<ul style="list-style-type: none"> reduction in local CO₂ emissions improvement in air quality 	<ul style="list-style-type: none"> reduction in overall CO₂ emissions

The assessment of outputs should be relatively simple, although it will need to be broadly consistent with existing policy systems to ensure that the framework is compatible with the arrangements already in place for monitoring project performance. However, the quantification of some of the outcomes and impacts will be more complex and, in particular, it will often be difficult to quantify many of the social and environmental effects attributed to green infrastructure. Where this is the case, a monetary value and/or score can be calculated, as described below.

4.5.3 Valuing the benefits

It is useful to present benefits in monetary terms so they can be directly compared with costs. Where possible, market prices should be adopted to reflect the economic value of a benefit. There will though be circumstances where there is no readily available market data. Nevertheless, it will be important to value both the market and non-market benefits so as to obtain an accurate reflection of a good or service's full economic impact. If the non-market benefits are not measured then it is likely that the overall value of an intervention will be underestimated.

Therefore, in order to properly capture the overall value of a good or service, it is necessary to consider the alternative methods of valuing non-market benefits. A number of approaches have been developed to measure the value of non-market goods or services, including:

- **hedonic pricing (revealed preference)** – this method relates the price of a marketed good (usually property values) to a non-marketed good. For example, property prices near green infrastructure compared to those elsewhere can be seen as providing an estimate of the value of green infrastructure;
- **contingent valuation** – this is a survey method whereby preference information is collected by asking households how much they are willing to pay (WTP) or willing to accept (WTA) in compensation for some change in the provision of a good or service;
- **benefits transfer** – taking available information from valuation studies already completed in one location and/or context and applying them to the current context.

These three approaches are used in order to obtain a monetary value. Particularly in terms of hedonic pricing and contingent valuation, this can prove to be complex and it is essential that such valuations are subject to rigorous testing in order to ensure that the results are credible and reflect the true value of the potential benefits. The benefits transfer method is only as accurate as the initial study and since valuations are often context and time specific, care needs to be taken in their use and interpretation.

Each technique is subject to methodological and practical difficulties and often some combination of measures is appropriate. In the main though the benefits transfer method is the most feasible and it is recommended that, in the majority of cases, existing evidence and research should be used to attach a monetary value to each of the economic value impacts. It may also be appropriate to attribute a monetary value to some of the social and environmental impacts, but this is likely to prove more complex and may require the assistance of professional experts.

4.5.4 Scoring framework

From Table 4.5, it can be seen that green infrastructure has the potential to result in a diverse range of benefits, some of which do not have an easily measurable value. When assessing the overall value associated with a given project, it will though still be important to try and quantify these less tangible benefits so as not to underestimate the impact of

green infrastructure. A useful approach that can be adopted to ensure that the full range of benefits generated are taken into account is to use a scoring framework.

A scoring framework involves attributing scores against each benefit, depending upon the impact of the intervention. This approach can be used to express the impact of an intervention on a number of benefits, including those for which a readily measurable value has not been established, and offers the ability to compare the performance of alternative options against non-quantifiable, as well as quantifiable, outputs and outcomes. The use of such multi-criteria approaches inevitably involves a degree of subjectivity, but can be used to provide an indication of an intervention's overall economic value.

It is therefore proposed that, when applying the assessment framework, in addition to (or in place of) a monetary valuation and/or a measurement of the units of output generated, a score should be given to each benefit shown within Table 4.3. This should be based upon the scoring range outlined in Box 4.1 and reflect the effect of a green infrastructure project under each impact criterion.

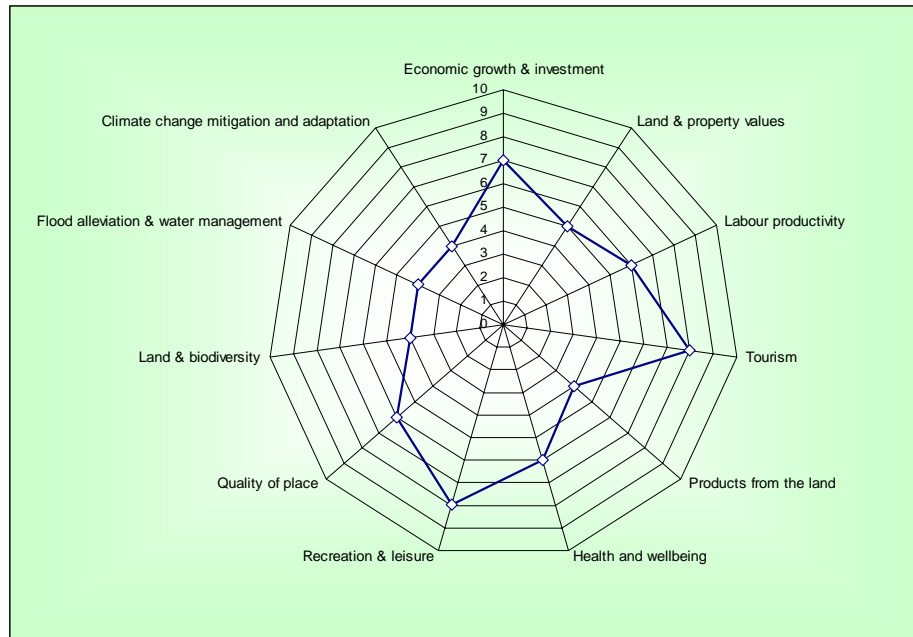
Box 4.1 – Scoring range⁸⁹

- -1 - -5 = a negative impact
- 0 = a neutral/no change position
- 1 - 2 = a marginal positive impact
- 3 - 5 = a positive impact
- 6 - 8 = a significant positive impact
- 9 - 10 = an extremely significant positive impact

An excel spreadsheet has been developed that will generate a colour coded cover sheet and 'spider' diagram for the assessment scoring. An example of the 'spider' diagram is shown in Figure 4.2.

⁸⁹ It is expected that most interventions will result in a positive impact for the majority of the potential benefits and therefore a greater positive scoring range has been used than negative scoring range, so as to better capture the differential between alternative options.

Figure 4.2: Assessment scoring



In contrast to the monetary valuation and measurement of units of outputs produced, a score is required for each benefit so as to obtain a full assessment of the expected impact of the project. This approach should also be used to present and compare the results of any alternative options. One of these options will need to be the reference case (what would have happened anyway in the absence of the project) so that the net additional impacts can be assessed (see Appendix A).

4.6 Assessing value for money

VFM is defined by OffPAT as being “determined by the relationship between total costs (the resources a project uses up) and total benefits (including, in particular, the outputs and outcomes it is anticipated to achieve)...for a project to offer VFM its benefits must exceed its costs”.⁹⁰ There are two main approaches to assessing VFM:

- (i) *Cost-benefit analysis (CBA)* – this method involves quantifying in money terms as many of the costs and benefits of a project as possible, including items for which the market does not provide a satisfactory measure of value (such as social and environmental costs). The costs and benefits are then compared to determine whether benefits exceed costs and the project is VFM; and
- (ii) *3Es analysis* – this technique focuses on the public sector funding and involves an assessment of the:
 - ratio of costs to inputs (referred to as economy) – in other words is the required specification being delivered at an appropriate price. This will often be in the form of a cost appraisal and might include ratios, such as, cost per trainer;
 - ratio of public sector costs to outputs (efficiency, or sometimes referred to as cost effectiveness); and
 - delivery of objectives or key outcomes – the extent to which the project will achieve the desired objectives (effectiveness).

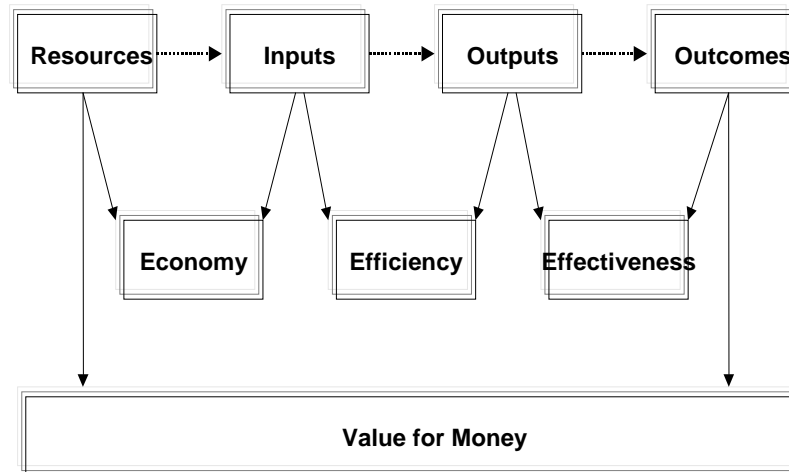
⁹⁰ OffPAT (2008), ‘Value for Money – Project Advice Note’.

It is proposed that, within the assessment framework, both of these approaches are applied such that

4.6.1 3Es analysis

The structure of a 3Es analysis is summarised in Figure 4.3.

Figure 4.3: 3Es analysis



Source: Assessing the Impacts of Spatial Interventions: Regeneration, Renewal and Regional Development 'The 3Rs guidance'⁹¹

Each of the components of the 3Es analysis is explored in turn:

Economy

Economy involves assessing the reasonableness of the cost of the inputs being consumed. For example, is the remediation / construction costs the minimum necessary given the nature, quality and sustainability standards of the project? The reasonableness of input costs need to be tested by reference to: past performance; benchmarks; internal or external experts; and/or the results of competitive tendering exercises.

Efficiency

Efficiency is defined as the relationship between inputs (public sector costs) and outputs or, where possible, outcomes. These ratios are generally expressed in terms of public sector pounds spent to generate a unit of output – for example, cost per hectare of land remediated.

The main focus should be on net costs and net additional outputs or outcomes. Where there is uncertainty about receipts and/or a lack of benchmark data, gross costs may also be used.

The process involved in calculating cost effectiveness is as follows:

- (i) calculate the present value (PV) of the net public sector costs;

⁹¹ The approach is based on that set out in HM Treasury, Cabinet Office, National Audit Office, Audit Commission, Office for National Statistics - Choosing the Right FABRIC: A Framework for Performance Information.

- (ii) determine the principal output/outcome of the project and assess the number of gross direct and net additional outputs that are expected to be generated. If the project delivers a range of important benefits, then costs may be allocated or attributed to benefits and a number of relevant cost effectiveness ratios calculated. In particular, the ratio of NWDA investment per attributed net additional output/outcome will need to be assessed; and
- (iii) then calculate the PV net public sector cost per unit of output/outcome by dividing costs by the outputs/outcomes.

Box 4.2: Example of efficiency assessment – destination green infrastructure project

By way of example, a green infrastructure project is concerned with enhancing the visitor offer and attracting visitors to a priority area. The estimated costs, benefits and VFM are as follows:

COSTS		
A	PV of net public sector costs (£)	10,000,000
OUTPUTS/OUTCOMES		
B	Net additional visitors	50,000
COST EFFECTIVENESS RATIOS		
C=A/B	PV net public sector cost per net additional visitor (£)	200

The PV of the net public sector cost per net additional visitor is £200.

It will also often be important to estimate leverage ratios. These show the level of other public and private sector investment levered into a project.

Effectiveness

Effectiveness is the extent to which the project outputs are likely to achieve the desired objectives. This is often assessed using a statement (referred to as an impact statement) of the extent to which the project is likely to meet each objective or alternatively a weighting and scoring system can be used. Where possible, the weighting and scoring system should be based upon the views of a number of individuals including potentially an external mediator.

Box 4.3: Example of weighting and scoring effectiveness

A weight has been attributed to a project’s two main objectives, to reflect their relative importance, and a score out of 100 given according to the project’s expected contribution to achieving the objective.

Objective	Weight	Score	Weighted Score
Increased economic activity	9	65	585
Enhanced social cohesion	10	70	700

The scores have been multiplied by their respective weight to give a weighted score for each benefit, which have then been summed to give a total weighted score of 1,285. This can be compared with the weighted scores of alternative options in assessing the contribution to delivering the project’s objectives.

4.6.2 Cost-benefit analysis

CBA compares the costs and benefits associated with a project over time. It involves putting a money value on all relevant costs and benefits. The full costs should be calculated net of any expected revenues (i.e. anticipated income/receipts should be deducted from costs) and the net additional benefits identified.

The different timing of costs and benefits should be identified. The time period for the appraisal should extend to cover the useful lifetime (in other words, the period over which the asset can be expected to be used for its intended purpose) of an asset or be long enough to allow for all important costs to be incurred and benefits to arise.

In order to compare costs and benefits that occur in different time periods they should be discounted. Discounting involves reducing future costs and benefits to reflect the fact that society places greater value on costs and benefits that arise sooner rather than later. Discounting provides a present value (i.e. the value that is placed on them today) of costs and benefits.

The process in undertaking a CBA can be summarised as follows:

- (i) determine the annual cash flow of additional costs and calculate their present value (PV);
- (ii) identify the annual profile of benefits in money terms by PV of benefits; and
- (iii) calculate the net present value (NPV) of the project – this is done by deducting the present value of the costs from the present value of the benefits.

If the NPV of a project is positive (i.e. benefits exceed costs) then the project is VFM. Calculating a project's NPV is the principal method of assessing VFM using a CBA approach, although sometimes alternative techniques, such as benefit cost ratios, are also used.

Box 4.4: Net present value

(i) Example 1 – land restoration

A range of options has been appraised for the restoration and subsequent management of a 5 hectare site for open space on a former coalfield site. The present value of the restoration costs is £0.5 million (based on £100,000 per hectare) and is the same for each option. However, the estimated management and maintenance costs vary between options. Research⁹² by the then Department for Transport, Local Government and the Regions identified that urban fringe land has a present value of £200,000 per hectare to society – giving a total value of £1 million.

The estimated net present value of each option is as follows:

Option	Present value of benefits £m A	Present value of restoration costs £m B	Present value of management costs £m C	Net present value £m D = A-(B+C)
Option 1	1.0	0.5	0.6	-0.1
Option 2	1.0	0.5	0.4	+0.1
Option 3	1.0	0.5	0.3	+0.2
Option 4	1.0	0.5	0.5	0

The best option is Option 3, because it has the highest positive net present value.

(ii) Example 2 – Regional park events programme

⁹² DTLR (2002), 'Valuing the External Benefits of Undeveloped Land'.

A five year programme of events in a regional park is proposed which is designed to attract additional visitors to an area. The total benefit, in terms of net additional GVA, of these visitors has been estimated. The discounted cash flow and net present value of the project is as follows:

	Year 0	Year 1	Year 2	Year 3	Year 4	Total
Costs (£000s)	500	500	500	500	500	2,500
Benefits (£000s)	200	300	600	900	1,000	3,000
Net value (£000s)	-300	-200	100	400	500	500
Discount factor	1	0.966	0.934	0.902	0.871	-
Net present value (£000s)	-300	-193.2	93.4	360.8	435.7	396.6

Where the objectives of a project include benefiting specific groups, such as disadvantaged people, greater weight will be given to those net additional benefits that accrue to those target groups. The calculation of net additional benefits will have included specific consideration of whether the target group or area is expected to benefit through assessing leakage⁹³. Consequently, there will have been some assessment of what the “distributional effects” are, or how costs and benefits affect different groups in society. However, for some projects, which involve significant distributional impacts, a more in-depth analysis may be necessary.

⁹³ In calculating additionality, allowance needs to be made for leakage – the proportion of outputs and outcomes that benefit those outside of the project’s target area or group. Further explanation of this and the other additionality factors are set out in The Additionality of Project Benefits – PAN8.

5 Conclusion

Green infrastructure, in its many forms, is seen as having an important role to play in supporting sustainable economic growth within the North West. This is reflected in the increasing prominence given to green infrastructure and, more generally, quality of place within regional and national policy. The development and enhancement of green infrastructure will assist in creating areas in which people want to live, work and visit, helping to stimulate additional investment and economic activity. It will also contribute to key environmental goals, such as that set out within the North West's Climate Change Action Plan for a low carbon, well adapted region.

There is a need for public sector intervention to support the development of the region's green infrastructure, due to a number of interlinked market failures, which serve to limit private sector investment. Moreover, green infrastructure projects have the potential to contribute significantly to the NWDA's key priorities, outputs and outcomes, including GVA per head. Evidence of this is being provided through the establishment of regional parks, which are expected to deliver a number of economic benefits, such as increased visitor numbers and spend.

Overall, the research into the impact of green infrastructure, and its different forms, indicates that it can generate a range of economic, social and environmental benefits. The main benefits that were highlighted by the literature are summarised in Box 5.1.

Box 5.1: Economic, social and environmental benefits of green infrastructure

Economic benefits:

- economic growth and investment – for example, research in the South West found that 35% of relocating companies quoted environmental attractiveness as a key reason for the move;
- land and property values – for example, an uplift of up to 34% in property values can be obtained for properties facing a park and views of natural landscapes can increase property values by as much as 18%;
- products from the land – for example, activities linked to the management of the environment, including food production, contribute around £67.6 million per annum in GVA to the natural economy;
- labour productivity – for example, one survey found that 60% of staff indicated that their surroundings and external views had the greatest impact on how they felt at work; and
- tourism – for example, research indicates that environmental tourism sustains approximately 26% of the region's tourism sector, with rural tourism supporting 37,500 jobs.

Social benefits:

- health and wellbeing – for example, a study has suggested that doubling tree cover across the West Midlands would help prevent 140 pollution related premature deaths within the region each year;
- recreation and leisure – for example, green infrastructure provides the opportunity for various forms of recreational activity, including outdoor sports, and walking and cycling; and

- quality of life – for example, the development of green infrastructure can improve civic pride and place vitality, providing opportunities for social interaction and increased community cohesion.

Environmental benefits:

- land and biodiversity – for example, green infrastructure provides a habitat for a wide variety of species, with research suggesting that the greatest influence on ecology is the proportion of greenspaces;
- flood alleviation and water management – for example, the retention of flood plains as greenspaces can reduce requirements for engineered flood defences; and
- climate change and mitigation – for example, research suggests that vegetation has a significant value as a carbon sink and that green infrastructure can result in environmental cost savings.

Overall, green infrastructure has significant economic value. The actual value added can be difficult to quantify, but there is growing evidence of economic social and environmental 'returns'. For instance, government commissioned research showed that the benefits of undeveloped land can range from £20,000 per hectare for agricultural land to £10.8 million per hectare for an urban park. Furthermore, a range of different stakeholders can benefit from green infrastructure, including local businesses, occupiers, public sector bodies and the wider community.

Investment in green infrastructure, along with the reuse of brownfield land, can contribute significantly to sustainable economic development and GVA growth. Enhancing the quality of the natural environment by, amongst other things, developing regional parks can provide a context for high quality investment and activity. Through improving greenspace, high value added businesses and entrepreneurs can be retained and attracted to priority locations. By creating a high quality of place, green infrastructure can attract visitors and help to develop the tourism sector. The re-use of brownfield land will ensure that scarce resources are efficiently used.

Appropriate long-term maintenance arrangements and funding though need to be established if the benefits are to be long lasting.



Appendix A Additionality

Additionality

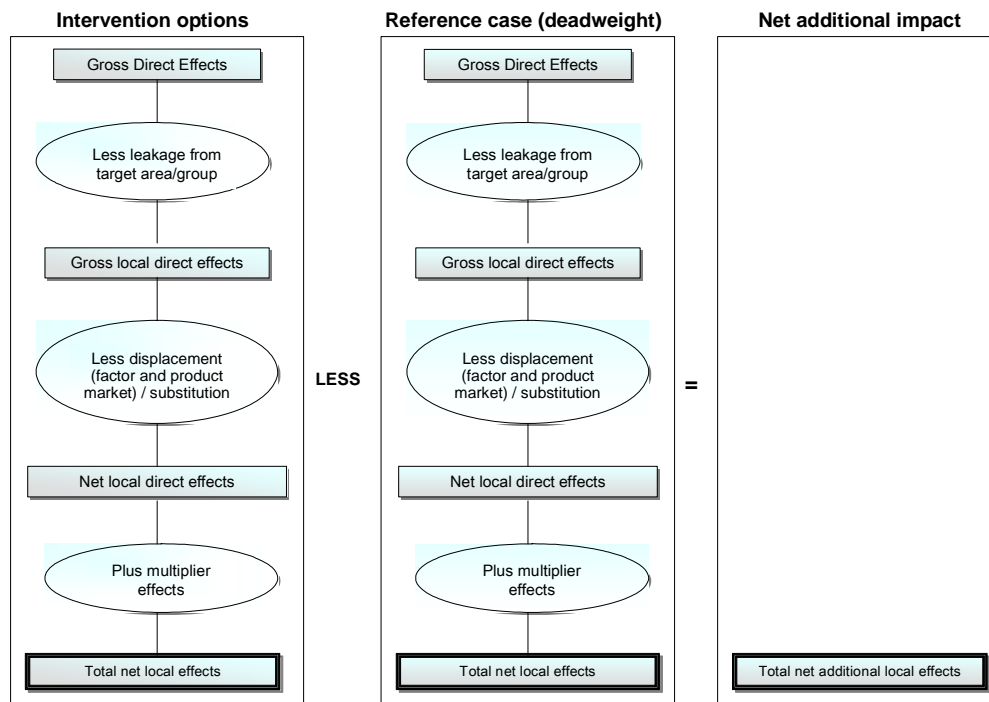
Most projects will have both positive and negative effects and their actual impact on the economy will almost always differ from the gross outputs. In appraising the impact of a project it is, therefore, important that all of these effects are taken into account, so as to determine its additional impact.

This concept is referred to as additionality and relates to the net changes that are brought about by a project over and above what would have taken place anyway. Additionality is defined by the two principle government guides as:

- HM Treasury Green Book⁹⁴ – “an impact arising from an intervention is additional if it would not have occurred in the absence of the intervention”; and
- ODPM’s 3Rs guide⁹⁵ – “the extent to which activity takes place at all, on a larger scale, earlier or within a specific designated area or target group as a result of the intervention”.

The additional impact of a project is therefore the difference between the reference case position (what would have happened anyway) and the position achieved by the project (intervention option) once it has been implemented. In order to calculate the additionality of project outputs, a number of adjustments need to be made to both the project itself and the reference case, as shown in Figure 4.3.

Figure 4.3: Approach to assessing project level additionality – key components



Source: English Partnerships (2004)

⁹⁴ HM Treasury (2003) ‘Appraisal and Evaluation in Central Government’ – known as the Green Book.

⁹⁵ ODPM (2004) ‘Assessing the Impacts of Spatial Interventions – Regeneration, Renewal and Regional Development’ – known as the 3Rs guide.

In calculating the above adjustments for additionality, reference should be made to English Partnerships' Additionality Guide⁹⁶. As well details on how to assess each element of additionality, the guide also contains ready reckoners that can be applied to the gross outputs of a project in order to derive net additional estimates. These though should only be used where there is a limited evidence base in relation to the scale of leakage, displacement / substitution and/or multiplier effects.

⁹⁶ English Partnerships (2004) 'Additionality Guide – A Standard Approach to Assessing the Additional Impact of Projects'.