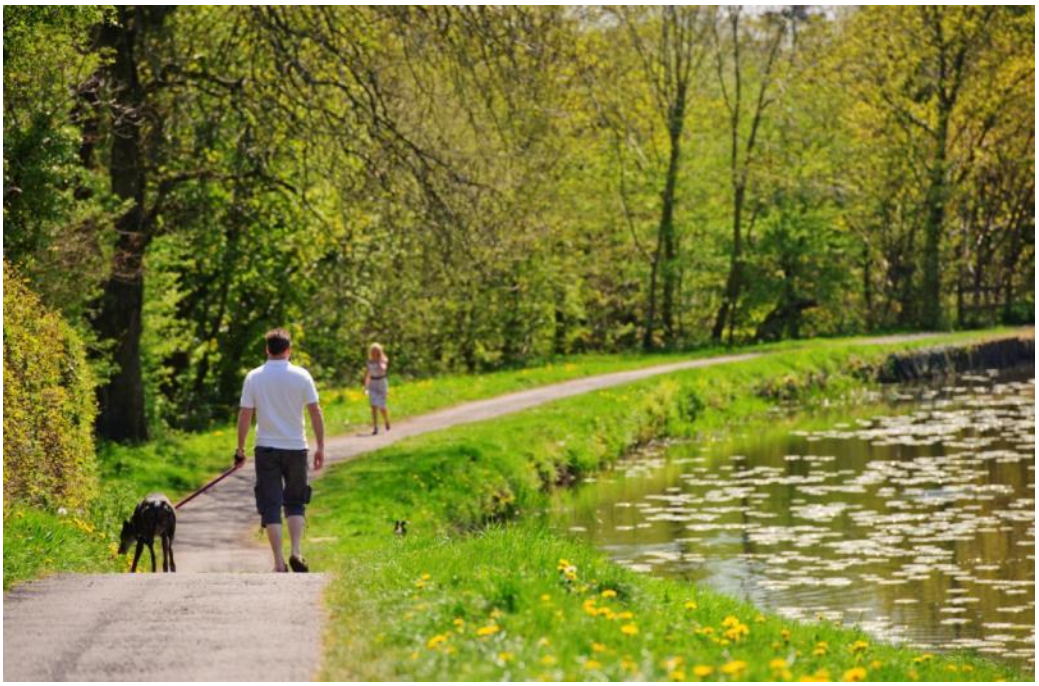
TORFAEN COUNTY BOROUGH
BWRDEISTREF SIROL TORFAEN

TORFAEN GREEN INFRASTRUCTURE



An assessment of the Green Infrastructure Assets of Torfaen and the functions they perform.

An Executive Summary of this document is available in Welsh and English versions
Mae Crynodeb Gweithredol o'r ddogfen hon ar gael yn Gymraeg ac yn Saesneg

Contents

FIGURES

TABLES

TORFAEN GREEN INFRASTRUCTURE

Context

WHAT IS GREEN INFRASTRUCTURE?

Green infrastructure is defined in Planning Policy Wales Edition 11 as "the network of natural and semi-natural features, green spaces, rivers and lakes that intersperse and connect places". Green Infrastructure can function at a range of different scales; from entire ecosystems such as wetlands and rivers to parks, fields and gardens. Street trees, hedgerows, roadside verges, and green roofs/walls can all contribute to green infrastructure networks. These features are termed Green Infrastructure Assets and have a role to play in supporting biodiversity and delivering health, social, economic and cultural benefits.

> Living closer to nature may foster greater appreciation of it

WHY IS GREEN INFRASTRUCTURE IMPORTANT?

These green assets form a network which if **planned, designed and well managed** provide a wide range of holistic benefits to people and nature which have been largely undervalued until recently. These benefits can also be referred to as **ecosystem services** as these green assets provide services such as clean air and water, fertile soil in which to grow our food and energy resources with which to heat our homes. We depend on many of these services for human existence.

There are also many less visible ecosystem services. These include the climate regulation and natural flood defence provided by woodlands, the billions of tonnes of carbon stored by peatlands, and the pollination of crops by insects. Even less visible are cultural ecosystem services such as the inspiration we take from wildlife and the natural environment and the spaces we use for recreation which contribute to our physical health and mental wellbeing. To function properly, these ecosystems need to be healthy and the increasing fragmentation and pressure being put on our Green Infrastructure is degrading the services that can be provided.

Individual assets often produce multiple benefits. For example, a route that enhances accessibility for walkers, cyclists and horse riders may also help to improve people's mental and physical health by providing somewhere to exercise, support economic development through tourism and decrease carbon emissions by reducing car use. This multi-functionality is further amplified if these assets are linked together to form a network.

Green Infrastructure should be protected and well managed, and the networks of existing and new Green Infrastructure should be planned and delivered at all spatial scales from the county and local level to regional, national and trans-national level.

THE GREEN INFRASTRUCTURE APPROACH

There are increasing pressures on our natural resources, especially our land, as we aim to provide housing and employment opportunities for our growing population, face the challenge of a changing climate and tackle the health and well-being agenda.

The Well Being for Future Generations Act 2015 challenges public bodies to think more holistically about these issues to ensure '*that the needs of the present are met without compromising the ability of future generations to meet their own needs*'. This is the sustainable development principle. We need to take a strategic view of the management and development of our land resource. A Green Infrastructure approach promotes a way of tackling these diverse and often competing land management issues in a spatially coherent manner. At a time of financial pressure, we need to ensure we are making the most efficient use of the resources, both financial and natural, that we possess.

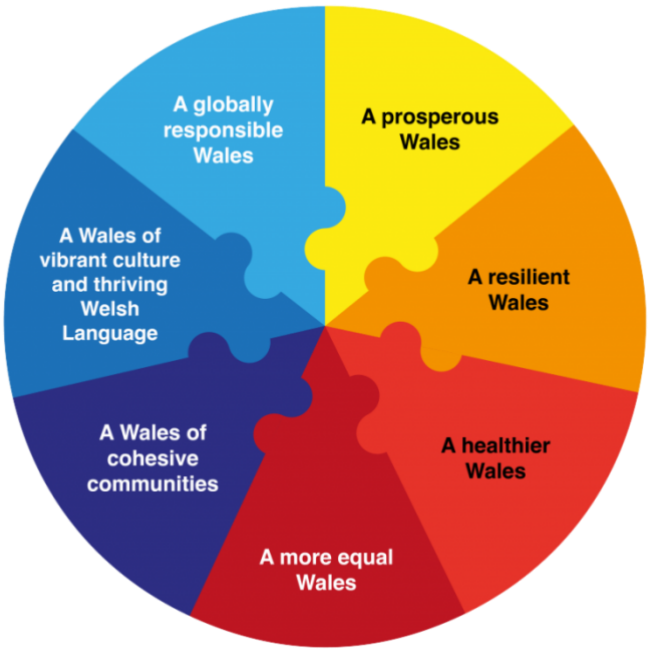
Understanding how an area of land provides these ecosystem services or benefits is an important step for taking informed choices about its management. The Green infrastructure approach encourages a more sustainable and resource efficient development process.

THE PURPOSE OF THE ASSESSMENT

Planning Policy Wales Edition 11 requires planning authorities to prepare a Green Infrastructure Assessment to guide and shape the planning and delivery of Green Infrastructure within Torfaen. This document forms the baseline for a positive and proactive approach to the management and enhancement of Torfaen' s natural assets, in particular when associated with the level of growth identified in the Replacement Local Development Plan (RLDP).

This document will provide a mechanism to support the implementation of local planning policies on Green Infrastructure with the aim of promoting a Green infrastructure approach to land-use planning, design and management. This will ensure Green Infrastructure forms an integral and significant part of development and wider infrastructure proposals.

TORFAEN GREEN INFRASTRUCTURE Policy



POLICY FRAMEWORK

The Well Being for Future Generations Act

The Well-being of Future Generations (Wales) Act 2015 requires public bodies in Wales to carry out sustainable development. The Act sets out a common aim for the public sector 'to improve the economic, social, environmental and cultural well-being of Wales in accordance with the sustainable development principle'. This means seeking to ensure 'that the needs of the present are met without compromising the ability of future generations to meet their own needs'.

Five Ways of Working

In applying the sustainable development principle public bodies will need to demonstrate that they have used the following five ways of working:

- Integration – demonstrating a joined-up approach to communities and people, the economy, the environment and culture.
- Long-term thinking - balancing current and long-term needs.
- Prevention - taking action now to prevent problems in the future
- Collaboration - working with others to meet our objectives
- Involvement - involving the people affected by our actions.

Green Infrastructure approach to land management takes in all these ways of working. It is an **integrated** approach identifying the multiple functions that an area of land may have which could be social, economic and environmental. It takes a **long-term** view of how any assets may be used in the future and how the site could be developed to make it more multifunctional such as to **prevent** flooding due to surface runoff. It takes a **collaborative** approach looking at the competing needs of biodiversity, climate change adaptation and mitigation, housing, employment, transport and recreation and should **involve** local people in how the Green Infrastructure asset is managed. The Green Assessment forms part of the evidence base on which decisions about the management of land can be made.

How Green Infrastructure can help to deliver the Well Being Goals

The Act sets seven well-being goals to help the public sector deliver sustainable development– setting out a shared purpose. The following shows how well designed and managed green infrastructure can contribute to fulfilling these goals.

A prosperous Wales

An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change); and which develops a skilled and well-educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work.

The Green Infrastructure approach provides for the efficient use of our land resource, acts as a carbon sink to reduce CO_2 emissions and environmental cost savings through the reduction in environmental damage such as from flood episodes. It provides opportunities for green jobs and creates attractive environments which help to encourage inward investment.

A resilient Wales

A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).

A Green Infrastructure approach helps to ensure the delivery of healthy, interconnected ecosystems that provide the hidden benefits upon which human society relies.

A healthier Wales

A society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.

Well designed and maintained Green Infrastructure assets provide space for physical exercise and improved wellbeing by creating attractive environments in which to live and work. They can help people (especially children) to reconnect with nature which has proved to be a valuable aid to physical and mental wellbeing.

A more equal Wales

A society that enables people to fulfil their potential no matter what their background or circumstances (including their socio-economic background and circumstances).

The development of green jobs as well as better health and well-being creates a positive attitude to study or work which can help raise educational attainment and productivity, increasing people's ability to earn and reducing inequality of opportunity.

A Wales of cohesive communities

Attractive, viable, safe and well-connected communities.

The more attractive environments created by the inclusion of green infrastructure within our urban areas can help attract inward investment, reduce crime, provide safe transport routes and give opportunities for community and social cohesion through community growing schemes and providing places to meet and socialise.

A Wales of vibrant culture and thriving

A society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.

Cultural heritage is included within the definition of Green Infrastructure and these assets should be considered equally when decisions regarding land management are being made. It also ensures there is adequate accessible green space for sport and recreation.

A globally responsible Wales.

A nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being and the capacity to adapt to change (for example climate change).

Green Infrastructure can make a significant contribution to climate change mitigation and adaptation by providing services such as carbon storage through the preservation and enhancement of woodland and peat bogs; reducing flood risk by the provision of flood storage areas, providing shade to alleviate higher summer temperatures and increasing the capacity of the landscape to absorb surface runoff.

Environment Act

The Green Infrastructure approach uses the concept of ecosystem services as a way of looking at our natural resource management which is aligned to the approach outlined in the Environment (Wales) Act 2016.

Part 1 of the Act also provides an iterative framework to deliver the sustainable management of natural resources. Sustainable management of natural resources is defined in the Act as: "using natural resources in a way and at a rate that maintains and enhances the resilience of ecosystems and the benefits they provide. In doing so, meeting the needs of present generations of people without compromising the ability of future generations to meet their needs, and contributing to the achievement of the well-being goals in the Well-being of Future Generations Act."

The framework includes the State of Natural Resources Report (SoNaRR) produced by Natural Resources Wales (NRW) which contains NRW's assessment of the state of natural resources in relation to Wales and provides the evidence base for the National Natural Resources Policy (NNRP). The NNRP sets out the Welsh Government's priorities in relation to the management of natural resources.

NRW has prepared and is implementing Area Statements. These set out the key priorities and risks that need to be carefully managed and mitigated and the key opportunities for the sustainable management of natural resources at a more local level. These documents provide vital evidence for public bodies on the priorities, risks and opportunities in relation to our natural resources and can help to inform decisions.

Section 6 of the Act places a duty on public authorities to 'seek to maintain and enhance biodiversity' so far as it is consistent with the proper exercise of those functions. In so doing, public authorities must also seek to 'promote the resilience of ecosystems'.

National Natural Resource Policy 2017

The policy sets out three National Priorities. These are:

- Delivering nature-based solutions
- Increasing renewable energy and resource efficiency
- Taking a place-based approach

The State of Natural Resources Report shows that investment in our natural resources, in these areas shown below, deliver most in terms of both ecosystem resilience and benefits across all the wellbeing goals:

- **Increasing green infrastructure in and around urban areas;**
- Coastal zone management and adaptation.
- **Increasing canopy cover and well-located woodland, for example close to towns and cities where it will have the greatest recreational and ecosystem service value;**
- Maintaining, enhancing and restoring floodplains and hydrological systems to reduce flood risk and improve water quality and supply; and,
- **Restoring our uplands and managing them for biodiversity, carbon, water, flood risk and recreational benefits.**

International Memorandum of Understanding on Nature Based Climate Action

Recognising the importance of the nature-based approach as a key component of climate change action, the Welsh Government initiated and is a founding signatory to the International Memorandum of Understanding on Nature Based Climate Action.

The Welsh Government has committed to:

- promote investments in enhancing ecosystem resilience as part of the response to the need for mitigation and adaptation.
- look to natural or "green" infrastructure solutions to reduce climate risk and provide wider ecosystem services whilst safeguarding biological diversity and ecosystem health;
- the use of tools and assessments that promote the understanding of the wider value of biodiversity and healthy ecosystems in addressing climate change and providing wider multiple benefits;
- the development of tools to measure the benefits of integrated approaches to climate change (including ecosystem services, safeguarding biological diversity, carbon sequestration, and wider co- benefits that support increased resilience);
- the need for enhanced technical and scientific cooperation and measurement in relation to implementation; and,
- fostering closer links between ecosystem management, climate-change adaptation and sustainable development.

Planning Policy Wales - Edition 11 (2021)

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It clusters traditional planning policies around four themes:

- Strategic and Spatial Choices
- Active and Social Places
- Productive and Enterprising Places
- Distinctive and Natural Places

The key issues within the **Active and Social theme** include the improvement of sustainable access to services, cultural opportunities and recreation facilities to support people to adopt healthy, culturally fulfilled lifestyles which will assist in improving health and wellbeing. This theme emphasises that when planning and managing future development, planning authorities need to ensure that residents of existing and new communities have access to jobs and an appropriate range of community facilities including recreation, leisure, health and education.

The **Distinctive and Natural Places theme** covers the historic environment, landscape, biodiversity and habitats, coastal characteristics, air quality, soundscape, water services, flooding and other environmental (surface and sub-surface) risks.

The special and unique characteristics and intrinsic qualities of the natural and built environment must be protected in their own right, for historic, scenic, aesthetic and nature conservation reasons. These features

give places their unique identity and distinctiveness and provide for cultural experiences and healthy lifestyles.

The environmental components of places influence and shape health and wellbeing as well as playing a role in sustaining and creating places which are adaptable and resilient to change. **Distinctive and Natural** places must maintain or incorporate **green infrastructure** as key components of their natural and built fabric, recognising the wide-ranging role it can play. Doing so will maximise the health and well-being of communities and the environment.

Green infrastructure plays a fundamental role in shaping places and our sense of well-being, and is intrinsic to the quality of the spaces we live, work and play in. The planning system should protect and enhance **green infrastructure assets and networks** because of these multi-functional roles. The protection and enhancement of biodiversity must be carefully considered as part of green infrastructure provision alongside the need to meet society's wider social and economic objectives and the needs of local communities.

Planning authorities should adopt a strategic and proactive approach to green infrastructure and biodiversity by **producing up to date inventories and maps of existing green infrastructure and ecological assets and networks.** The Green Infrastructure Assessment should be used to develop a robust approach to enhancing biodiversity, increasing ecological resilience and improving well-being outcomes, and should identify **key strategic opportunities** where the **restoration, maintenance, creation or connection of green features and functions would deliver the most significant benefits.**

The need for ecosystems, habitats and species to adapt to climate change should be considered as part of the Green Infrastructure Assessment. This should include identifying ways to minimise or reverse the fragmentation of habitats, and to improve habitat connectivity through the promotion of wildlife corridors and identifying opportunities for land rehabilitation, landscape management and the creation of new or improved habitats. Planning authorities should ensure that development minimises impact and provides opportunities for enhancement within areas identified as important for the ability of species to adapt and/or to move to more suitable habitats.

The development of networks of statutory and non-statutory sites and of the landscape features which provide links from one habitat to another can make an important contribution to ecosystem resilience and the maintenance and enhancement of biodiversity and the quality of the local environment, including enabling adaptation to climate change.

Welsh Government- Future Wales- The National Plan 2040: The Working Draft NDF Document: September 2020 Version

The Planning (Wales) Act 2015 allows the Welsh Government to produce a National Development Framework (NDF), which will be a 20 year land use framework for Wales and will be the national development plan for Wales and replace the current 'Wales Spatial Plan - People, Places Futures' 2004 (Updated 2008). It will be known as Future Wales (FW). The Working Draft of Future Wales (September 2020) sets out 11 outcomes. These aim to develop a Wales where people live…

- and work in connected, inclusive and healthy places;

- in vibrant rural places with access to homes, jobs and services;
- in distinctive regions that tackle health and socio-economic inequality through sustainable growth;
- in places with a thriving Welsh Language;
- and work in towns and cities which are a focus and springboard for sustainable growth;
- in places where prosperity, innovation and culture are promoted;
- in places where travel is sustainable;
- in places with world-class digital infrastructure;
- in places that sustainably manage their natural resources and reduce pollution;
- in places with biodiverse, resilient and connected ecosystems; and
- in places which are de-carbonised and climate resilient.

Placemaking and walkable scale neighbourhoods are a central concept to the plan. Publicly owned land must be reviewed to identify potential sites for development, including for mixed use and affordable housing developments to support the creation of sustainable places. An emphasis is also placed on safeguarding ecological networks and maximising green infrastructure. Cumulative action towards achieving the enhancement of biodiversity and the resilience of ecosystems should be demonstrated as part of development proposals through an innovative, nature-based approach to site planning and the design of the built environment. There is also a plan to develop a national forest with a target to increase woodland cover by at least 2,000 ha per annum. The Working Draft sets out Pre-Assessed Areas for wind generation and a criteria based policy on large scale wind and solar renewable energy projects. Pre-Assessed Area 10 extends a short distance into Torfaen to the west of Cwmbran.

Torfaen lies within the 'National Growth Area' (focused on Cardiff, Newport and the Valleys) of the South East Wales Region and identifies Cardiff, Newport and the associated valleys as 'Centres of National Growth' and the main areas of focus for investment and growth. The Valleys area, covering large parts of Bridgend, Rhondda Cynon Taf, Merthyr Tydfil, Caerphilly, Blaenau Gwent and Torfaen is a priority area for the Welsh Government and should be a priority for the Strategic Development Plan. Welsh Government central estimates identify a need for 66,400 additional homes until 2039. Growth is to be focused in places with good active travel and public transport connectivity; and land close to Metro stations should be the focus of development.

The Strategic Development Plan is required to identify a Green Belt between Newport / Cwmbran and the eastern part of the region and should support the establishment of the Valleys Regional Park with the LDP being required to embed its principles into planning frameworks.

Technical Advice Note 5: Nature Conservation and Planning 2009

This Technical Advice Note provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation. "Conservation" in the context of this TAN, involves preservation, protection, wise use, sustainable management and restoration of the natural heritage.

Paragraph 3.2.2 states that Article 10 of the Habitats Directive requires Member States to endeavour, in their land use planning and development policies, to encourage the management of features of the landscape that are of major importance for wild flora and fauna. These features are those that, because

of their linear and continuous structure or their function as stepping-stones, are essential for migration, dispersal and genetic exchange. **Such features include rivers with their banks, traditional field boundary systems (such as hedgerows), ponds and small woods.** Statutory sites and non-statutory sites, together with features which provide wildlife corridors, links or stepping stones from one habitat to another, all contribute to the network necessary to ensure the maintenance of the current range and diversity of our flora, fauna, geological and landform features and the survival of important species.

The Active Travel (Wales) Act 2013

The Act makes walking and cycling the preferred option for shorter journeys, particularly those made every day. Local authorities must produce Integrated Network Maps, identifying the walking and cycling routes required to create fully integrated networks to access work, education, services and facilities. Statutory Design Guidance sets out the standards expected of new and improved active travel infrastructure in Wales including audit tools to assess existing infrastructure and future routes for their suitability.

The planning system has an important role to play in promoting and supporting the delivery of the Active Travel Act and creating the right environments and infrastructure to make it easier for people to walk and cycle, including new and improved routes and related facilities.

Countryside and Rights of Way 2000

The Countryside and Rights of Way (CRoW) Act 2000 introduced new provisions to modernise Public Rights of Way management and create a new Statutory Right on Foot to certain types of open land. The Open Access Land designation to land such as mountain, moor heath, down and registered common has expanded public access opportunities to Green Infrastructure at the landscape scale.

As part of the CROW Act a duty was placed on all Local Authorities to develop and publish a Rights of Way Improvement Plan (ROWIP). The ROWIP is a 10-year strategic plan by which local authorities identify, prioritise and plan for improvements to their local rights of way network considering the particular needs of less able people. This assists the Authority in meeting its statutory obligations under relevant access legislation as well as contributing to the achievement of the well-being goals. It also requires the appointment of a Local Access Forum to advise local authorities and others on the improvement of public access to land for open air recreation and the enjoyment of the area.

Torfaen's Corporate Plan 3

Torfaen's Corporate Plan 3 2016-21 sets out a vision for:

- Cleaner and greener communities and a sustainable local environment that residents can be proud of.
- All our young people to be given the best possible chance in life by attaining a good standard of education.
- A healthier community where the most vulnerable people are assisted to lead healthy, independent lives, where the council and other agencies work to prevent suffering and hardship and to reduce inequality.

Management of our Green Infrastructure assets is vital to the fulfilment of much of this vision to create a cleaner, greener and more sustainable environment. If people are satisfied with their parks they tend to be satisfied with their council (CABE 2010). As we have seen well designed and maintained GI can bring social, economic as well as environmental and cultural benefits. Inequality of health and opportunity can be addressed in part by investment in the GI within Torfaen. Strong correlations have been found between poor quality and quantity of spaces in deprived areas and the low levels of physical activity of residents, suggesting that investing in the quality of parks and green spaces is an important way to tackle inequalities in health and well-being.

TORFAEN GREEN INFRASTRUCTURE

Challenges

KEY ISSUES AND DRIVERS

Local Context

The county borough of Torfaen is located in the south-east of Wales and borders the city of Newport to the south, the county of Monmouthshire to the east and the county boroughs of Caerphilly and Blaenau-Gwent to the west and north-west. Torfaen has an area of 126km2 and is the third smallest borough in Wales with a population of around 93,000 (ONS UK).

Geographically the area runs from the Heads of the Valleys in the north to the M4 corridor in the south with three main settlements - Blaenavon, Pontypool and Cwmbran. Torfaen is the most easterly of the industrial valleys of South Wales with the settlements in the north and middle of the borough originally established to exploit the abundant non-renewable charcoal, coal and iron resources in the area. As those heavy industries declined over the past hundred years, so did the prosperity of those areas.

Today the World Heritage Site town of Blaenavon has a population of around 6,000 and is situated in the north of the borough. Blaenavon is famous for the Big Pit coal mining museum and Europe's best preserved 18th century ironworks. The former industrial town of Pontypool with its traditional indoor and outdoor market is the next largest settlement and is located in the heart of the borough. Including the various communities that surround it, Pontypool has a population of around 37,100. In the south of the borough is Cwmbran which uniquely is the only New Town in Wales. Designated in 1949, it was designed as a distinctive, progressive, modern town offering new opportunities for its residents. Significantly expanded since that date Cwmbran now has a population of around 48,700. Cwmbran Shopping Centre attracts around 17 million customers a year from the wider area of Gwent and the M4 corridor.

The borough of Torfaen is included within the NRW Area Statement for South East Wales. The Area Statement defines three of the distinct landscape character areas found within this part of Wales all of which are found to some degree within the borough of Torfaen. These are:

Eastern Valleys: The area to the north of Pontypool is part of an extensive wild and wind-swept plateau with intervening deep valleys. Well known for its extensive industrial coal and ironworking heritage set within an upland moorland of heather, grass, bracken and stone walls, much of the area is common land. Moorland, bog, ffridd and rhos pasture are notable.

Newport: The most heavily urbanised area includes the New Town of Cwmbran and post-industrial Pontypool. The M4, main roads and railways are prominent in the landscape. Extensive urban greenspace exists within Cwmbran with some sections of the Afon Lwyd river corridors providing tranquil and biodiverse sections.

Central Monmouthshire : To the south and east of Cwmbran the landscape is more akin to that of central Monmouthshire consisting of a fairly tranquil, sheltered landscape with gentle rolling hills and intervening valleys providing notable views towards the uplands. The undulating lowlands are pasture-rich with hedgerows and isolated small parcels of woodland with broadleaved and mixed plantations on hills and slopes.

Well-being Plan for Torfaen 2018-23

The Well-being of Future Generations (Wales) Act 2015 establishes Public Service Boards (PSB) across Wales setting out statutory functions to assess the well-being of the area and form well-being plans on a five-year cycle. The PSB for Torfaen has established the following seven objectives:

1. Develop a functional, connected network of natural areas that support the current and future well-being needs of local populations.
2. Develop mitigation and adaptation responses to the impacts of climate change.
3. Provide children and young people with the best possible start in life.
4. Support healthy lifestyles and enable people to age well.
5. Tackle the intergenerational patterns of poverty and develop economic resilience.
6. Improve local skills through work-force planning, training, apprenticeships, and volunteering opportunities.
7. Create safe, confident communities and promote community cohesion.

Torfaen Well Being Assessment

To inform the PSB Well-being Plan a Well Being Assessment was carried out to identify the main issues facing the borough of Torfaen. These were identified as:

- An unhealthy and inactive population
- Air quality
- Noise
- Flooding
- Biodiversity decline

Replacement LDP Issues

Development Pressures

- *Housing Development:* the pressure for housing development within the restricted urban boundary is impacting on urban green space protection and the urban-rural fringe especially in the south of borough.
- *Need for large employment sites:* large employment sites within the borough need to be retained to attract and retain employment opportunities. These sites are subject to pressure to convert this employment land to housing.
- Biodiversity loss: Any biodiversity which has become established on undeveloped allocated sites needs to be accommodated or mitigated for when land comes forward for development.
- *Loss of green infrastructure assets:* Insufficient compensation has been received for the loss of green infrastructure assets, in both the past and present, due to the overriding pressure to provide large scale development.
- *Maintenance of GI assets:* lack of investment in existing green infrastructure and inadequately funded maintenance has led to the degradation of existing assets and inadequate provision in places.

- *Agricultural Land Quality:* the highest quality agricultural land which needs to be retained for food production is coming under increasing pressure from housing development and renewable energy production.
- *Special Landscape Areas*: the designation of Special Landscape Areas is inconsistent across the neighbouring local authority areas.
- *Coalescence:* there is a risk that pressure for development will lead to the coalescence of Newport, Cwmbran and Pontypool.

Climate Change

- *Flooding:* from the C2 flood plain along the Afon Lwyd and surface water runoff from hard surface development.
- *Biodiversity:* declining overall levels with habitat fragmentation and reduced extent.
- *Water Quality:* the Afon Lwyd and its tributaries north of Pontymoile are of poor quality largely due to abandoned mines and contaminated land. Barriers to fish migration and agricultural pollution also contribute to poor water quality.
- *Active Travel:* A modal shift is required from cars to forms of active travel such as walking, cycling and increased use of public transport to achieve, healthier lifestyles, reduce carbon emissions and cut air pollution.
- *Air Quality:* there are no Air Quality Management issues within Torfaen but outward commuting contributes to AQMA's within neighbouring local authority areas.
- *Renewable Energy:* requirements for renewables are putting additional demand on our agricultural and upland resource.

Ageing population

- The County Borough will have an ageing resident population as people live healthier and longer lives. Ensuring an ageing population can access and negotiate the built and natural environment is important to help people keep healthy and independent into old age, with prevention starting from an early age.

Deprivation

- High levels of overall deprivation occur within pockets of Torfaen
- Housing delivery affordability is an issue within the borough.
- The requirements of the Gypsy Traveler community need to be catered for.
- Torfaen has low levels of educational attainment.
- Torfaen has an unhealthy population.
- Deficiency in provision for sport, play areas, allotments and access to natural green space has been identified within the Torfaen Open Space Assessment.

Cultural

- There are a declining number of Welsh Speakers within Torfaen

- The borough possesses a number of heritage assets including Blaenavon Industrial Landscape World Heritage Site and thirty three buildings at risk. The setting of some of these assets are threatened by overdevelopment.

Environmental Challenges

Under the Environment (Wales) Act 2016, Natural Resources Wales have a duty to produce Area Statements with the aim of informing 'place based' action. Areas Statements bring together data, information and ways of engaging others to help understand the state and trends of natural resources of specific areas, the pressures on them and their benefits. Area Statements also use evidence to consider the relevance of the National Resources Policy priorities in an area. Area statements provide an evidence base for Local Development Plans, as well as feeding into Public Service Board Well-being Plans.

NRW South East Wales Area Statement

The South East Area Statement area covers the Local Authorities of Blaenau Gwent, Caerphilly, Monmouthshire, Newport and Torfaen collectively referred to as 'Gwent'. The Area Statement identifies the following four themes:

Linking Our Landscapes

This theme is concerned with the identification of local opportunities for protected sites, and natural and built environments to contribute towards the resilience of wider priority habitat networks in the region. These opportunities for improving ecosystem resilience should support ecological connectivity between sites, across boundaries and at a landscape scale. The 'Linking Our Landscapes' themed network has explored two significant and interconnected strands of work:

- reversing the decline in biodiversity by developing ecological networks and improving ecosystem resilience across Gwent
- considering how and where our natural assets can be used to deliver preventative, cost-effective and long-term nature-based solutions to some of our most complex social, economic and cultural well-being needs

Ecosystem resilience relates to diversity, condition, extent and connectivity, all of which combine and contribute in various ways to the overall health and adaptability of any particular ecosystem (its resilience). The key risks to the health of our ecosystems have been identified as

- climate change
- habitat loss and degradation
- excessive nutrient load and other forms of pollution
- Invasive Non-Native Species (INNS)
- over exploitation and unsustainable use.

Climate Ready Gwent

This theme is concerned with landscape and regional scale opportunities and collective interventions for climate adaptation and mitigation which enhance local ecosystem and community resilience. These include:

- improve health and resilience of our ecosystem services
- improve resource efficiency
- de-carbonisation
- identify and reduce risks of climate change
- reduce greenhouse gas emissions

Healthy Active Connected

This theme involves identifying opportunities and collaborative interventions that protect and improve health and well-being, connecting people, communities and service delivery to nature for the benefit of both people and the environment.

It looks to encourage nature-based solutions to health inequalities delivered across Gwent which

- Improve the green recreational offer by providing increased access to GI and promoting this offer
- Increase access to growing spaces
- Safeguard and enhance local greenspace offer for new and existing developments
- Improve active travel infrastructure
- Improve local greenspace quality creating more Green Flag eligible spaces
- Support opportunities for outdoor learning and play
- Identify and assess opportunities for managing public estate to enable delivery of nature based solutions to health inequalities

Ways of Working

This theme involves recognising the benefits of strategic regional collaboration and identifying what we need to do once, well, at a regional scale to maximise local delivery. This strategic theme adds value to the ways in which our natural resources are managed collaboratively, maximising the benefits they provide.

Local biodiversity issues

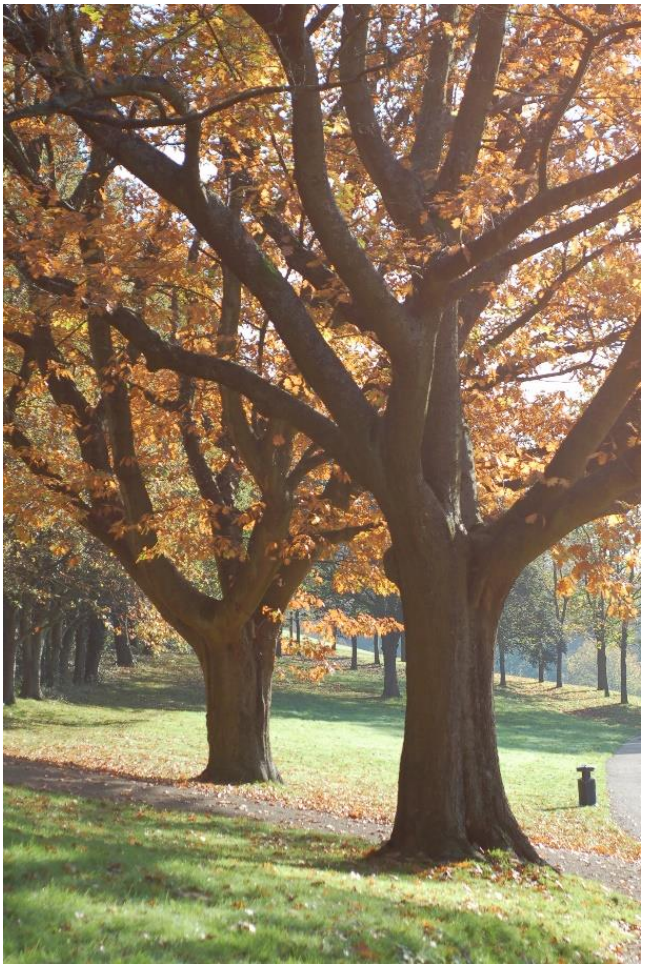
The following biodiversity issues are a particular problem in Torfaen.

- A reduction in tree canopy and consistent non- replacement of mature street trees
- Habitat fragmentation
- Lack of connectivity between wildlife sites
- Habitat patch isolation (linking to fragmentation and connectivity)
- Declining area of existing sites
- Building too close to existing mature trees, hedgerows, woodland and ancient woodland sites
- Lack of grassland habitat
- Continuing loss of semi-natural grassland areas to development and agricultural improvement.
- Insufficient management of key habitats
- Invasive non-native species (INNS)

- Poor ecological status of some of Torfaen' s watercourses.
- Upland drainage. Historic approaches to the management of water in the uplands has impacted on bog and mire habitat. More water retention interventions are required to reverse the damage.
- Inhospitable urban environments.

In terms of habitats and species, all those that occur in Torfaen and are listed on section 7 of the Environment Wales Act 2016 are a priority for conservation action. Some of the key species that we are about to lose are Lapwing, Small Pearl-boarded Fritillary and Glow-worm.

TORFAEN GREEN INFRASTRUCTURE Assessment



A VISION FOR GREEN INFRASTRUCTURE

Vision

These issues have been prioritised into four key Green Infrastructure or GI themes which reflect the Well Being Goals, the PSB's Well Being Objectives and Torfaen's Corporate Plan 3 priorities

A green view can reduce stress in 3 to 5 minutes

Theme 1: Improve ecological resilience

Conserving and enhancing biodiversity and geo-diversity, through the protection and enhancement of habitats, wildlife sites and the connectivity of key habitats.

Theme 2: Mitigate and adapt to climate change

Manage the impacts of climate change by developing initiatives that reduce greenhouse gas emissions and that actively take carbon dioxide out of the atmosphere; promote access to green routes that reduce the need for travel by car; and create Green Infrastructure that supports our adaptation to a changing weather pattern through, for example, flood control.

Theme 3: Placemaking

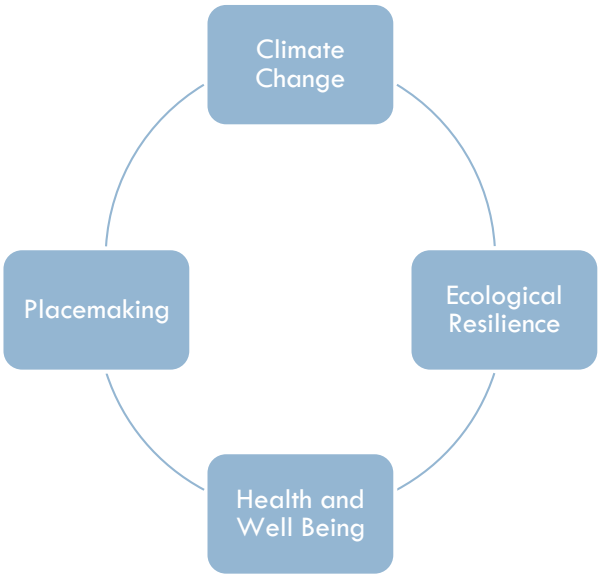
Green Infrastructure plays a key role in place-making, ensuring Torfaen remains a place where people want to live and invest. It can help attract and retain high quality workers and visitors, as well as contributing to the character of our settlements and countryside to create attractive and distinctive new places.

Theme 4: Healthier Torfaen

Green Infrastructure can support healthy and active lifestyles, promote good mental health, inspire learning, and create a sense of community by maintaining spaces for cultural activities.

These priorities are reflected in the Public Service Board's Green Infrastructure Vision for Torfaen.

FIGURE 1: GI THEMES



Torfaen has a well-connected, multi-functional green infrastructure network of distinctive, biodiverse and resilient natural spaces, which provide well-being benefits for people and nature. Our natural resources and ecosystems are managed in sustainable ways that maintain, protect and enhance the network's integrity and connectivity, while recognising the interdependency of Torfaen's biodiversity, landscapes and cultural heritage.

THE BENEFITS OF GREEN INFRASTRUCTURE

Green infrastructure assets provide societal benefits which can help to contribute to the health, wealth and well-being of Torfaen. Well designed and managed GI can help:

- **address climate change**
- **improve our health and well-being**
- **develop ecological resilience**
- **create great places to live**

1 hectare of trees and shrubs absorbs 1 tonne of CO_2

Climate change mitigation and adaptation

Well planned and managed Green Infrastructure can

- **help us adapt to increasing temperature and extreme weather events**
- **help reduce flood risk**
- **improve water quality**
- **store and sequester carbon**

As our climate changes we are likely to see increasing temperatures, more storms and heavy downpours. Improved Green Infrastructure can help us mitigate for these changes and keep us resilient to climate change.

Heat Amelioration

Urban areas suffer from the 'heat island effect' which results in built up urban areas experiencing higher temperatures than the surrounding countryside. Those neighbourhoods with little or no greenspace or tree cover will be especially vulnerable to increasing temperatures. Green Infrastructure assets such as urban trees and woodlands, vegetation cover and open water bodies can help cool the surrounding atmosphere ***by evaporative cooling*** and ***providing shade*** and **shelter**. Potcher et al. (2006) has shown that open spaces with a higher number or larger area of trees have been found to have lower temperatures than those with fewer trees. Increasing urban tree cover will also help ***sequester carbon*** from the atmosphere, reducing CO_2 levels and help to limit the increase in global temperatures.

Wales Heat Wave Plan (Welsh Government 2012) identifies the risk to vulnerable residents of excessive summer temperatures and guidance recommends investment in 'greening the built environment' to provide shade and cooler environments especially around hospitals, care and nursing homes and schools.

Flood alleviation:

During heavy rainstorms water landing on impermeable hard surfaces such as roads, car parks and driveways runs straight into drains and then into streams and rivers which can rise quickly during heavy downpours leading to flash flooding. Trees, woodland and green spaces, however, intercept rainwater via their leaves allowing water to

infiltrate into the soil and travel gradually through to nearby water courses. Ponds and lakes store water locally so it never reaches those rivers. The use of porous or permeable surfacing is another way to reduce overland flow of water to streams allowing water to percolate slowly through the soil. Investment in Green Infrastructure could help reduce the costs and environmental damage caused by serious flood events (Odefey et al. 2012).

> Greenspace can soak up 3.5 times more water than hard surfaces reducing flood risk

Water quality: Water percolating through the soil also helps ***remove harmful pollutants*** from our water supply providing cleaner water to our streams and rivers and protecting wildlife habitats (Stovin et al 2008).

Carbon sequestration and storage:
Our woods, trees and peat bogs are massive ***carbon stores***. One hectare of trees and shrubs can absorb one tonne of CO_2. Felling of woodland and drainage of peat bogs reduces our ability to store and sequester or extract CO_2 from the atmosphere which lowers CO_2 emissions and reduces the impact of climate change.

Health and well-being

Well planned and managed Green Infrastructure can

- **Reduce health inequality**
- **Improve physical activity and health**
- **Improve psychological health and well-being**
- **Promote community cohesion and social inclusion (sense of place/ local area)**

The evidence base is increasingly demonstrating the positive impact of access to good quality green spaces on our health and wellbeing. A network of well-designed and managed Green Infrastructure can contribute to Torfaen's Corporate Plan 3 priority to create a healthier community reducing health inequality and assisting vulnerable people.

Health inequality:
The Mental Health Foundation (2009) found that access to green space is particularly influential on conditions which are significant contributors to health inequalities, such as obesity, circulatory disease, mental health, chronic stress and asthma. A link between social deprivation and ill health has also been observed when communities have very limited access to green open space, especially in urban areas (Natural England 2008) and (Natural England, 2010). An analysis by Cohen et al. (2007) found that urban parks are critical resources for physical activity amongst residents in low-income, minority communities.

Environmental health issues can also be addressed to some extent by Green Infrastructure. Leaves ***trap particulate matter and pollutants*** such as car fumes improving air quality and absorbing noise especially from busy roads. This could reduce the incidence of asthma and help those with breathing difficulties. A

study produced by Public Health England in 2014; 'Estimating Local Mortality Burdens Associated with Particulate Air Pollution' placed the level of fine particulates in Torfaen arising from human activities (anthropogenic), when weighted against age of the population, as being the third highest in Wales in 2010. The associated attributable deaths of those over 25 were 46 with an associated 473 of life years lost. Although monitoring by TCBC shows a level of measured pollutants below National guidelines, when modelled and correlated against population statistics, certain pollutants are seen to have a health burden in Torfaen that is higher than the Welsh average (TCBC 2016).

Daily walk in the park reduces risk of heart attack by 50%

Noise is regarded as a form of environmental pollution and can cause anxiety, tension, or even illness. Greenspace has the ability to mitigate noise in urban areas. Planting "noise buffers" composed of trees and shrubs can reduce noise by five to ten decibels for every 30m width of woodland (Forestry Commission 2006).

Improvements in physical activity and health.

Being able to access formal or natural greenspace near your home makes a significant difference to a person's level of physical activity. (Nielson and Hansen, 2007) found that the further away residents are from green space the less likely they are to visit it. The study suggested that for those individuals under 25 years of age, the further they lived from green space, the more likely they were to be obese. Green Infrastructure assets such as local parks, the public rights of way network and cycle way provision are also provided at no or low cost to the end user, a significant factor in the more economically deprived areas.

Psychological health and mental wellbeing.

Mental health issues and stress are significant concerns in the UK. The stress reducing benefits of nature are well documented and green spaces have been shown to provide a restorative environment which helps alleviate stress and mental fatigue. There is also strong evidence which suggests that green spaces have a beneficial impact on mental well-being and cognitive function through both physical access and usage (Whitelaw et al., 2008), as well as through access to views of greenspace (Ulrich, 1984). Promoting access to natural greenspace should be a vital part of the Green Infrastructure approach.

Walking produces endorphins which can fight depression.

Community Engagement

Social interaction: Volunteering in the outdoors or community growing schemes such as Incredible Edibles or working on an allotment allows people to interact socially.

Community cohesion: A sense of local community is engendered when people meet on the street or in the park to have a chat. Outdoor space provides a low cost option to allow people to socialise.

Social inclusion: Less user friendly environments heighten the fear of crime, nuisance and traffic and make older people less likely to go outdoors reinforcing feelings of isolation and loneliness (Landscape Institute 2013).

TCBC Corporate Plan 3 emphasizes the importance to local residents of having a clean and green environment acknowledging the idea that a more attractive environment improves people's sense of well-being. People are more motivated to exercise, learn and engage socially. Walkable local environments that promote physical activity in daily life can increase opportunities for social engagement, thus encouraging social wellbeing and increasing people's sense of security.

> Likelihood of children visiting a greenspace at all has halved in a generation

Enhancing learning and development

A good start in life with a healthy attitude to learning will improve educational outcomes, helping to deliver Corporate Plan Priority 2 'Raising Educational Attainment.' Contact with nature can play an important role in the education and social development of children; and exposing young children to nature helps them to develop pro-environmental values and behaviour later in life (Natural England 2009). An evaluation of the Forest Schools programme, which promotes contact between children and nature, found that children developed greater confidence, social skills, communication skills, motivation and concentration, physical skills and knowledge and understanding.

As well as maintaining physical and mental well-being, play and play provision is very important in increasing self-awareness, self-esteem and self-respect and has been shown to play a major role in brain development. Outdoor activity has been found to have a positive effect on long-term memory (Rickinson et al., 2004), and cognitive development is influenced by free play and exploration (Bixler et al., 2002; Berman et al., 2008). Engagement with wild nature also secures positive outcomes for adults (Wells and Lekies, 2005). It is important to develop better access for young people to the full spectrum of opportunities for wild adventure in natural spaces, to help support their developmental needs in a socially inclusive way. Young people need access to local places for outdoor adventure that are attractive and within easy walking distance of their homes as well as structured adventure activity in more distant wild and countryside places.

Ecological resilience

Well designed and managed Green Infrastructure can help to

- **Increase the overall area of habitat.**
- **Increase the population of some protected species.**
- **Increase species movement.**

Biodiversity loss and loss of habitat are threatening the future of the planet. The State of Nature Report (Wales) (SoNaRR 2016) highlighted the key factors threatening biodiversity as; a) inappropriate land management including farming, b) the fragmentation of habitats due to inappropriate development and c) climate change. The drive to increase pollinator habitat due to a potentially disastrous decline in the bee population is an example of where human society relies on nature to provide a vital service which has been

put at risk by Man's activity. To keep ecosystems working they need to be healthy so they can provide these benefits or ecosystem services.

A wide range of rare and protected species use the green infrastructure within our urban and rural areas. The species population size is directly linked to the size of the habitats. As habitats come under increasing pressure from development so do the species, both animal and plant, which inhabit them. Urban Green Infrastructure provides 'stepping stones' for species to travel between favourable habitats which also influences the size of population that can be supported.

In order to reverse biodiversity loss we need to increase areas of habitat, especially important habitats or those under threat as identified in Section 7 of the Environment (Wales) Act and create ecological corridors to enable wildlife and plants to travel to forage for food and seek shelter. This species movement is particularly important as climate change advances and wildlife needs to move northwards to cooler temperatures.

Placemaking

Well designed and managed Green Infrastructure can help

- **attract inward investment and job creation**
- **increase land and property values**
- **contribute to local economic regeneration.**

Good quality open space can reduce antisocial behaviour

Reduced costs to business

A healthy, skilled and motivated working population is essential for a local economy to thrive. As discussed earlier, a good Green Infrastructure network can help to improve the overall health and well-being of Torfaen residents. Delivering active travel connectivity which provides for safe cycling and walking routes to work will reduce fuel costs for employees and improve health. This not only reduces demands on public finances from sickness benefits and NHS costs, but also reduces the burden of sick pay and absence for employers and can improve productivity (EFTEC 2013).

The costs of environmental damage could potentially escalate as climate change proceeds leading to increased incidents of flooding, structural damage due to high winds and the increased need for and cost of air conditioning as temperatures rise. These can be ameliorated by planting shade giving trees and providing more vegetated areas that cool by evaporation such as green roofs and green walls. In the UK, Rawlings et al. (1999) similarly found that the sheltering effect of trees could save 3 to 9% of energy bills. Green Infrastructure investment is often a more cost-effective way to meet environmental targets than engineering solutions allowing business' to invest in more productive activities.

Increased property values and inward investment

There is strong evidence that increasing the attractiveness of an area by providing high-quality parks, increases inward investment and property values. Garrod (2002) found that proximity to, or the view of,

broadleaved woodland enhanced property values and estimated that proximity to at least 20% woodland cover could raise the value of an average house by 7.1%. Increased property values may help to increase the attractiveness of areas of Torfaen which are currently less favourable to developers. GEN Consulting (2006) found that regeneration using green infrastructure of a run-down area of Glasgow caused house prices to increase by 111%. The development of attractive well designed sustainable housing schemes with good access to recreational facilities and natural greenspace via green travel routes will help attract and retain a skilled workforce.

> Living near a well maintained park can increase the value of your home by 6%

Sustainable economic development

Tourism has been identified as an important driver in the sustainable economic development of Torfaen worth £65 million to the local economy in 2014 and 490,000 visitors recorded in 2015. A strong tourism offer is being encouraged based on our industrial heritage which is highlighted by our Blaenavon Industrial Landscape World Heritage Site status along with our natural heritage and stunning landscape. The important Green Infrastructure assets that provide the aesthetic and recreational function upon which tourism relies needs to be protected and enhanced. These include the World Heritage Site and Mon & Brecon Canal and centre largely around walking and cycling trails, horse riding, orienteering, adventure and extreme sports, conservation holidays.

Food tourism is another significant strand in economic development of Torfaen based on local sourcing of produce. This requires the supply of agricultural land for cattle/ sheep/honey, cider and juice production close to the urban area. Opportunities exist to generate employment through the development of the green economy including biomass and local wood fuel production in forestry, social enterprises in grounds maintenance, training in countryside and woodland management and food production itself.

Land Regeneration and sustainable urban development

Improved environmental and aesthetic quality can create great places to live through sensitive planning and good design. Protecting the existing Green Infrastructure resource within new developments should be a primary objective. Regeneration of previously developed land (brownfield sites) should be encouraged and sustainable transport routes incorporated where possible within all new developments in line with the Active Travel Plan and utilising the Integrated Network Map (INM).

Cultural

Improvements in quality of place should embrace cultural heritage to create distinctive local spaces which celebrate local culture. Natural and built heritage within developments should be protected to create and retain a sense of place.

Local events such as annual fetes and celebrations are also vital to the cultural life of an area and spaces need to be provided within our settlements to allow these to continue and develop in order for a sustainable community to flourish.

The natural environment can often be complimentary to the setting, local distinctiveness and sense of place in an area of cultural value.

Aims and Objectives

The primary aim of the Green Infrastructure Assessment is to support the delivery of the LDP and to identify how protection, enhancement and creation of Green Infrastructure can be used to contribute to addressing some of Torfaen's key issues, as identified above.

Objectives

The objective of this Green Infrastructure Assessment is to:

a) Identify Green Infrastructure assets and the functions that contribute to each of the Green Infrastructure themes
b) Map the baseline of Green Infrastructure assets and functions across Torfaen on GIS
c) Develop an Urban Green Grid map of green 'ecological and leisure corridors' across Torfaen which link these assets and create the urban Green Infrastructure network
d) Provide evidence for the protection of this network or Urban Green Grid through LDP policy
e) Identify areas of need based on baseline mapping of WIMD data etc.
f) Identify and provide guidance on ways in which Green Infrastructure can be improved and enhanced, depending on need (OPPORTUNITY MAPPING)

This Assessment will address objectives a) b) and c).

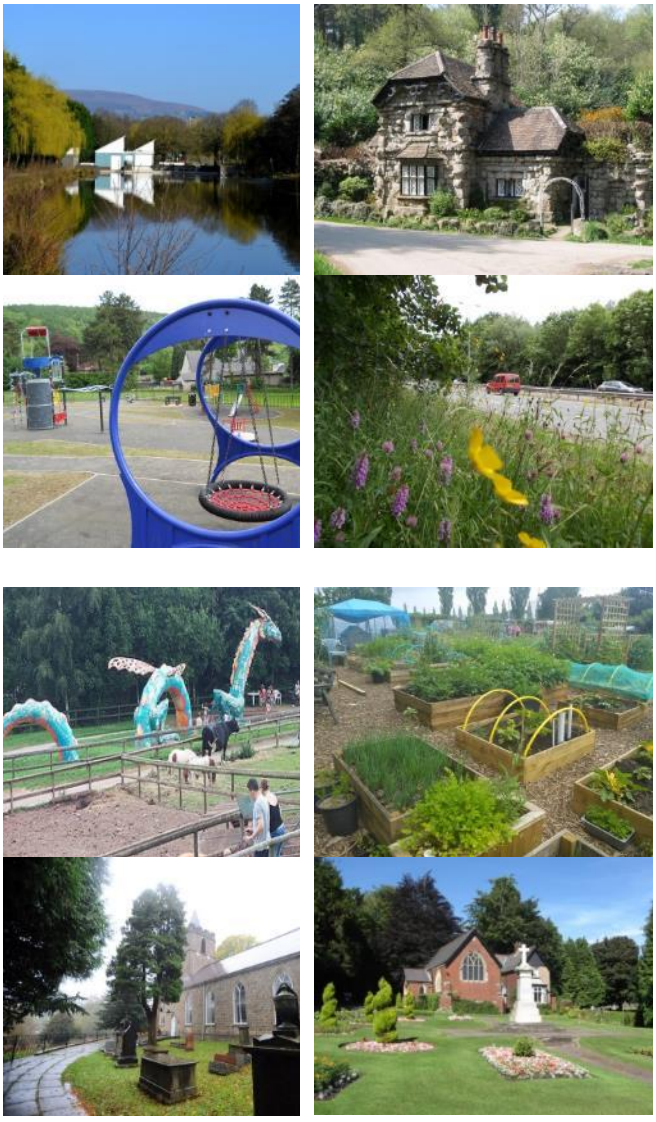
Objective d) will be addressed by the companion document, Torfaen Open Space Assessment 2020. This provides information on the quantity, quality and accessibility of Torfaen's GI assets to identify where there is a deficit of each type of open space within the borough against established standards.

Objective e) and f) will be addressed through the development of GI Ward or MSOA based maps and profiles which will identify local issues and deficits in provision and focus on how these can be mitigated for through GI investment. Priority open spaces for improvement works will be selected and generic management prescriptions for open space typologies proposed.

Identifying our Green Infrastructure Assets

As we have seen, our Green Infrastructure assets include all our natural green spaces such as our woodlands, moorlands, wetlands and rivers, our parks and amenity open spaces, our green corridors such as cycle routes and public footpath network, functional greenspace such as sustainable drainage schemes and green roofs and includes our heritage sites and conservation areas (Fig 1).

FIGURE 2 : EXAMPLES OF GI ASSETS



Parks and gardens including urban parks; private gardens; and institutional (e.g. schools and hospitals) grounds (e.g. Cwmbran Boating Lake, Glansychan Park & American Gardens

Amenity greenspaces including informal recreation spaces; play areas; outdoor sport facilities; housing green spaces; domestic gardens; other incidental space; hedges; civic squares and spaces; and highway trees and verges (e.g. Designated Important Urban Open Spaces)

Allotments, community gardens, city farms, orchards, roof gardens, and urban edge farmland (e.g. Green Meadow Community Farm & Cwmbran & South Torfaen Allotments)

Cemeteries and churchyards (e.g. Panteg Cemetery & St Peter's Churchyard Blaenavon


Natural and semi-natural rural, peri-urban and urban greenspaces including woodland and scrub; grassland, heath and moor; wetlands; rivers and lakes; brownfield sites; bare rock habitats (e.g. cliffs and quarries); includes important and protected species and habitats e.g. Graig Fawr and Garn Lakes


Heritage sites including CADW listed sites and gardens, national parks, World Heritage sites, historic sites and monuments (e.g. Blaenavon Industrial Landscape World Heritage Site, Pontypool Park)


Green corridors including rivers and canals and their banks; road and rail corridors; cycling routes; and public rights of way (e.g. Afon Lwyd cycle route & Monmouthshire and Brecon Canal).


Functional green space including sustainable drainage schemes, flood storage areas, green roofs and walls (e.g. Blaenavon World Heritage Centre green roofs)

Identifying Green Infrastructure Functions

These assets perform functions such as providing shade and shelter from winds, keeping us cool, trapping pollutants from air and water, absorbing and collecting rainwater to prevent flooding, providing us with food and fuel, providing habitats and movement corridors for wildlife, areas for recreation, sustainable transport routes and scenic beauty. These functions are also termed 'ecosystem services'. Table 1 shows the full list of functions which can be provided.

TABLE 1: LIST OF GI FUNCTIONS

ENVIRONMENTAL	SOCIAL	ECONOMIC	CULTURAL
Shading from the sun	Green travel route	Food production	Heritage asset
Evaporative Cooling	Aesthetic	Fuel production	Cultural asset
Shelter from wind	Learning	Timber production	
Habitat for wildlife	Recreation	Green jobs	
Wildlife corridor		Setting for development	
Soil stabilisation		Supporting image	
Water storage			
Water interception			
Water infiltration			
Flow reduction due to surface roughness			
Carbon storage			
Carbon sequestration			
Pollination resource			
Noise absorption			
Trapping pollutants			

Multifunctionality

Each type of GI can be performing a number of functions simultaneously providing multiple benefits. Broad leaved and other woodland habitats provide one of the most multifunctional green infrastructure assets and are an important resource for Torfaen which must be protected and enhanced. Woodland that is **slowing the speed of runoff** to streams and rivers is also **storing carbon** in the trees and soil, **creating shade, absorbing pollution** from the air and rainfall, providing **a biodiversity resource** and potentially an area for **active recreation** or **quiet reflection.** Figure 3 illustrates the multiple benefits provided by urban trees which are also social and economic as well as environmental.

FIGURE 3: URBAN TREE BENEFITS

Connectivity

Whilst individual GI assets can serve one or more functions, connectivity between different GI assets can help maximise the benefits that they generate. Well-connected GI assets create infrastructure that is adaptive and resilient to environmental changes. Physical connections make the most impact, often by creating physical 'stepping stones' that encourage biodiversity migration and connect places with

sustainable walking or cycling routes. Linked together, GI assets form important multifunctional GI networks, which should be considered at all spatial scales.

TABLE 2: GI FUNCTION PERFORMED BY EACH ASSET

GI ASSETS	FUNCTIONS																											
	Shading from sun	Evaporative cooling	Shelter from wind	Habitat for Wildlife	Wildlife Corridor	Pollination Resource	Soil Stabilisation	Water storage	Water Interception	Water Infiltration	Surface roughness	Pollutant removal	Noise absorption	Carbon Storage	Carbon Sequestration	Green Travel Route	Food Production	Fuel Production	Timber Production	Aesthetic	Heritage	Cultural asset	Recreation	Learning	Green jobs	Setting for development	Supporting image
Woodland	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			■	■	■	■		■	■	■	■	■	■
Grassland/ Moorland/ Meadow		■		■	■	■	■		■	■	■									■	■		■	■	■		■
Individual/ Group of Trees	■	■	■	■	■				■	■			■	■	■					■	■				■	■	
Wetland		■		■	■			■						■	■					■			■	■	■	■	■
Rivers / Lakes/ Ponds/ Streams		■		■	■			■								■	■	■		■		■	■	■	■	■	■
Canal		■		■	■			■								■				■	■	■	■	■	■	■	■
Cemeteries/ Churchyards	■	■	■	■	■	■			■	■	■			■						■	■	■			■		
Farmland		■			■	■			■	■	■						■	■	■	■					■		
Allotments		■		■	■	■			■	■	■						■					■	■	■	■		
Provision for children & young people																								■	■		
Outdoor sports pitches		■			■					■						■							■		■		
Parks and formal gardens	■	■	■	■	■	■			■	■				■		■				■	■	■	■	■	■	■	■
Institutional grounds		■		■	■	■				■	■									■		■	■	■	■		
Green corridors				■	■	■										■				■		■	■	■	■	■	■
Heritage Assets																				■	■	■		■	■		■
Functional greenspace		■		■	■	■			■	■	■	■													■	■	

Assessing functionality

Each typology has been assessed to establish which functions they are able to perform and this was collated in the Typology/ Function Matrix overleaf.

Though these assets may not perform all these functions in every circumstance, for simplification and for the purpose of this exercise, it has been assumed that they do. A more in depth analysis of functionality for any given site can take place when detailed intervention proposals are being formulated.

Table 2 illustrates the functions performed by each different type of Green Infrastructure with Table 3 showing how each of these functions can help deliver against our four Green Infrastructure themes.

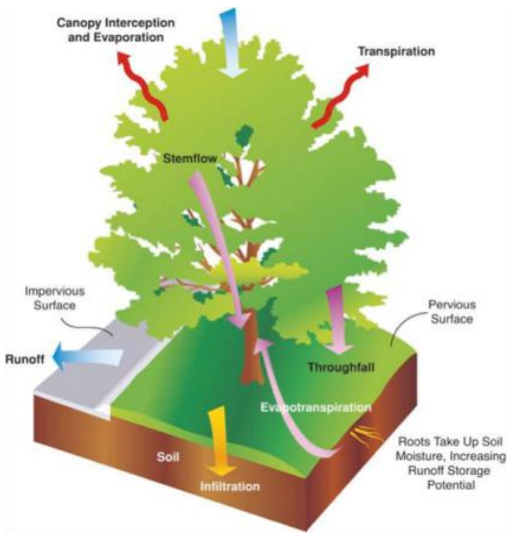
TABLE 3: HOW GI FUNCTIONS DELIVER OUR THEMES

GI THEME	FUNCTION	ASSET
Health and Well Being	Recreation Active travel Trapping air pollutants Community space Local food growing	Pitches, Play areas, Green leisure corridors, PRoW Cycle routes, PRoW Woodland, Trees, Civic spaces, Amenity Greenspace Allotments, Orchards, Pasture
Ecological Resilience	Pollination Habitat for wildlife Corridor for wildlife	Grasslands, Orchards, Allotments Natural Greenspace, Green corridors, verges, rivers, streams, water bodies, canal
Climate change	Shading from the sun Soil stabilisation Carbon storage Water storage and conveyance Pollutant removal Local food production	Woodlands, Street trees Woodlands, grasslands Woodlands, Street trees, Bogs, Cycle routes Natural greenspace, Amenity Greenspace, SUDS Woodland, trees, grassland, bogs, SUDS Allotments, Orchards, Pasture
Placemaking	Providing jobs Lifelong learning Skills and volunteering Visual contribution to landscape Connection to local environment Noise absorption Heritage and culture	Parks, Amenity green space, Natural Green space Institutional Grounds, Natural Green space Natural Greenspace, Amenity Green space, All GI Green corridors Trees, Woodlands BILWHS Conservation Areas, SAM, Listed Buildings. Listed Parks and Gardens

Need

Green or blue spaces (rivers, lakes, ponds and reservoirs) are an asset if they perform a function in an area of need. Upstream of an area at risk of flooding due to surface water runoff, urban woodland can help to intercept rainwater via their leaves. This reduces the impact of raindrops on the soil which might otherwise be washed into nearby streams. The roots of the tree and other groundcover vegetation provide channels through which the water can infiltrate into the soil reducing the amount and speed of water entering local watercourses and thereby decrease the risk of localised flooding downstream.

FIGURE 4: HOW TREES REDUCE FLOOD RISK



Mapping the assets

A Green Infrastructure Map Configuration has been developed on TCBC's Geographical Information System (GIS) which consists of subsets of layers of information which relate to GI assets present in Torfaen.

This map enables a holistic picture of all the potential assets that any given site or geographically defined area possesses providing a powerful tool in assessing its value to people and nature. This information will need to be under regular review and able to be updated centrally to be of most value. Though more detailed site analysis will be required prior to definite interventions being finalized the GI Asset map reveals how a multitude of different benefits can be provided by different aspects on a single site.

The Green Infrastructure Asset Map consists of a series of layers comprising spatially mapped data. Specific assets have been categorized into a GI typology as shown (Table 4).

TABLE 4: ASSETS DEFINED WITHIN EACH TYPOLOGY

Natural Greenspace	Woodland, grassland, moorland, watercourses, open water, bog and quarries
Allotments	Allotments, Community Gardens, Orchards
Civic Spaces	Public realm, memorial gardens, town squares
Parks and Formal Gardens	Public Parks and publicly accessible formal gardens
Provision for Children and Young People	Play areas, MUGAS, Skate parks, Ball Walls, Youth Shelters
Institutional Grounds	Cemeteries and Churchyards, Schools, Hospitals, Residential Homes
Amenity Green space	Open spaces around people's homes
Sports Pitches	Football, Rugby, Tennis, Cricket, Bowls, Hockey, Athletics
Multifunctional Spaces	Spaces with more than one primary function e.g. Pontypool Park/ Central Recreation Area
Green Corridors	Canal, River, Streams, Highway verges. PRoW, Cycle routes

Additional layers have been added to illustrate the value assigned to certain spaces (See Table 5).

TABLE 5: GREEN INFRASTRUCTURE ASSET MAP GROUPS (GIS)

GROUP	LAYERS
GI Asset typologies	Natural Greenspace, Amenity Greenspace, Civic Spaces, Parks and Gardens, Provision for children and Young People, Sports Pitches, Allotments, Functional green space, Multifunctional spaces
Tree cover	Ezy Tree OS Mastermap data
Nature Conservation Designations	SSSI, LNR, RIGs, SINC, AW, PAWS
Greenspace Designations	BBNP, BILWHS, SLA, IUOS
Heritage Designations	SAM, Listed buildings, Conservation Areas, Buildings at Risk Register
Cultural Sites	Sites associated with cultural events
Land classification	Agricultural Land Classification Common Land

Identifying data sources for mapping GI assets

The Ordnance Survey Mastermap Topography Layer was used as the base layer for mapping GI assets. Publicly available datasets were acquired through NRW's Lle portal (http://lle.gov.wales/home) and Ordinance Survey's OS Open Data resource. Additional data layers were sourced from Torfaen's extensive GIS mapping database including the Green Space Assessment 2019. Green corridors were identified where green assets formed a linked series of spaces running through the urban fabric. See Figure 5: EXAMPLE OF GREEN INFRASTRUCTURE MAPPING.

Torfaen's Urban Green Grid

The Torfaen PSB Green Infrastructure Strategy produced a strategic overview of the borough's Green Infrastructure with strategic corridors identified around the western and eastern fringes of the borough and along the Afon Lwyd and the Mon & Brecon Canal.

The Urban Green Grid Map concentrates on the intra urban Green Infrastructure network highlighting the green corridors which link specific Green Infrastructure assets and provide essential connectivity for both wildlife and people. The protection and enhancement of these so called 'stepping stone' sites are vital for ecological resilience but also allow for a permeable urban environment through which people can travel.

A public facing version of this Urban Green Grid Map is available to view at

http://gis.torfaen.gov.uk:8010/connect/analyst/mobile/ -/main?mapcfg=Public%20View&lang=en_GB&overlays=Urban%20Green%20Grid

A map of Torfaen's green spaces is available to view at

http://gis.torfaen.gov.uk:8010/connect/analyst/mobile/ -/main?mapcfg=Public%20View&lang=en_GB&overlays=Green%20Spaces%20-%20Mannau%20Gwyrdd

These maps will be updated on at least an annual basis as new information becomes available and through observation on the ground.

FIGURE 5: EXAMPLE OF GREEN INFRASTRUCTURE MAPPING

HOW TO MAKE AN ASSESSMENT

This Assessment takes a dual approach to help us in our decision making with regard to how we need to manage our GI assets to maximize the benefits they provide for people and nature with limited resources. Figure 6 illustrates the **Top Down Approach** suitable for the strategic management of our GI resource with the **Bottom Up approach** appropriate where a site based analysis is required.

The Top Down Approach looks to:

- map the GI assets for Torfaen borough
- identify the functions they currently provide
- identify where these functions are not being provided
- suggest where the most appropriate interventions can be made.

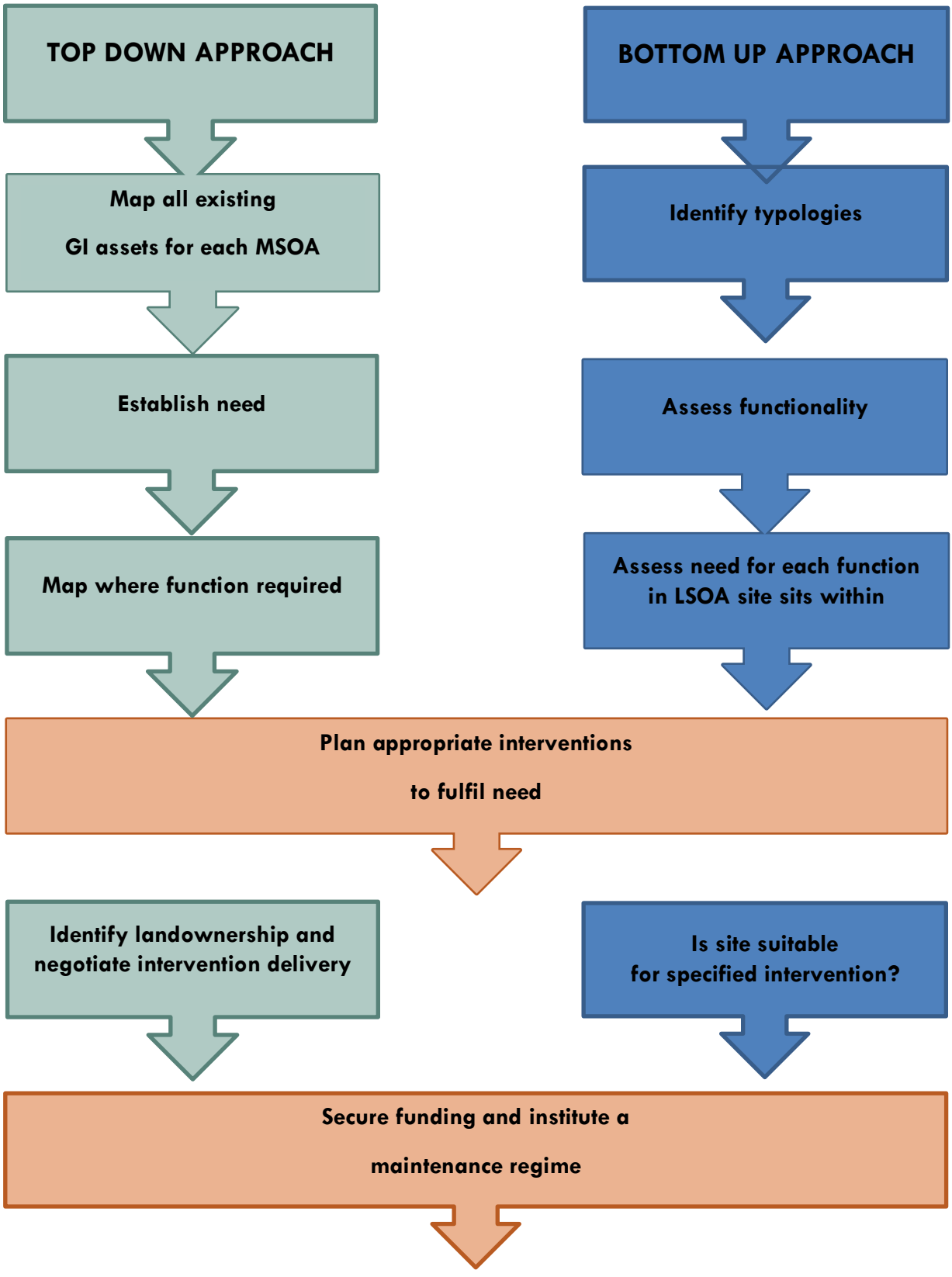
The Bottom Up approach can be used:

- when reviewing LDP candidate sites,
- for site planning of LDP's Strategic Development sites,
- for planning application consultations,
- to decide on the management regime for any given site,
- or where disposal decisions are being considered when land is declared surplus to requirements by a TCBC department.

This section sets out the method suggested for

- mapping of GI Assets in Torfaen.
- assessing the functions each type of GI performs
- identification of the strategic need for each function to aid decision making on where interventions would be most beneficial and cost effective. **(Top Down Approach).**
- assessing the relative value of a specific site in terms of functionality in relation to other sites in Torfaen to inform investment or disposal decisions **(Bottom Up Approach).**

FIGURE 6: METHODOLOGY



TORFAEN GREEN INFRASTRUCTURE

Interventions

IDENTIFYING STRATEGIC NEED

Identifying Strategic Need

To establish the need for any of these functions, a set of indicators has been suggested (Table 8). Typologies which perform each function are mapped and areas of need defined as those areas where these typologies are lacking. Additional indicators of need such as areas of poor health or vulnerable groups such as the elderly or children will further prioritise the need for a specific function such as recreational space or shading.

Assessment is made on a Medium Super Output Area (MSOA's) basis so as to be comparable with the Public Service Board Well Being Assessment. A Medium Super Output Area is a geographical area of consistent size with an average population of approximately 7,200 people which is used to report neighbourhood statistics.

For each MSOA within Torfaen, the current provision for each function is mapped and data showing need for that function overlaid to establish the following:

- Where the function is currently performed and fulfils the need. Here the action should be to protect existing GI.
- Where need is apparent but function not being performed. Here the action should be to create or enhance GI asset base.
- Where there is no apparent need but the function is performed. Here the action should ideally be to protect GI to cater for potential future needs.
- Where no perceived need or function performed. No action is necessary but any opportunities to create or enhance GI should be taken if possible.

Table 6 shows, for each function, the indicator of provision and need and the source of that data.

Creation of the MSOA/LSOA Profile and Opportunity Mapping

Once each function has been considered in turn, a profile can be drawn up for each MSOA to show

- Where all GI Assets are located and who manages them
- Where specific functions are lacking within the MSOA
- Which assets can be developed to provide these functions
- How interventions can be designed to be multifunctional, fulfilling several functions simultaneously.

This approach enables us to set priorities for interventions, putting valuable resources where they are needed for the benefit of future and current generations.

TABLE 6: INDICATORS OF NEED

FUNCTION	ASSET PROVIDING FUNCTION)	GI CONFIGURATION MAP LAYER	NEED	DATA SOURCE
Shade	All woodland Trees/ tree groups	Natural Green Space: Broad Leaved Woodland Coniferous Woodland TCBC Trees National Tree Map	Pop density of LSOA's >747.50 per km2 >500 pop with limiting long term illness >30% pop over 65, >25% pop 0-15, Grade 1 agricultural land, 100m buffer of schools, town and neighbourhood centres < 25% tree canopy cover	WIMD 2019 Predictive Agricultural Land Classification (ALC) Map Nov 27 2017 Torfaen Tree Report
Evaporative cooling	Natural green space Amenity Greenspace Parks and Gardens Grass Sports pitches Allotments/ Orchards Functional Green Space	Natural Green Space TCBC Trees Amenity Greenspace Parks and Gardens Sport pitches Institutional Grounds Allotments Functional Green space National Tree Map	LSOA's with>500 pop with limiting long term illness, >30% pop over 65 or 60, >25% pop 0-15	WIMD 2019
Shelter (wind)	All woodland Trees/ tree groups	Natural Green Space: Broadleaved woodland Coniferous Woodland TCBC Trees National Tree Map	Av wind speed >5.5m/s at 10m above ground level	DEC Wind Speed database

FUNCTION	ASSET PROVIDING FUNCTION)	GI CONFIGURATION MAP LAYER	NEED	DATA SOURCE
Wildlife habitat	Woodlands Meadows, Bogs, Streams, rivers, canal, water bodies Agricultural land Allotments/Orchards Cemeteries/ churchyards Soft Suds schemes Parks & gardens	Natural Green Space TCBC Trees Amenity Greenspace Parks and Gardens Institutional ground, Orchards Functional greenspace National Tree Map	Where Section 7 habitats & species present within MSOA NRW Connectivity Mapping	Section 7 Species & habitat mapping required Woodland Connectivity Mapping layer
Wildlife corridor	River and canal banks Highway verges Cycle routes Rivers and streams Canal	Natural Green Space TCBC Grounds Maintenance BA Grounds Maintenance TCBC Green Corridors National Tree Map	Where gaps in network identified	Green Infrastructure Map Configuration on SSA
Pollination resource	Woodland Trees Acid /neutral grassland Dwarf Heath	Natural Green Space National Tree Map	Areas lacking in pollination resource/dense urban grain	Torfaen Pollinator Action Plan
Water storage	Bogs/ Wetland Ponds	Natural Greenspace Functional greenspace Sports Pitches	Upstream of historical flooding	Flood Risk Map

FUNCTION	ASSET PROVIDING FUNCTION	GI CONFIGURATION MAP LAYER	NEED	DATA SOURCE
Water interception	Trees Woodland Grassland	Natural Greenspace National Tree Map Amenity Greenspace Parks and Gardens Institutional grounds Sports Pitches Functional Green Space	Upstream of historical flooding	Flood Risk Map
Water infiltration	Trees Woodland Grassland	Natural Greenspace National Tree Map Amenity Greenspace Parks and Gardens Institutional grounds Sports Pitches Functional Green Space	Upstream of historical flooding	Flood Risk Map
Pollution removal	Natural greenspace Amenity Greenspace Street trees	Natural greenspace Amenity Green space TCBC Trees National Tree Map	Air : Pop density .747/km2, Section 7 habitats, Within 100m of A roads Grade 1-3 agricultural land	
Carbon sequestration	Woodland Bogs Street trees	Natural greenspace TCBC Trees National Tree Map	Universal need (where habitat absent)	
Carbon storage	Woodland Bogs Street trees	Natural greenspace TCBC Trees National Tree Map	Universal need	
Green travel route	Cycle routes PRoW Canal Canal/ riverbanks	Green corridors	Active Travel Plan/ Integrated Network Map will identify aspirational routes which could be realized by intervention up to 2030.	Integrated Network Map

FUNCTION	ASSET PROVIDING FUNCTION)	GI CONFIGURATION MAP LAYER	NEED	DATA SOURCE
Food production	Grade 1-3 agricultural land Allotments Community Growing areas Orchards	Agricultural Land classification Allotments Orchards	Less than specific area of agricultural land MSOA does not meet standard provision of allotments	Lle Portal Predictive Agricultural Land Classification (ALC) Map Nov 27 2017
Fuel / energy production	Existing energy production sites e.g. solar/ wind farms/ micro hydro/ anaerobic digesters	Carbon Trust	Universal need Local and national renewable energy search areas	Torfaen Energy Opportunities Mapping Carbon Trust
Timber production	Coniferous woodland	NRW Lle	5km buffer of potential timber stations	
Aesthetic	BB National Park BIL World Heritage site SLA's IUOS	Greenspace Designations Heritage Designations	Mapping of essential setting of WHS, M&B Canal, Afon Lwyd and other Heritage sites	Heritage Designations WHS Management Plan
Heritage	Conservation areas Listed Buildings SAM's Cadw listed sites Cadw listed gardens Civic spaces	Heritage Designations	Mapping of essential setting of assets	1.2 km buffer required
Cultural	Civic spaces Parks and Gardens Local Event spaces e.g. Boating Lake	Civic spaces Heritage Designations Parks and gardens	One required in each identifiable neighbourhood	Identified by Community & Ward Councillors

FUNCTION	ASSET PROVIDING FUNCTION)	GI CONFIGURATION MAP LAYER	NEED	DATA SOURCE
Recreation	Sports pitches Play areas MUGAS Skate parks Amenity greenspace Allotments Accessible natural greenspace	Sports Pitches Provision for Children & Young People Amenity Green space Parks and Gardens Allotments Natural Greenspace	Deficiencies in provision against agreed standards for: Play Allotments Accessible natural greenspace Accessible woodlands Amenity greenspace Sports pitches	Open Space Assessment 2020
Learning	School / college sites inc grounds	Institutional grounds Accessible Natural Greenspace	100m buffer of educational establishment	MSOA profile
Green jobs	Street Trees Woodlands Parks Verges Institutional grounds Farmland	TCBC Trees Natural green space TCBC Grounds maintenance BA Grounds Maintenance Institutional Grounds National Tree Map	Torfaen Unemployment figures WIMD data 3-5 on income	WIMD 2019
Setting for development	Woodland Street Trees Amenity Greenspace	LDP Proposals Plan National Tree Map	Industrial estates of poor environmental quality and low occupancy rates Candidate sites	Torfaen Economic Development
Supporting image	BWHIL National Park Conservation areas Listed Buildings SAM's Cadw listed sites Cadw listed gardens Mon & Brec Canal	LDP Proposals Plan Heritage Designations 1&2 Greenspace designations Mon & Brec Canal	Where poor environmental quality could impact on sustainable tourism opportunities e.g. cycling, canal boat, WHS, building at risk register	Economic Development/ Regeneration Team

Interventions

The exact nature of any intervention will depend on site specific characteristics and the need for any given function locally. For example, where shade is lacking more street trees or woodland blocks should be considered. Where there is a deficiency in play space, areas of public open space could be developed for play. This does not necessarily need to involve play equipment but just providing appropriate spaces where children can create their own play. Functions should not be seen in isolation and interventions which fulfill multiple functions simultaneously should be encouraged.

Where the site is owned or under the control of TCBC a decision can be made to invest in the area. If owned by another public body or private landowner, negotiations can take place to develop co-development schemes to bring projects to fruition.

This profile could inform Section 106 negotiations with developers as areas of need for specific functions such as biodiversity or play will have been determined and the potential sites for investments identified within a specific geographical area.

Within the MSOA it is also necessary to consider land use pressures e.g. from housing, employment and transport to arrive at a MSOA profile which balances all the needs identified. This holistic appraisal will lead to better land use planning decisions which will have the maximum benefit for Torfaen.

Worked Example: Assessing a MSOA for the function: provision of shade

Mapping is undertaken of typologies that provide shade i.e. woodlands and trees. Areas with sparse or no tree cover represent a lack of shade provision.

Need for shade is determined by mapping where vulnerable communities are situated within this MSOA. The MSOA area is divided into smaller divisions known as Lower Super Output Areas (LSOA). The Welsh Index of Multiple Deprivation (WIMD) data is the Welsh Government's official measure of relative deprivation in these areas. WIMD data can be used as an approximation of need.

Analysis of MSOA 003 Torfaen, which covers the LSOA area of Trevethin 1 and 2, St Cadocs and Pen y garn and Snatchwood, reveals an area of overall high deprivation (Figure 7) with poor health being a particular issue within Trevethin (Figure 8) and physical environment a concern in Snatchwood (Figure 9). Those with ill health are likely to be disproportionally affected as temperatures rise due to climate change as will vulnerable groups such as children and the elderly. Mapping of LSOA with over 30% of the population which are over 65 and 25% of the population which are under16 would help to further target these groups. Increasing the shade provided by trees in an area such as this will help reduce the impact of these temperature rises on these more vulnerable groups.

Figure 10 identifies potential sites where interventions which deliver this shade function could be provided. This would include tree planting in gardens and within the streetscape as detailed in Appendix 1 Possible Interventions Table 10.

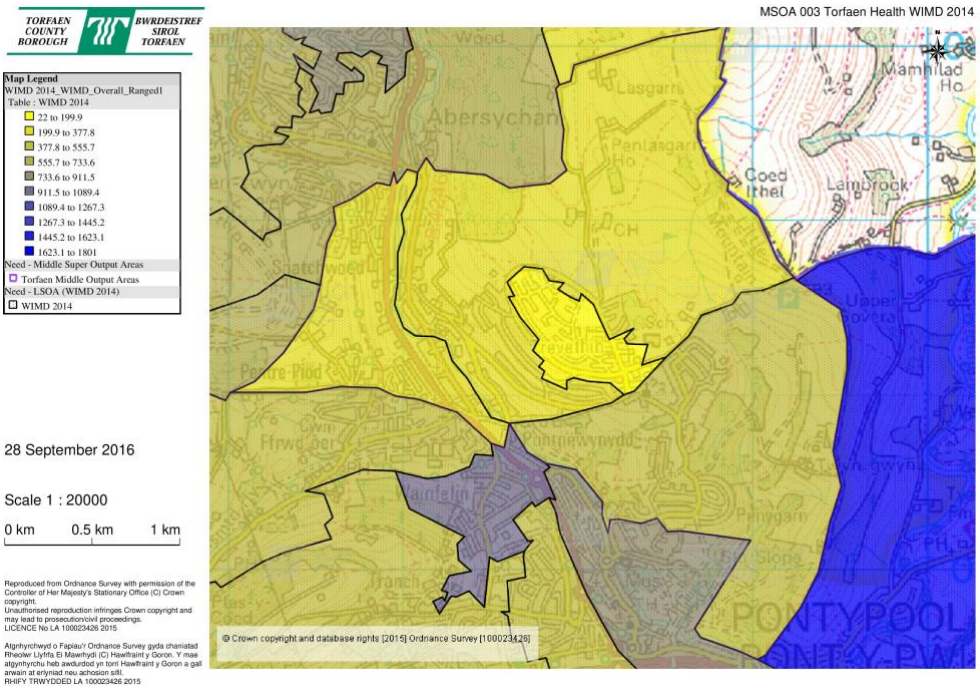


FIGURE 7: LEVELS OF OVERALL DEPRIVATION MSOA 003 WIMD

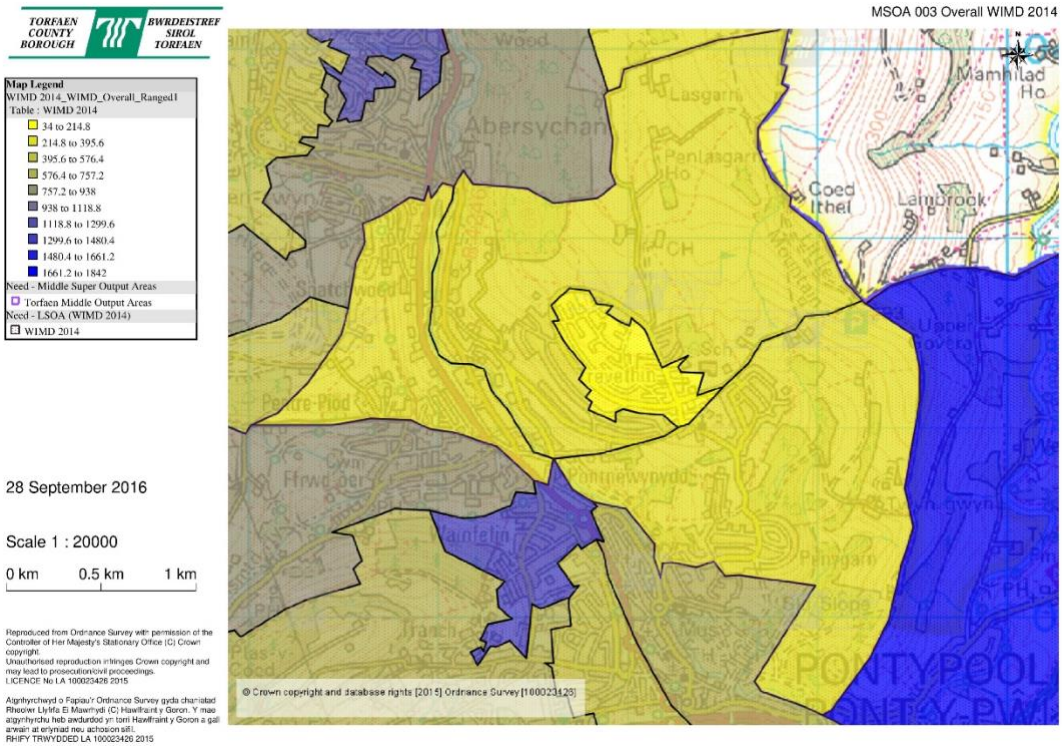


FIGURE 8: RELATIVE DEPRIVATION FOR HEALTH WITHIN MSOA003 WIMD

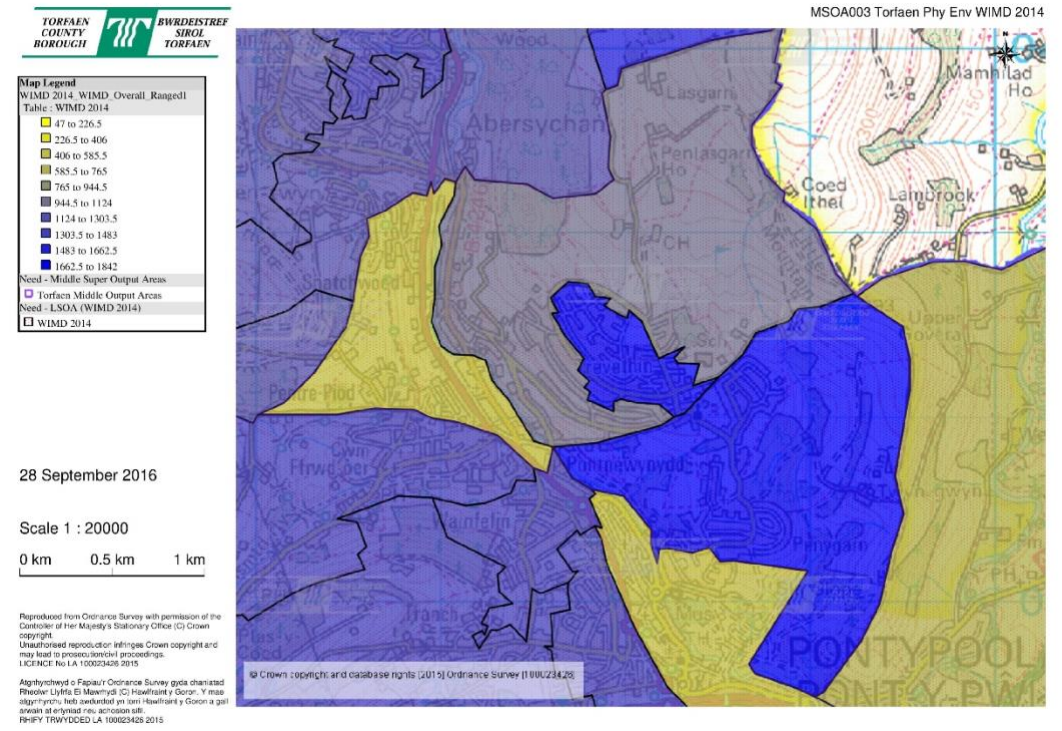
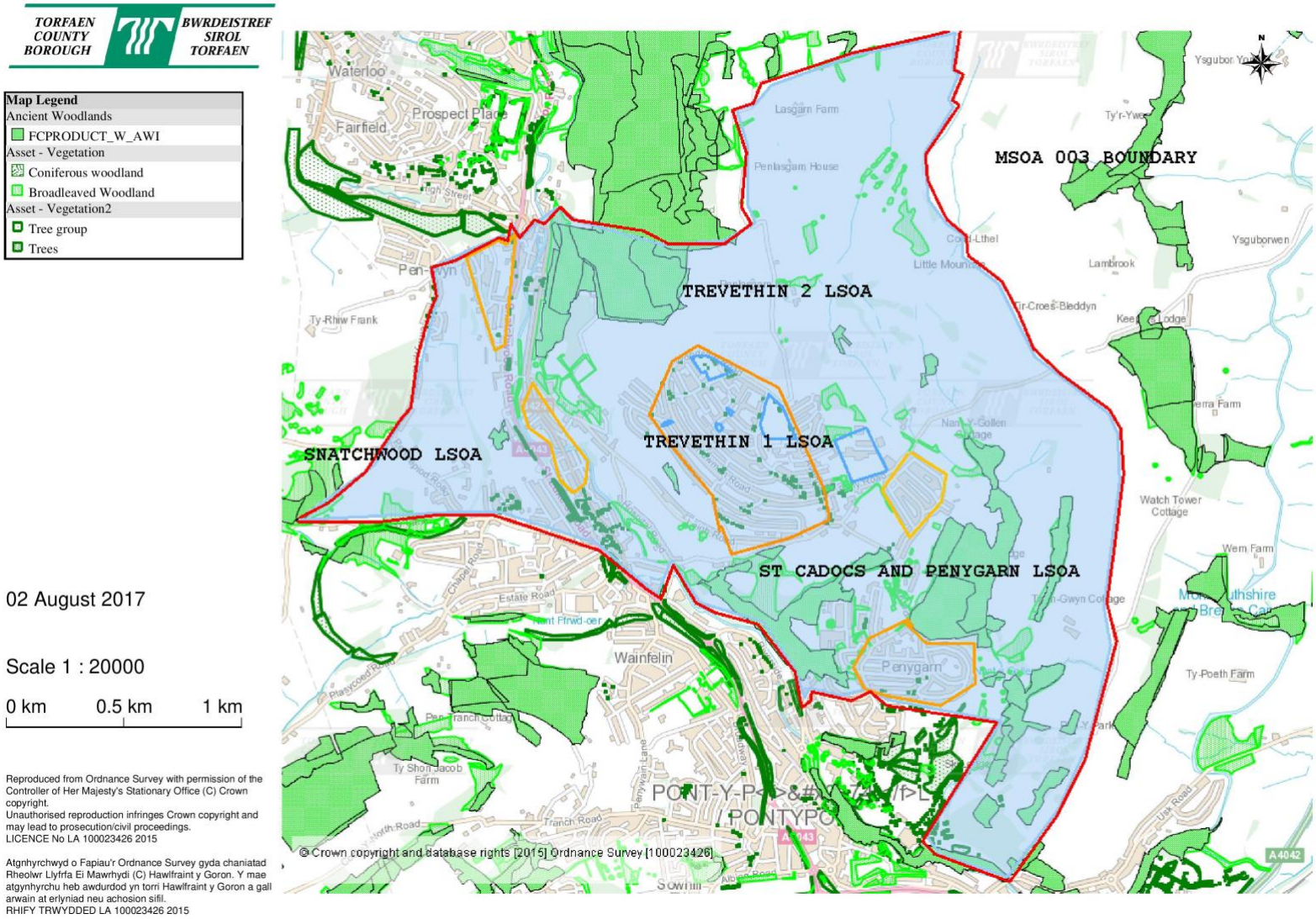


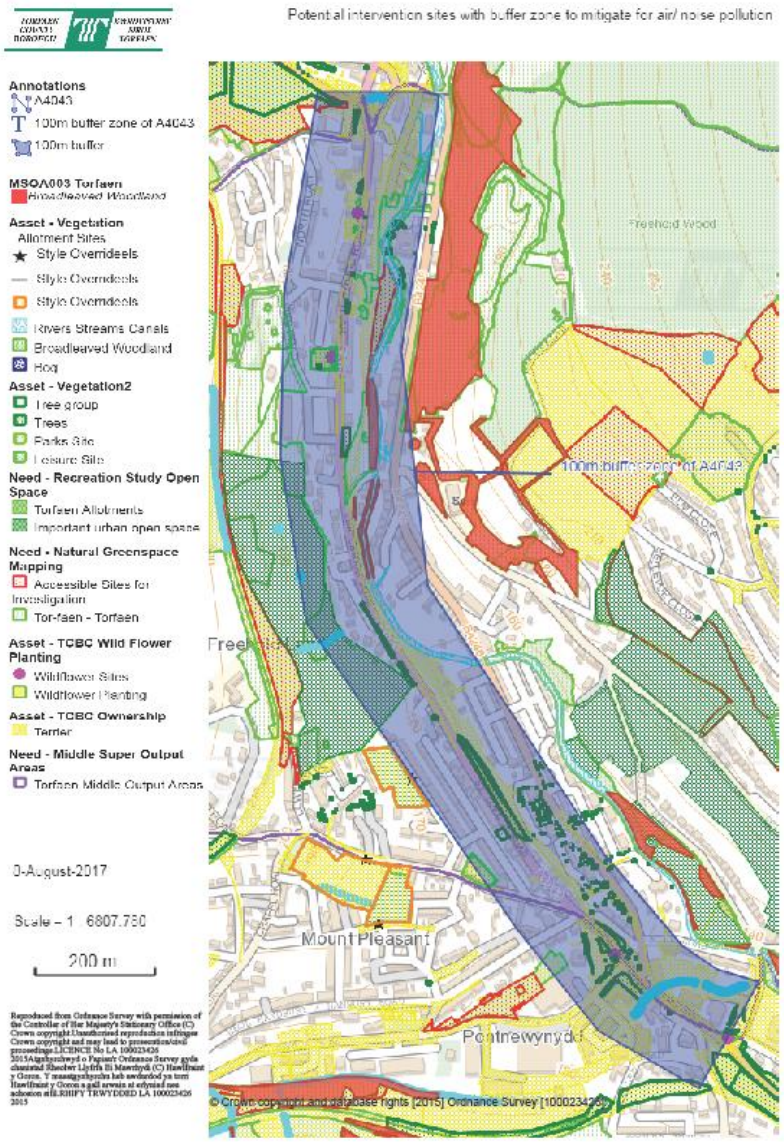
FIGURE 9: RELATIVE DEPRIVATION OF PHYSICAL ENVIRONMENT WITHIN MSOA 003 WIMD

FIGURE 10: AREAS OF POSSIBLE GI INTERVENTIONS



Worked example 2: Air and noise pollutant mitigation:

The MSOA 003 profile has shown the LSOA of Snatchwood as having poor physical environment as well as poor physical health. The A4043 corridor at this point has been identified as a poor air quality hot spot. Creation of a 100m buffer zone of the A road in the MSOA (A4043) and the mapping of green spaces within or adjacent to this zone will enable sites which could be used for mitigation to be identified. Spaces can then be assessed as whether they are suitable for the types of interventions required to perform this function, namely planting of large leaved trees and hedging. The assessment will also identify where existing Green infrastructure assets are already performing this function so they can be protected and/or enhanced e.g., bank of trees between St Luke's Road and Abersychan Greenway.



The following should be mapped:

- MSOA's with population density of >732.30 km2 (a density of pop in Torfaen 2016)
- LSOA's with high WIMD data score for health (pollutants contribute to ill health)
- LSOA 's with high WIMD data score for physical environment
- Air quality data (Environmental Health)
- 100m buffer zone either side of any A roads within the MSOA
- Any sites for nature conservation value e.g. SSSI, SINC, LNR (pollutants damage the environment for wildlife)

FIGURE 11: MSOA 003 POTENTIAL INTERVENTION SITES TO MITIGATE FOR AIR/ NOISE POLLUTION

Interventions

For any existing Green Infrastructure sites which lie within this 100m buffer zone there is an opportunity to reduce air pollutants through the planting of tree belts or woodlands which will absorb particulate manner from the atmosphere, helping to clean the air. Prioritising the more densely populated areas of Torfaen will benefit more people.

If any nature conservation sites are present within the MSOA opportunities should be sought to undertake tree planting around these sites to absorb air pollution and protect the health of these important ecosystems.

Cost savings to society from such an intervention could include health benefits of cleaner air, less lung disease, less GP visits, fewer hospital referrals, and fewer workdays lost to sickness. This needs to be weighed up against the cost of supplying, planting and maintaining these trees.

Bottom Up Approach: Site Specific Assessment

The Bottom Up approach provides a mechanism for assessing the functionality of a specific site to show the benefits it currently provides to the local community. This assessment can be used

- to decide whether future investment should be made on the site to increase its functionality
- when considering a candidate site for the LDP
- when assessing a proposed development site through the development control process
- when considering an asset for disposal
- when seeking potential sites for mitigation for biodiversity

A Green Infrastructure SPG will be developed to illustrate how existing green infrastructure present on a site should be incorporated into and enhanced as part of any development proposals.

Identifying need

To establish the need for specific functions within an individual site reference should be made to the MSOA/ LSOA profile within which the site lies. If a given MSOA is identified as having low health and poor physical environment indicators with little access to recreational provision and/ or natural greenspace and is at risk of flooding, the potential that the individual GI assets being assessed have to mitigate for these issues should be examined.

The Welsh Index of Multiple Deprivation (WIMD) data 2019 indicates areas of deprivation relating to different parameters (see Appendix 2). An area of high deprivation may be considered as a priority area for intervention.

Assessing competing land use needs

Appendix 5 establishes a checklist to ascertain what competing land use needs the site may be subject to or potentially be used for to enable the user to build up a profile of competing potential land use on the site.

Reference to the Green Infrastructure Needs Mapping will identify if the site is a:

- Housing Allocation site
- Employment Allocation site : LDP Proposals
- Candidate site for Housing with potential to be developed for housing
- Road and/or rail scheme
- Infrastructure site: Utilities such as gas, electric, water, telecom

The Green Space Assessment provides information on deficiencies in recreation in the MSOA which could potentially be provided for on the site. Natural Greenspace mapping will show the need for access to natural greenspace within the MSOA which has been shown to be vital to tackling health inequalities.

Habitat Connectivity mapping by NRW shows whether changes in management regime on the site could enhance local ecological connectivity.

Flood Maps TAN15 and the Flood Risk Strategy will identify whether the site can be useful for storing water or intercepting downstream flows through changes in management prescription.

Torfaen' s Renewable and Low Carbon Energy Assessment highlights whether the site has potential to produce renewable energy.

This assessment will aid in identifying the most appropriate development sites which result in the least damage to biodiversity and water quality, loss of important recreational space and reduced flood risk ensuring we achieve sustainable development.

Assessing candidate sites prior to inclusion in LDP

Any candidate sites to be considered for inclusion within the LDP should be assessed in terms of their GI functionality prior to development using the method outlined in above. Should they go forward for inclusion, the protection and enhancement of these important GI assets and functions should be paramount and inform discussions on the final layout of the scheme.

Assessing sites submitted for planning permission

Torfaen is developing Supplementary Planning Guidance regarding Green Infrastructure which looks for developers to consider the Green Infrastructure assets which the site possesses at the initial stage in any development proposals prior to any design work taking place. In accordance with best practice a Green Infrastructure Statement should be produced which consists of a

- Green Infrastructure Context Map which maps all Green Infrastructure on the site
- Green Infrastructure Opportunities Map which examines the need for Green Infrastructure in the locality by the process outlined above and maps the opportunities to fulfil this need
- Green Infrastructure Concept Map which shows how this need can be fulfilled through the development process. This will then inform the initial site design to ensure the most efficient use of the land is achieved while protecting and enhancing Green Infrastructure benefits.

The Green Infrastructure Statement will help to inform pre-application discussions with the planning department and other local authority consultees ensuring a holistic approach to development of land in keeping with the goals of the Well Being for Future Generations Act 2015 and Environment Act (Wales) 2016.

Ideally this Statement should be produced prior to pre-application discussions or at least as a result of these discussions and prior to any formal application being submitted. This will ensure that Green Infrastructure protection within the development is not paid lip service to but is an integral part of the design layout. Retention or enhancement of existing green infrastructure may negate the need for mitigation on site or compensation off site. It will provide a ready-made setting for housing which will add maturity and value to any scheme providing safe, attractive, healthy environments in which to live.

Assessing sites for disposal

All TCBC land which has been declared surplus to requirements by a specific Council department should undergo an assessment of Green Infrastructure functionality showing the benefits which the site currently provides.

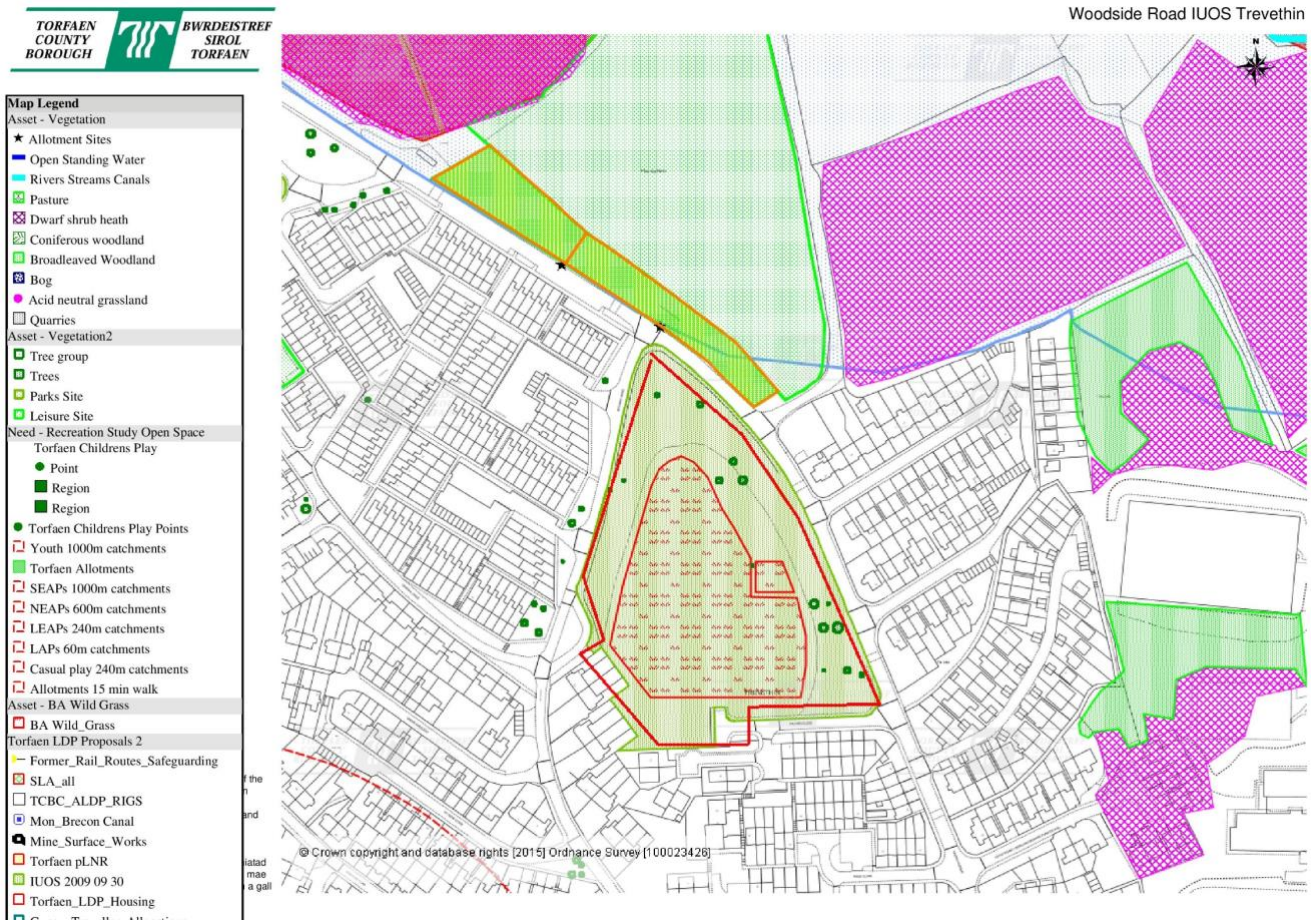
Various attempts have been made to quantify the value that Green Infrastructure assets contribute to the local economy and the savings made to society by the free provision of goods and services by the environment. Work should be undertaken to establish typical values for these goods and services so some attempt can be made to monetarise these benefits. The assumed value of loss of these assets to future generations can then be set against the potential capital receipts that a piece of land may fetch. If the site is likely to be developed a post development functionality score should be drawn up for the site based on an assumed development density to illustrate what will be lost in terms of functionality if the site is developed. Once out of TCBC ownership there is less control on the land use or future management of the site which could be used to mitigate for biodiversity on a site elsewhere in the borough which may be of less functional value.

Worked Example 1: Potential intervention site MSOA Profile Woodside Road, Trevethin

Figure 16 maps the GI assets on a site within MSOA 003 Torfaen at Woodside Road, Trevethin. The site is classified as Important Urban Open Space in the Torfaen LDP and is currently managed as amenity grassland with an area of grass cut more infrequently as meadow grass by landowners Bron Afon Community Housing. Some scattered trees lie across the site with a youth shelter situated in the centre with no maintained access path to it. The site lies adjacent to an allotment and playing fields, the latter which are now leased to a football club. The site affords good long-distance views across to Newport but is consequently very exposed.

The MSOA profile shows the area to be deficient in equipped play provision as well as lacking shade and records high heat density within the built-up area. The current biodiversity value is likely to be low but changes to the management regime could increase this as the area was originally pasture with a latent seed bed of wildflowers. The site affords the potential to provide a range of new habitats such as community woodland, flower rich meadows and ponds which could include a natural play and recreation area for local residents. This would also provide some ecological connectivity from the adjoining farmland into the estate. Development pressures on this site could also be accommodated if the remaining greenspace is upgraded to deliver increased functionality.

FIGURE 12: CHURCH AVENUE, TREVETHIN GI ASSETS



Worked Example 2: Site Specific Assessment Hollybush Way Open Space

Figure 13 shows the GI mapping for Hollybush Way Important Urban Open Space illustrating the assets present on the site. Assets include broadleaved woodland along a small stream, an area of damp grassland managed for biodiversity and a play area associated with a community building which is adjacent to large area of mown grass. A right of way passes across the site crossing the stream at a bridge and a cycle way runs along the edge of the site. An allotment lies just north of the site. Table 9 scores the functionality of the site.

FIGURE 13: HOLLYBUSH WAY OPEN SPACE

Potential interventions

The opportunities map shows that part of the site is a Site of Interest for Nature Conservation (SINC) which could be extended in area or managed to enrich its biodiversity value and pollinator habitat potential. The downstream flood risk could be mitigated by the creation of ponds to hold up the water. The broadleaved woodland could be extended into the site to increase shade, enhance biodiversity, and intercept more runoff. An assessment could be made of the potential of the back lane to the rear of Mill House Court as a safe route to the neighbouring school. The play and recreation value of the site could be increased through adding natural play features. Shade could be provided along the roadside cycle way by the planting of additional large leaved trees. The maintenance implications of these interventions would need to be weighed against the benefits to people and nature provided and the local community would need to be involved before any definite scheme was implemented.

FIGURE 14: HOLLYBUSH WAY GI MAPPING

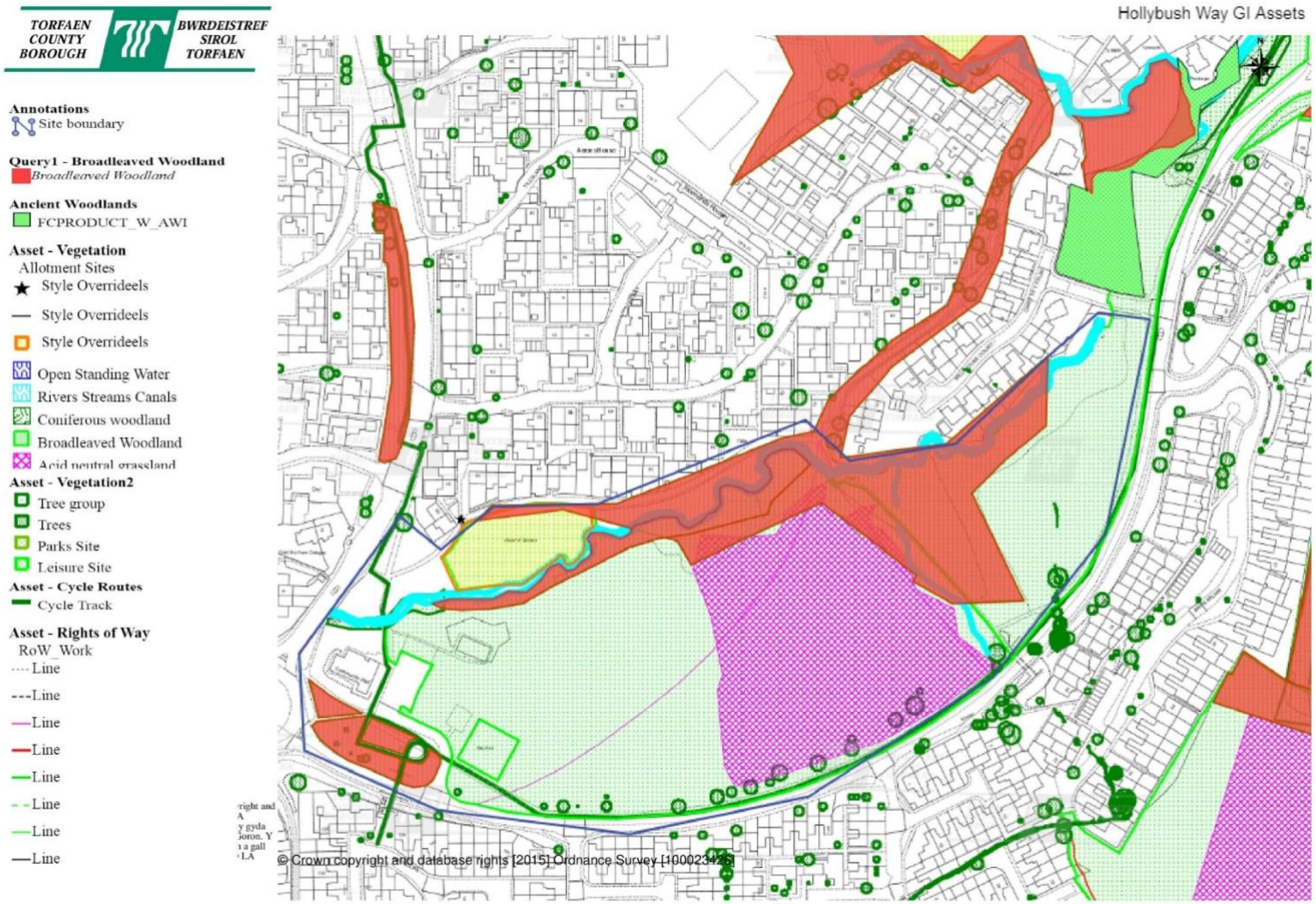
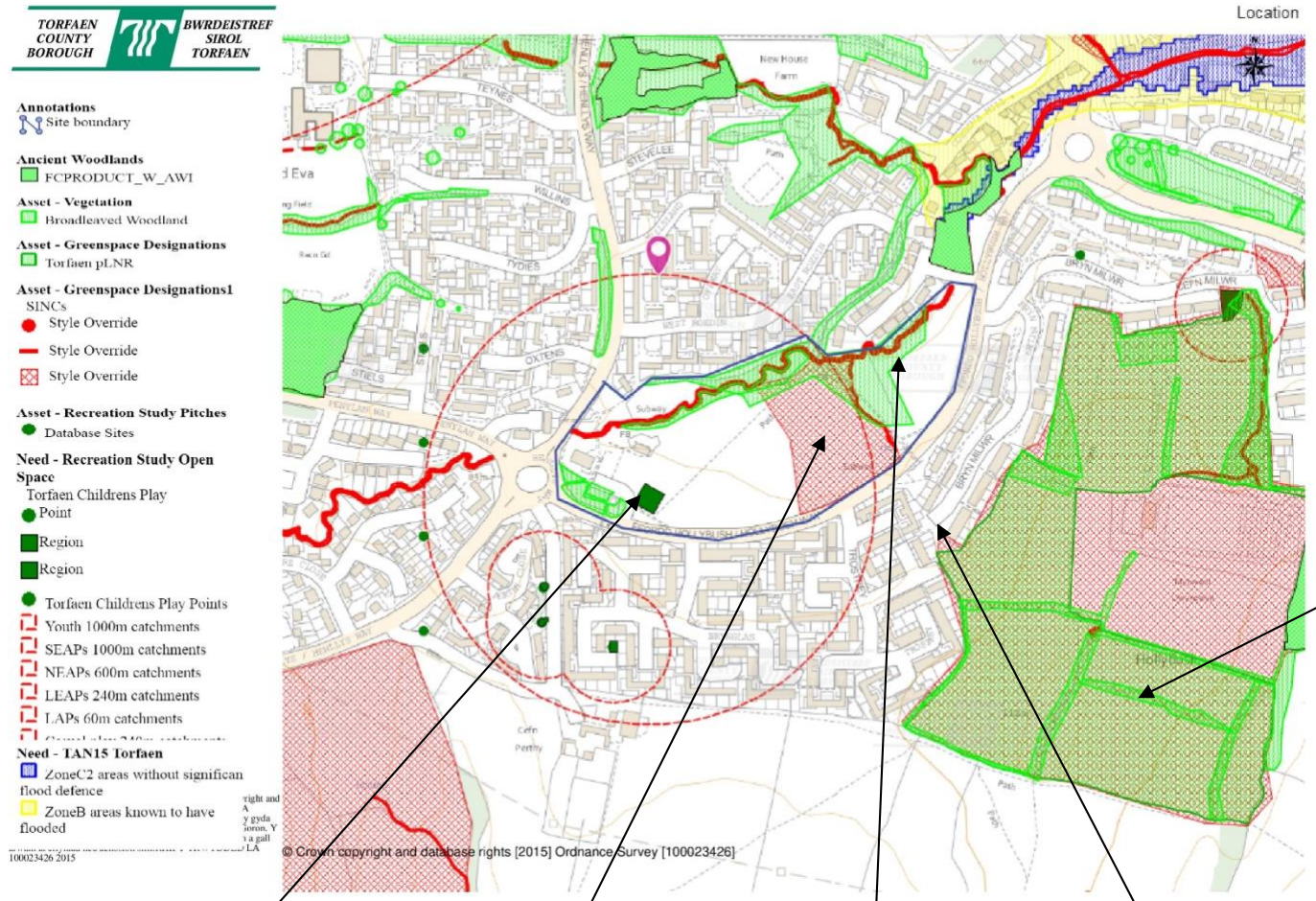


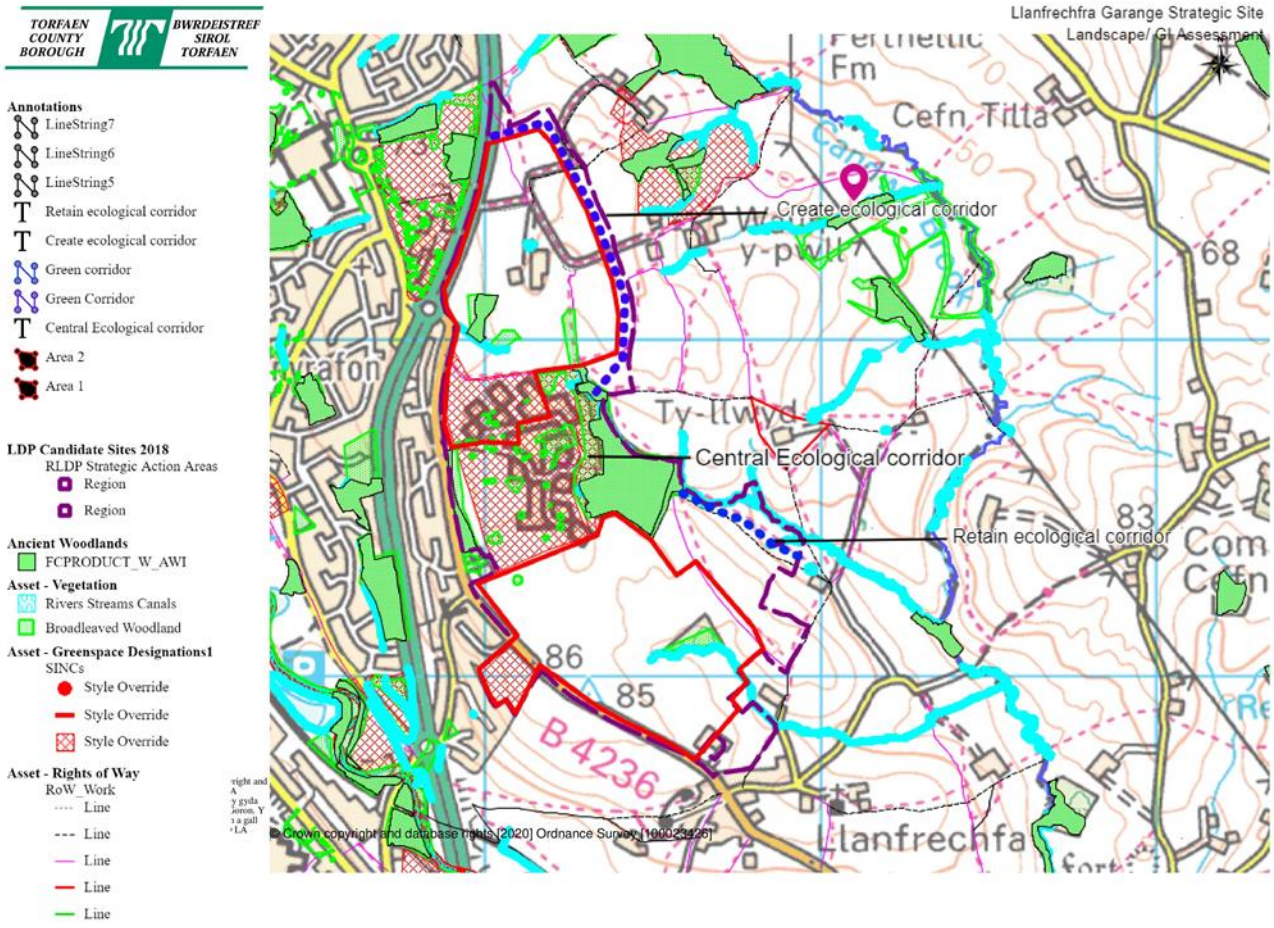
FIGURE 15: HOLLYBUSH WAY OPPORTUNITY MAPPING



Worked Example 3: Llanfrechfa Grange Strategic Development Site

Fig 19 shows the GI Asset Map for Llanfrechfa Grange Strategic Development site indicating the key Green Infrastructure Assets. This highlights the features that need to be protected during development proposals. The Concept Plan (Fig 20) details where GI should be enhanced such as linking areas of broadleaved woodland to provide ecological connectivity and how features such as streams and PRoW can be incorporated within the design layout.

FIGURE 16: LLANFRECHFA GRANGE SAA GI ASSET MAPPING



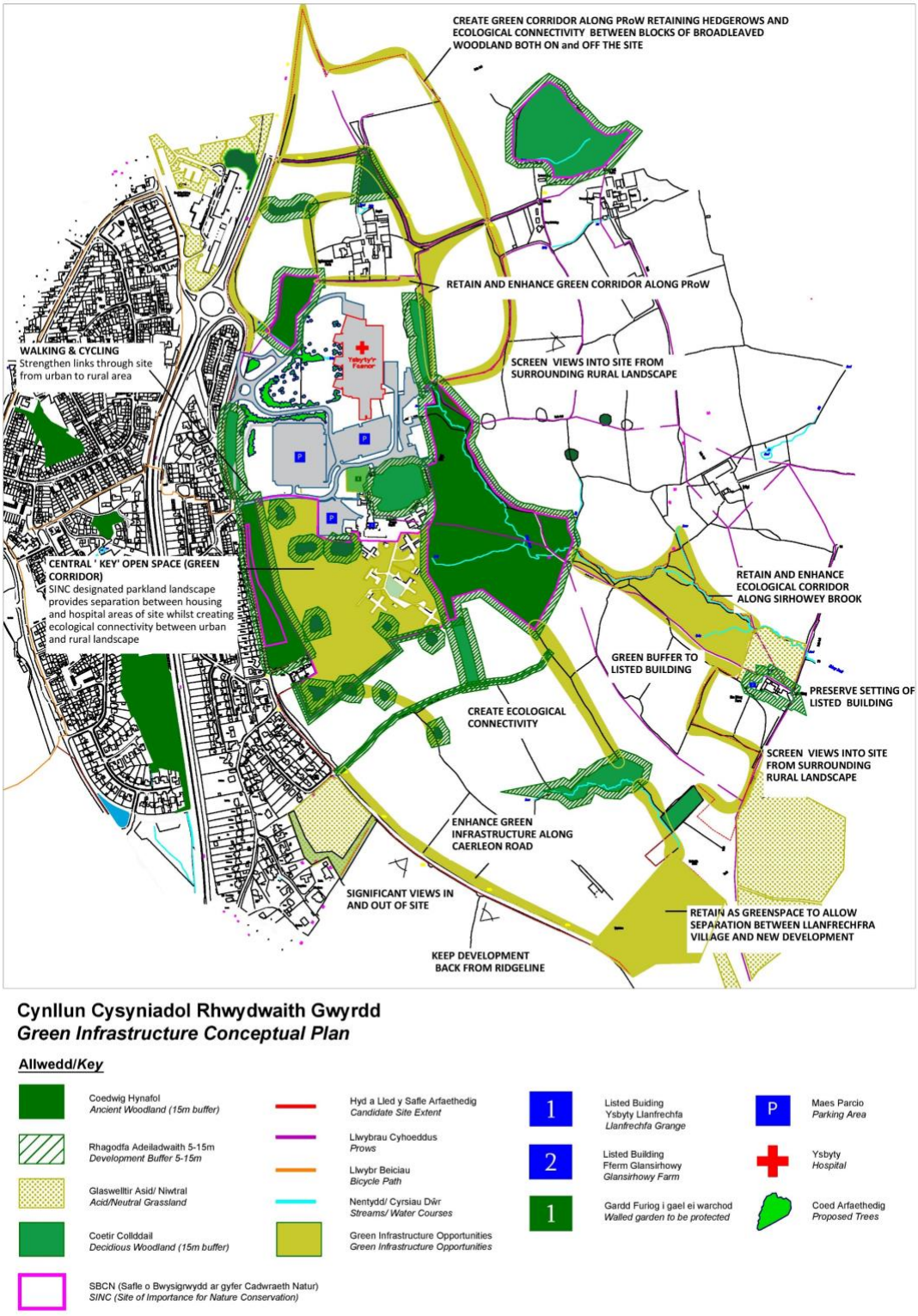


FIGURE 17: LLANFRECHFRA GRANGE SAA OPPORTUNITY MAPPING

THE GREEN INFRASTRUCTURE APPROACH

The key to the Green Infrastructure approach to land management is the preservation, creation and enhancement of the 'network' of Green Infrastructure Assets. The key GI assets identified within the borough are identified in Table 7: GI ASSETS below.

TABLE 7: GI ASSETS

KEY GREEN INFRASTRUCTURE ASSETS WITHIN TORFAEN	
Upland bogs and heather moorland:	Blaenavon Industrial Landscape World Heritage Site
Large Water bodies	Llandegfedd Reservoir, Afon Lwyd river corridor; Mon & Brecon canal, Garn Lakes LNR
25% urban tree cover	Urban woodlands/ Ancient Woodlands and extensive tree cover; Blaen Bran Community Woodland: Community management accessible woodland
The British	Remnant industrial site now largely reclaimed by nature providing semi natural green space for informal recreation
Monmouthshire & Brecon Canal	Green movement corridor for people and wildlife
Local Nature Reserves	7 sites providing access to nature for local people
Green leisure corridors	NCN 492/Afon Lwyd Trail/ Abersychan Greenway/ Afon Lwyd Greenway/ Henllys Incline
Central Recreation Area including Cwmbran Boating Lake	Designed to provide greenspace through Cwmbran accommodating the river corridor, sports pitches, public park and play area, skate park and riverside cycle route.
Cwmbran New Town original design layout	Preserved line of existing streams and created green fingers throughout the urban area including preserving ancient woodland blocks
Formal Parks	Pontypool Park, Glansychan Park, Blaenavon Flower Gardens, Oakfield Flower Gardens

The Torfaen Urban Green Grid mapping has identified green corridors which run through our urban fabric and can link our urban and rural environment. These consist of the individual green assets including those identified above such as parks, churchyards, woodlands etc. that have a specific function which are linked together by 'stepping stone' sites to create the Green Infrastructure network. These stepping stones sites which could be streams, lines of street trees, hedges or areas of visual amenity, are important as they create the movement corridors through which species can pass to forage and breed.

The fragmentation of wildlife habitats as well as a reduction in extent is one of the primary sources of biodiversity decline in recent years due to pressure from development within Torfaen.

These green corridors help to provide the ecological connectivity needed to sustain the habitats which remain within the urban area. They also frequently include walking and cycling routes providing opportunities for physical exercise which is free at the point of use ideally from outside your front door.

The Replacement LDP will aim to preserve, create, and enhance the green corridors identified within the Urban Green Grid mapping to ensure ecological movement corridors are retained. The opportunity to walk or cycle through natural or semi natural green spaces increases our sense of well-being and our physical health. Simply a view of greenspace can help to increase well-being.

Key corridors include:

TABLE 8: KEY CORRIDORS

Strategic Corridors *(as identified in PSB Green Infrastructure Strategy)*	**Primary Urban Green Corridors**
Afon Lwyd river valley	Central Recreation Area including Cwmbran Boating Lake, Southfields, Northfields and Woodland Road Recreation Ground
Monmouthshire and Brecon Canal	NCN 492 Cycle route
Northern Uplands	Dowlais Brook corridor and tributaries
Western Uplands	Nant Milwr corridor and tributaries
East and Southern Lowlands	Henllys Incline
Afon Lwyd river valley	Blaen Bran and tributaries
	Cwmbran Brook
	Ty Gwyn Way woodland corridor
	Graig Fawr - Churchwood- Greenforge Way
	Stream adj Wren's Nest
	Woodland adj Bevans Lane
	A472 corridor
	Herbert's Wood- Folly Lane, Trevethin
	Foundry Road, Abersychan
	Nant Ffrwd through Abersychan & Talywain
	Middle Coed Cae Recreation Ground, Blaenavon
	Elgam Ravine- Ellick Street, Blaenavon

ADDRESSING KEY ISSUES

The key issues identified within this Assessment which can be addressed to some extent through the Green Infrastructure approach include the following:

- Climate change adaptation and mitigation: heat island effect; flooding; de-carbonisation
- Overall biodiversity loss and the degradation and fragmentation of habitats including pollution, invasive species, poor water quality and pressure from development.
- An unhealthy and ageing population
- Poor educational attainment reducing life chances for young people
- Loss of green infrastructure assets due to pressure from housing development and renewable generation requirements
- Lack of investment in urban green space leading to poor quality environments which are subject to misuse and deficiencies in provision in allotments, play areas, sports pitches and access to natural green space as identified in the Torfaen Open Space Assessment 2020 (Appendix 6).

Table 9 below details the opportunities and actions that are currently being undertaken and those in the planning stage to address these issues.

TABLE 9: KEY OPPORTUNITIES AND ACTIONS

KEY ISSUES	BENEFITS	ACTIONS
CLIMATE CHANGE		
Bog restoration	Carbon storage, water quality improvements, flooding	SE Wales Upland Management Plan
Protection of existing woodland blocks and street trees	Carbon storage, mitigation for heat island effect and shelter, reduced flooding, view of nature	GI SPG to be developed to institute 15m minimum natural habitat buffer zone between woodland canopy edge and curtilage of dwelling to protect health of woodlands
Replacement of felled street trees, additional street tree planting	Shade. aesthetic	New Tree Policy adopted by Council to replace street trees felled. Aim to monitor felled street trees annually to inform replacement programme.
Planting or replanting of woodland blocks in upland areas	Carbon storage, water attenuation	TWIG grant application Trees for Cities application Implement The British Management Plan
Investment in and maintenance of walking and cycling network to	Reduction in carbon emissions	Safe Routes to School Programme Gwent Green Grid finding to improve access to green infrastructure.
Use of Sustainable Drainage Systems on all new development and retro fitting where possible	Water attenuation	SUDs now mandatory in all new developments. Schemes need to add value in terms of amenity and biodiversity. GI SPG to incorporate guidance on requirements of SUDs design

BIODIVERSITY		
Invest in quality of designated sites.	Increase ecological resilience	LNR Management Plans to be updated with GGG funding. Natural Resource Management plan for SE Wales updated. 10ha bog restoration undertaken. Further work in negotiation stage. Seek funding for urban woodland management plans and implementation.
Ensure existing biodiversity on sites protected and enhanced on development sites	Improve ecological connectivity/ resilience	GI and Biodiversity SPG to provide guidance on development sites
Preserve, enhance and create ecological corridors within urban area	Increase ecological connectivity/ resilience	Urban Green Grid mapping and PSB Strategic GI Strategy identifies green corridors within the borough which will be preserved and enhanced through LDP policy. Gaps identified and interventions planned for. Implement Afon Lwyd Restoration Action Plan
UNHEALTHY AND AGEING POPULATION		
Improve maintenance of and access to our natural green spaces	Improve mental health outcomes	Update LDP Annex 6 to increase funding for public open space provision. Invest in existing sites to benefit wider community. GGG funding, PSB funding
Improve access to places to exercise e.g. Walking and cycling routes, attractive safe parks, good quality sports pitches, play areas, allotments. Requires investment in these assets.	Improve physical health outcomes	Update LDP Annex 6 to increase funding for public open space provision. Invest in existing sites to benefit wider community. Active Travel funding. Play Wales funding.

Design the built and natural environment which is accessible to all, providing bench, toilets and level access on key GI sites	Increased use of outdoor spaces for all to improve social and community inclusion	Carry out Disability Audit to key GI sites. Seek funding to improve facilities with existing GI and SPG to improve inclusive design of new spaces
INCREASING LIFE CHANCES FOR CHILDREN		
Provide access to nature.	Improved physical and mental health outcomes and life chances for children and young people	Provide Environmental Education programme. Invest in increasing access to natural play areas or spaces through GGG funding
Create volunteering opportunities and green jobs	Improve life chances and mental health outcomes	Apprentice Scheme for Countryside Wardens through GGG.
Provide good quality play areas and junior sports provision	Improved physical and mental health outcomes and life chances for children and young people.	Consult on and implement recommendations in Torfaen Open Space Assessment on deficiencies in play, youth and junior sports provision using S106 agreements through planning. LDP Annex 6 to be revised to increase funding for provision of play, youth and junior sports. Two inclusive/ sensory play areas to be designed and installed to provide facilities for physically disabled children and those with learning difficulties by December 2022

PRESSURE ON GI ASSETS FROM HOUSING DEVELOPMENT		
Resist development on identified key GI assets, identified green corridors and stepping stone sites.	Protect connectivity for people and nature	Urban Green Grid identifies GI network and key assets which will be protected under Replacement LDP policy
Ensure protection and incorporation of GI assets within development proposals at initial site allocation stage	Site ecology, visual amenity and adequate open space provision maintained to protect physical health and wellbeing outcomes	Replacement LDP GI policy will ensure all sites identified on the Urban Green Grid Map will be protected from development unless allocated site or identified as potential site through candidate site process.
Secure LDP policies to increase proportion of GI on new development sites	Site ecology, visual amenity and adequate open space provision maintained to improve physical health and wellbeing outcomes	Specific GI policy being consulted on in Replacement LDP Preferred Strategy
INVESTMENT IN EXISTING GI ASSETS AND CREATION OF NEW		
Enhance biodiversity on all GI assets within Torfaen	Improve ecological resilience	Assess major GI assets for potential to increase biodiversity. Biodiversity enhancement plans have been prepared for 6 Parks in Torfaen. Gwent Green Grid funding will help implement these plans in 2022_23
Improve quality of parks and open spaces to encourage use of outdoor spaces	Improve physical health and wellbeing outcomes	Update Annex 6 to increase funding for public open space provision. Invest in existing sites to benefit wider community. Specimen trees planted in 16 parks during 2021/22.
Improve quality of play areas within Torfaen as required	Improve outcomes for children and families and allows community cohesion	Complete quality assessment of all play area sites within Torfaen. Identify sources of funding including available S106 to improve quality and play value of sites. 2 plays area installed or fully

		refurbished 2019/20 and 2 refurbished 2021/22
Increase number and quality of outdoor pitches within Torfaen	Improve physical health outcomes for children and families and develops community cohesion	Investment in quality of existing pitches through S106 funding and assisting clubs to undertake funding bids. All developments where pitch provision is required will need to provide full piped drainage system. Commuted sum or sinking funding for ongoing maintenance of drainage system should be considered to increase Council resources
Provide sufficient all- weather training facilities for outdoor pitch sports	Improve physical health outcomes and develops community cohesion	Feasibility study to examine the development of a 3G pitch at Abersychan School to be undertaken 2021/22.
Where demand identified increase provision of allotments and community growing	Improve physical health outcomes and develops community and social cohesion	Assess demand for allotments and community growing spaces in areas shown to be deficient in provision within the Torfaen Open Space Assessment 2020
Increase number of community orchards and ensure protection and enhancement of traditional orchards especially within potential development sites.	Improves ecological resilience and provides pollination resource. Placemaking.	GI Assessment of all new development sites will identify any traditional / community orchards on site. Developing GI SPG to ensure protection and enhancement of any existing orchard on new sites.

MONITORING AND REVIEW

The Green Infrastructure Assessment will be reviewed on a five yearly basis to assess the delivery of the action plan with real time updates of works to trees in Council ownership and changes to maintenance regimes captured on the Etsy tree and Grounds Maintenance recording systems.

The Urban Green Grid mapping will be reviewed and updated on an annual basis to ensure the data upon which decisions are being made is as robust as possible.

The Priority Open Spaces identified through the Ward Profile process and consulted upon and agreed by Ward, Community and Town Councils will be reviewed annually to assess the improvement of their condition over time.

A Recreation Strategy will be developed for improvements to play, youth and sports provision in line with recommendations of Torfaen Open Space Assessment 2020.

An Allotment Strategy will be developed to improve allotment provision within the borough with consideration being given to the diversion of S106 resources into allotment improvements.

CONCLUSION

The key strategic opportunities where green infrastructure will deliver the most significant benefits to Torfaen have been identified as follows:

Restoration of

- upland bogs
- ancient semi natural woodland habitat
- water quality along the Afon Lwyd and its tributaries
- reduction in grazing pressure on TCBC owned land to restore pasture to species rich grassland

Maintenance of:

- urban woodland stock
- reduced mowing regimes on publicly owned land to increase species diversity

Creation of:

- incorporate biodiversity and amenity value into sustainable drainage schemes on new development sites
- look for opportunities to retrofit sustainable drainage schemes into existing developments
- create ponds, scrapes and other water bodies
- encourage planting of native tree and hedge species on development sites and throughout borough.
- Increase number of street and garden trees to provide shade and shelter
- consider use of green roofs and walls where appropriate especially in urban areas where planting is constrained

Connection:

- Protect and enhance the identified green corridors within the Urban Green Grid Mapping and create or maintain link to wider strategic green corridors to aid the movement of species for breeding and foraging
- Planting of new street trees and replacement of existing stock to link green infrastructure assets

APPENDIX 1: POSSIBLE INTERVENTIONS

Table 10 outlines the interventions required if a deficit of the specified function is identified during the assessment of need and how these deliver the Well Being for Future Generations (Wales) Act Well Being Goals.

TABLE 10: GREEN INFRASTRUCTURE INTERVENTIONS

	AMELIORATE EFFECTS OF CLIMATE CHANGE
Shade	
Desired Outcomes	Reduce ambient temperatures particularly in urban areas Protect vulnerable people from effects of extreme temperatures
Interventions required	Planting of street trees Maintenance of existing street trees Replacement of existing street trees Management of existing woodlands with urban areas Increased area of woodland Plant species with large canopies to provide shade to buildings Plant in areas where people walk and gather
Evaporative cooling	
Desired Outcomes	Reduce ambient temperatures particularly in urban areas Protect vulnerable people from effects of extreme temperatures
Interventions required	Increase tree and vegetation cover on site Increase water bodies on site
Shelter from wind	
Desired Outcomes	Provide shelter from high winds and storms
Interventions required	Plant evergreen species to intercept air flow and reduce wind speeds
Soil stabilization	
Desired Outcomes	Retain carbon storage potential of soils, agricultural production, water quality
Interventions required	Plant trees to stabilize slopes and soils vulnerable to erosion
Water storage	
Desired Outcomes	Reduce risk of flooding
Interventions required	Plant trees / woodland blocks Manage existing woodland to preserve capacity to store water within underlying soils Avoid development on river flood plains De culvert water courses where appropriate Recreate natural flood plain vegetation

	Create or enhance GI upstream of flood risk areas to increase water storage Harvest, store and use rainwater on site Design permeable surfacing
Water interception	
Desired Outcomes	Reduce speed of surface runoff to streams/ drains
Interventions required	Green roofs installed to reduce runoff from roofs Plant trees with large canopies to intercept rainwater Install open water features such as ponds, swales, bio retention ponds Create or enhance GI upstream of flood risk areas to increase water interception by tree planting or increasing percentage of soft surfacing within site Use SUDS on development sites to maintain or reduce post development runoff and reduce flood risk and look to retrofit where feasible
Water infiltration	
Desired Outcomes	Reduce speed of surface runoff to streams/ drains
Interventions required	Plant trees Increase area of vegetation on site Create or enhance GI upstream of flood risk areas to increase water infiltration by tree planting or increasing percentage of soft surfacing within site Use SUDS on development sites to maintain or reduce post development runoff and reduce flood risk and look to retrofit where feasible
Carbon sequestration	
Desired Outcomes	Contribute to reduced CO_2 emissions in Torfaen
Interventions required	Increase tree cover either street trees or woodland blocks Manage existing woodlands to maintain healthy ecosystem Instigate rewetting of upland bogs Plant species which absorb most carbon Retain mature trees on all sites
Carbon storage	
Desired Outcomes	Contribute to reduced CO_2 emissions in Torfaen
Interventions required	Instigate rewetting of upland bogs Manage existing woodlands to maintain healthy ecosystem Reduce ploughing up of agricultural land which releases CO_2 into atmosphere Avoid development in areas of high carbon storage No dig policy in new development sites to reduce ground disturbance and release CO_2 into atmosphere

	Retain mature trees on all sites
BENEFIT	REVERSE BIODIVERSITY LOSS
Habitat for wildlife	
Desired Outcomes	Increase area of habitat, species numbers
Interventions required	Plant native species where appropriate esp. hedging Select fruit and nut bearing species of planting Create new habitats on site Create new water bodies including ponds Safeguard LBAP priority sites Select pollinator friendly plants Install bird and bat boxes. Minimize use of mown lawns 15m minimum buffer zones to all ancient semi natural woodland, native woodlands, woodland blocks, existing hedgerows Incorporations of hedgerows into semi natural open space within development sites
Wildlife corridor	
Desired Outcomes	Increase habitat connectivity
Interventions required	Link up green infrastructure assets where possible to create linking spaces Make linear features such as canal, river, streams, railway lines and road verges wildlife friendly reducing mowing regime to enhance biodiversity. Create new linear features such as hedgerows esp. in new developments
Pollination resource	
Desired Outcomes	Increase habitats which provide a pollination resource
Interventions required	Reduce mowing regimes in terms of frequency and/ or timing of cut. Sow and maintain new wildflower meadows where appropriate Plant nectar rich plant species on new development sites inc fruit and nut bearing species Plant new orchards and maintain traditional orchards

A HEALTHIER WALES	
BENEFIT	SUPPORT HEALTHY LIVING AND WELL BEING
Noise absorption	
Desired Outcomes	Reduce noise pollution
Interventions required	Plant trees to create sound barrier to intercept noise from major road and rail routes and around industrial premises Safeguard existing GI which provides sound barrier Generalised recommendations to reduce noise include: Plant the noise buffer close to the noise source (rather than close to the area to be protected). Plant trees/shrubs as close together as the species will allow and not be overly inhibited. When possible use plants with dense foliage. A diversity tree species, with a range of foliage shapes and sizes within the noise buffer may also improve noise reduction. Foliage of the plants should persist from the ground up. A combination of shrubs and trees may be necessary to achieve this effect. Evergreen varieties that retain their leaves will give better year-round protection. When possible use tall plants. Where the use of tall trees is restricted, use combinations of shorter shrubs and tall grass or similar soft ground cover as opposed to harder paved surfaces.
Trapping pollution	
Desired Outcomes	Improve air and water quality
Interventions required	Plant trees with large canopies Plant vegetation
Green travel route	Support healthy living and well-being and ameliorate for climate change
Desired Outcomes	Sustainable transport option to reduce carbon emissions Health benefits with knock on benefits to income
Interventions required	Incorporate green travel routes Provide signage and publicity for green travel routes
Recreation	
Desired Outcomes	Increased physical health
Interventions required	Ensure public access to all GI assets on site Provide benches in shade, sun and shelter Provide a variety of formal recreation facilities for all ages Provide play spaces for natural play as well as equipped spaces Maintain PRoW across development sites where possible. Maintain or institute new links to other GI assets from development sites.

	Maintain 'green view' from all windows of development Ensure provision of accessible greenspace from office developments
BENEFIT	A MORE PROSPEROUS WALES PROMOTE SUSTAINABLE GROWTH AND ECONOMIC DEVELOPMENT
Food production	
Desired Outcomes	Promote sustainable growth and economic development
Interventions required	No development of Grade 1-3 agricultural land Promote use of edible planting within development sites Safeguard any allotments on site Consider designation of more allotments on site Encourage household composting Use grey water to irrigate crops/ planting schemes
Fuel production	
Desired Outcomes	Increase area of land within Torfaen used for renewable energy production
Interventions required	Safeguard areas suitable for renewable energy production from development Plant tree crops which could be used as fuel Encourage biomass production
Timber production	
Desired Outcomes	Increase area of land within Torfaen used for timber production
Interventions required	Plant appropriate species on site to form future timber resource Replant larch felled areas as replacement timber resource Manage existing woodlands as timber resource where appropriate
Green jobs	
Desired Outcomes	Increase number of green jobs
Interventions required	Invest in jobs relating to maintenance and management of GI Invest in training
Setting for development	
Desired Outcomes	Increased inward investment Create attractive biodiverse places for people to live
Interventions required	Create attractive biodiverse landscapes which provide space for informal recreation to aid physical and mental well- being of workers increasing productivity
Supporting image	
Desired Outcomes	Increase tourism and inward investment
Interventions required	Management of uplands for biodiversity and recreation Management of commons

	Management and improvements to Rights of Way network Restoration works to Mon & Brecon canal

A MORE EQUAL WALES	
BENEFIT	FULFILLING POTENTIAL
Learning	
Desired Outcomes	Increased educational attainment due to better motivation as a response to improved mental wellbeing.
Interventions required	Provide outdoor classrooms Provide Forest School facilities Provide natural play areas Provide spaces contact to nature to improve wellbeing which produces more positive attitude to learning and boosts educational attainment

A MORE VIBRANT WALES	
Aesthetic	
Desired Outcomes	Sense of place and good quality environments
Interventions required	Create attractive green infrastructure around employment sites to encourage new businesses Create attractive environments around existing housing areas to increase well-being, reduce crime, increase social cohesion Design GI to improve image which is in keeping with existing landscape character Protect and enhance areas which are valued for their intrinsic beauty which contributes to mental well being
Heritage asset	
Desired Outcomes	Maintain and create sense of place
Interventions required	Incorporate heritage asset into GI to add local distinctiveness to sites Interpretation of local heritage
Cultural asset	
Desired Outcomes	Maintain and create sense of place
Interventions required	Improve functionality of cultural spaces Protect and enhance cultural assets

APPENDIX 2: DEFINITIONS OF FUNCTIONS

Shading from the sun.

As climate change progresses the UK is likely to see rising temperatures. This is likely to have a more significant impact on the more built up areas of Torfaen. Hard surfaces such as roads and pavements radiate heat from the sun warming up the adjacent air and increasing temperatures. The shade provided by trees and taller vegetation can help reduce this 'heat island effect' and provide more comfortable temperatures within urban areas.

Evaporative cooling

As plants transpire water is evaporated from their leaves cooling the air around them. All types of GI can provide this function especially open water and large leaved plants. This is a significant factor for agricultural land.

Shelter from wind

The more unpredictable weather associated with climate change is predicted to lead to more storms with higher winds. GI can reduce wind speeds at a local level by slowing and diverting currents. This can have a cost saving in terms of environmental damage to properties.

Habitat for Wildlife

Different types of GI can provide varying habitats for wildlife and plants which form an important part of our planet's ecosystem.

Wildlife corridor

In order for any ecosystem to remain healthy the wildlife and plants within it need to be able to move and disperse so it is important that they have a network of green and blue spaces to travel through in order to find food and shelter. Climate change will also mean species will need to move northwards to find climatic conditions which suit them or face possible extinction. Different types of GI can provide corridors for a wide range of species.

Soil stabilization

The roots of all types of vegetation help hold the soil together and preventing it from eroding. This is especially important when intense rainfall events are likely to be more frequent due to our changing climate. Surface runoff from bare soil will increase particulate matter running into our streams and rivers reducing water quality and requiring more capital expenditure on water treatment.

Water storage

Water can be stored in ponds, reservoirs, lakes and wetlands and manmade flood storage areas.

Water interception

Leaves and plants can intercept rain and slow down the time it takes to reach the ground. This helps to reduce flood risk as flooding occurs when rivers receive a rapid amount of surface water in a short amount of time. All types of GI will achieve some interception but larger leaved plants are the most effective.

Water infiltration

Vegetation and roots help water drain into the ground rather than running over the surface. The permeability of GI types as opposed to impermeable hard surfaces such as concrete and macadam helps them to reduce flood risk.

Carbon sequestration

Carbon dioxide gas can be removed from the atmosphere by trees through photosynthesis. This process involves plant cells converting the carbon from carbon dioxide to a solid form in sugars (the carbohydrates glucose and starch) that can be stored in leaves, stems, trunks, branches and roots, and contribute to tree growth. Oxygen is released back into the atmosphere as a by-product of photosynthesis which animals depend upon for survival.

Carbon storage

GI in the form of existing trees, peat bogs and soils lock up the carbon preventing it from being released back into the atmosphere.

Pollination resource

75% of the 1,300 types of plants grown around the world for food, beverages, medicines, condiments, spices and even fabric are pollinated by animals. These animals, including wasps, bees, flies, butterflies need habitat to thrive in and food to eat. GI can provide for these habitats.

Noise absorption

Vegetation which is tall enough to intercept and absorb sound waves especially near to major transport routes can help to reduce noise pollution and create a better environment for residents.

Trapping pollutants

GI can be used to reduce air pollutants especially around transport routes and industrial premises. Particulate matter can be removed from the air through uptake via leaf stomata and deposition on leaf surfaces.

Green travel route

Policy drivers to encourage walking and cycling both for increased health benefits and to reduce carbon emissions can be delivered through GI by developing green routes which link communities, educational establishments and places of work.

Aesthetic

Creating an attractive well cared for environment helps attract investment opportunities, increases a sense of local pride, reduces crime rates and improves mental wellbeing. Street trees and well planned and maintained open spaces, woodlands.

Learning
GI can provide opportunities for outdoor learning, environmental education and even natural play. It can also provide settings for learning new skills to help adults back to work e.g. Social Services Countryside unit.

Recreation
Recreation is a major function provided by GI. These include formal recreation areas such as sports fields, playing fields, golf courses and play areas but also woodlands and green spaces people use for dog walking and other informal recreation. The uplands also provide opportunities for extreme or adventure sports as well as hiking.

Food production
GI used to produce food including sheep and cattle grazing, arable crops and associated products such as honey and cheese.

Fuel production
GI which can be used to produce fuel such as logs and biofuels, the potential to produce energy such as micro hydro schemes, solar and wind energy.

Timber production
GI which can produce timber for large scale construction use or small-scale wood products.

Heritage asset
Historic features in the landscape are part of a sense of place and create local distinctiveness.

Cultural asset
Spaces which are used for cultural purposes such as for holding events or festivals or have cultural significance.

Green jobs
Space has the potential to support jobs within the green economy such as grounds maintenance, countryside management, tree surgery, canal and river maintenance, biodiversity, energy generation

Setting for development
Well landscaped business parks attract/ help retain tenants.

Supporting image

The quality of the upland landscape of north Torfaen and the BILWHS is a significant draw to tourists and more local visitors. Well landscaped business parks attract/ help retain tenants.

APPENDIX 3: WELSH INDEX OF MULTIPLE DEPRIVATION (2019) INDICATORS

Income Domain	Access to Services Domain	Physical Environment Domain	Housing Domain
Percentage of population in receipt of income related tax credits or benefits	Average of public and private travel times to food shops GP surgeries Primary schools Secondary schools Post office Public library Pharmacies Petrol stations (private transport only) Sports Facilities Access to digital services (% unavailability of broadband at 30M/bs	Households at risk of flooding score Air Quality Score Accessible Natural Green space score	Proportion of people living in overcrowded households 2011 Census based bedrooms measure) Likelihood of housing being in disrepair or containing serious hazards
Employment Domain	**Community Safety Domain**	**Health Domain**	**Education**
Percentage of working-age population in receipt of employment related benefits	Police recorded burglary Police recorded theft Police recorded criminal damage Police recorded violent crime Fire incidences Anti-Social Behaviour (ASB)	Cancer Incidence Rate per 100,000 GP recorded mental health conditions (per 100) GP recorded chronic conditions (per 100) Limiting Long-Term Illness per 100 Low Weight single Births (live births less than 2.5 kg) Children Ages 4-5 who are obese Premature deaths (per 100,000)	Foundation Phase Average point score Key Stage 2 average point score Key Stage 4 Average point score Repeat absenteeism Proportion of Key Stage 4 leavers entering higher education Adults age 25-64 with no qualifications

APPENDIX 4: ESTABLISHING COMPETING NEEDS

TABLE 11: COMPETING NEEDS CHECK LIST

ASSESSMENT OF COMPETING LAND USE NEEDS				
Site name:				
Ref:				
Need for intervention	**Relevant GIS layer**	**Strategies**	**Interrogation**	**Yes/ No**
Relative deprivation	WIMD		Is site in area of overall deprivation 1-3? Is site in area of deprivation for health? 1-3	
Need for flood mitigation	Flood Maps Flood Risk Mapping	TAN 15 Flood Risk Management Strategy	Is the site in a Flood zone? Is site at risk of riverine flooding? Is the site at risk from surface water flooding? Is site upstream of area of surface water flooding?	
Need for housing	LDP Proposals		Is site with Strategic Housing Area? Is site within Housing Allocation Area? Is site candidate site for housing? Is site within area of high development pressure for housing?	
Need for employment land	LDP Proposals		Is site within a Strategic Employment Area? Is site within an Employment Allocation Area? Is site candidate site for employment? Is site within area of high development pressure for employment?	
Need for land safeguarded for transport needs	LDP Proposals Active Travel Plan	Transport Plan Active Travel Plan	Is the site safeguarded for transport needs?	
Need for mineral safeguarding	LDP Proposals		Is the site safeguarded for mineral extraction needs?	
Need for biodiversity protection and enhancement	Habitat Connectivity Greenspace designations		Is there connectivity between the site and another site with similar habitat? Is it part of an ecological corridor?	
Need for energy production	Torfaen Renewable Energy Study		Does site have potential to generate renewable energy?	

APPENDIX 5: SECTION 7 HABITATS & SPECIES

TABLE 12: PRIORITY HABITATS & SPECIES IN TORFAEN

Reference	Habitat Action Plans	Species Action Plan
	Deciduous Woodlands	Great Crested Newt
HAP A-1	Upland Oakwood	Bullfinch
HAP A-2	Upland Mixed Ash Woodland	Grey Partridge
HAP A-3	Lowland Beech and Yew Woodland	Lapwing
HAP A-4	Wet Woodland	Peregrine Falcon
HAP A-5	Lowland Wood Pasture and Parkland	Skylark
HAP A-6	Scrub Woodland	Song Thrush
HAP A-7	Lowland Ancient and/or Species Rich	Cruet Collar Moss
HAP A-8	Woodland	Brown Trout
		Pink Meadow Cap
	Wildlife Corridors	Pale Chanterelle
HAP B-1	Cereal Field Margins	Dark Green Fritillary
HAP B-2	Boundary and Linear Features	White-clawed Crayfish
HAP B-3	Ancient and/or Species Rich Hedgerows	Glow-worm
		Longhorn Beetles
	Wetlands	Scarce Blue-tailed Damselfly
HAP C- 1	Floodplain and Grazing Marsh	Short-winged Conehead
HAP C- 2	Purple Moor Grass and Rush Pasture	Six-belted Clearwing
HAP C- 3	Blanket Bog	Small Pearl-bordered Fritillary
HAP C- 4	Open Standing Water and Canal	Southern Wood-ant
HAP C- 5	Mesotrophic Lakes	Badger
HAP C- 6	Rivers and Streams	Bats
		Brown Hare
	Species Rich Grassland	Dormouse
HAP D-1	Lowland Meadows	Otter
HAP D-2	Lowland Calcareous Grassland	Water Vole
HAP D-3	Lowland Dry Acid Grassland	Adder
		Common Lizard
	Heathland	Bee Orchid
HAP E-1	Dwarf Shrub Heath (Upland and Lowland)	Bluebell
		Dyers Greenweed
	Inland Rock	Mistletoe
HAP F- 1	Quarries	Moonwort
HAP F- 2	Colliery Spoil	Pennyroyal
HAP F- 3	Acidic Scree	Western Gorse
		Wild Daffodil
	Urban Habitats	Yellow Bartsia
HAP G-1	Built up Areas and Gardens including:	Japanese Knotweed
	(i) School grounds and public open spaces	
	(ii) Churchyards and Cemeteries	
	(iii) Brownfield sites and Industrial estates	
	(iv) Allotments	

REFERENCES

(British Military Fitness. (2001). Paper to UPF conference; Parks What's the use?) - 16

CABE (2010) Community green: using local spaces to tackle inequality and improve health

CABE (2010) Urban Green Nation. Building the evidence case. http://webarchive.nationalarchives.gov.uk/20110118095356/http:/www.cabe.org.uk/files/urban-green-nation.pdf

DEFRA (2013) Developing place-based approaches for PES including a case study on developing the market for carbon storage and sequestration by peatlands. Available Online from file:///C:/Users/1300168/Downloads/11330_NE1036_Final_Report.pdf Accessed September 2016

(Department of Health. (2004). At least five a week: Evidence on the impact of physical activity and its relationship to health) – 15

Environment Agency Wales (2007) Wildlife Economy Wales: An Economic Evaluation Scoping Study. Available at http://www.environment-agency.gov.uk/static/documents/Research/wildlifewales_wb_1823119.pdf

Forestry Commission (2006) Environmental benefits of Greenspace Available online at http://www.forestry.gov.uk/fr/infd-8aefl5 Accessed 29th September 2016

Garrod, G.D. (2002). Social and environmental benefits of forestry phase 2: landscape benefits. Report to the Forestry Commission. Centre for Research in Environmental Appraisal and Management, University of Newcastle upon Tyne.

GEN Consulting (2006). Glasgow Green renewal benefits analysis. A report to Glasgow City Council. November 2006.

Green space access, green space use, physical activity and overweight: a research summary. (Natural England, 2008) and Natural England Technical Information Note TIN055:

(Hakim, A. A. et al. (1999). 'Effects of walking on coronary heart disease in elderly men: the Honolulu Heart Program' Circulation, Vol. 100, pp9-30) - 13

Land Restoration Trust (2015) Perception Survey and Social Value Study. Available at http://thelandtrust.org.uk/wp-content/uploads/2016/01/Perceptions-Survey-and-Social-Value-Study-2015.pdf

Landscape Institute (2013) Public Health and Landscape. Creating healthy places. Available at http://www.landscapeinstitute.org/PDF/Contribute/PublicHealthandLandscape_CreatingHealthyPlaces_FINAL.pdf

Liverpool City Council (2010) Liverpool Green Infrastructure Strategy

The Mental Health Foundation (2009) *Mental health, resilience and inequalities*

(Mind. (2007). Get outdoors, get active: Green exercise should be a mainstream treatment option says Marcus Roberts Openmind Issue 145, May/June 2007)

Natural England (2014) STANDING ADVICE FOR ANCIENT WOODLAND AND VETERAN TREES http://www.forestry.gov.uk/pdf/AncientWoodsSA_v7FINALPUBLISHED14Apr3.pdf/$FILE/AncientWoodsSA_v7FINALPUBLISHED14Apr3.pdf

Natural England. (2010). Wild Adventure Space: its role in teenagers' lives

Natural England. (2010). Childhood and Nature: A Survey on Changing Relationships with Nature Across Generations - 34

Natural England. 2009. An estimate of the economic and health value and cost effectiveness of the expanded WHI scheme. Natural England Technical Information Note TIN055. Peterborough

Natural England. 2009. Our Natural Health Service. Peterborough.

National Trust (2006). Valuing our Environment: the Economic Impact of the National Parks of Wales. The Valuing Our Environment Partnership, Wales

National Trust (2001). Valuing our Environment: Economic Impact of the Environment of Wales. The Valuing Our Environment Partnership, July 2001.

Odefey, J., Detwiler, S., Rousseau, K., Trice, A., Blackwell, R., O'Hara, K., Buckley, M., Souhlas, T., Brown, S. and Raviprakash, P. (2012) Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide, Joint Report, American Rivers, the Water Environment Federation, the American Society of Landscape Architects and ECO Northwest.
Available at: http://www.asla.org/ContentDetail.aspx?id=31301

Potchter, O., Cohen, P. and Britan, A. (2006). Climatic behavior of various urban parks during hot and humid summer in the Mediterranean city of Tel Aviv, Israel. International Journal of Climatology 26 (12), 1695–1711.

Ramblers Cymru (2011). The Economic Impact of Walking and Hill-walking in Wales. Joint report of Ramblers Cymru, Visit Wales, the British Mountaineering Council and the Countryside Council for Wales, June 2011.

Rawlings, R., Mustow, S., Pinney, C. and Sterne, S. (1999) Environmental rules of thumb, Technical Note for the Department of the Environment, Transport and the Regions. Bracknell: The Building Services Research and Information Association.

Read, D.J., Freer-Smith, P.H., Morison, J.I.L., Hanley, N., West, C.C. & Snowdon, P.R. (eds) (2009). Combating climate change – a role for UK forests. The Stationery Office, Edinburgh.

Stats Wales (2012). Aggregate Agricultural Output and Income, 2011. Statistics for Wales - SDR 28/2012 28 February 2012.

Torfaen County Borough Council (2016) Air Quality Progress Report Synopsis

Torfaen County Borough Council (2016) Corporate Plan 3

Torfaen County Borough Council (2015) Destination Management Plan

Torfaen County Borough Council (2015) Flood Risk Management Plan

Torfaen County Borough Council (2013) Torfaen Economy and Enterprise Strategy 2013-20

Torfaen County Borough Council (2015) Torfaen Play Sufficiency Assessment

(Ulrich, R. S. (1999). Effects of gardens on health outcomes: Theory and research. In C. Cooper-Marcus & M. Barnes (Eds.), Healing Gardens: Therapeutic Benefits and Design Recommendations. New York: John Wiley, pp.27-86.) - 8

(Ulrich, R. S. (1984). View from a window may influence recovery from surgery. Science, 224, pp.420-421.)

Welsh Government (2014) Assessing the Potential for Payments for Ecosystems Market Mechanisms. Phase 2 Evaluation and Recommendations. Available from : http://gov.wales/docs/desh/publications/140718assessing-potential-for-payments-for-ecosystem-en.pdf Accessed August 2016

Willis, K.G., Garrod, G., Scarpa, R., Powe, N., Lovett, A. Bateman, I.J., Hanley, N. & Macmillan, D.C. (2003) The social and environmental benefits of forests in Great Britain. Forestry Commission, Edinburgh