LOCAL ACTION PROJECT

Leicester

Ecosystem **Benefits** in **Urban** Water **Environments**

defra

Environment Agency

Westcountry Rivers Trust

LOCAL ACTION PROJECT

Barriers to SuDS/GI delivery & evidence gaps. ***CaBA Urban Workshop – Birmingham, Oct 2015***

LOCAL ACTION PROJECT

1 in 4

SUFFER FROM POOR MENTAL HEALTH

2.5 - 4.2 DEGREES

expected mean temperature increase in the UK until 2080

8-11

ADDITIONAL DEATHS PER DAY

in the UK for every degree increase in air temperature during heat waves

pluvial flooding accounts for **15%** of flooding in Devon

£81m

economic damage of flooding in Devon

3.8 m

properties in England at risk of surface water flooding

10%

OF WATER BODIES IN THE UK FAIL THEIR ENVIRONMENTAL OBJECTIVES DUE TO URBAN POLLUTION

514.4

$MtCO_2e$

emitted in the UK in 2014

estimated annual cost of PM pollution in the UK

£16billion

10+% contribution to death rate

43

premature deaths per year due to air pollution in Exeter

Air pollution causes premature death of

IN THE UK PER YEAR

29,000

LOCAL ACTION PROJECT

30%
lower depression rates in areas with high greenspace levels

PRIDE & ENGAGEMENT

in areas with more greenspace
80%
less incidents of VANDALISM

cooling demand can be reduced by **75%** by green roofs

INCREASING GREEN COVER **10%**

REDUCES AIR TEMPERATURE **3°**

Retention ponds **REDUCE METALS** by up to **80%**

a green roof could save **£5.20/m²** in cooling costs per year

A RAINGARDEN CAN INFILTRATE **90%** OF ANNUAL RAINFALL

constructed wetlands provide habitat to over **50** invertebrate species

view of a vegetated surface improves **ATTENTION**

and provide **PEAK DISCHARGE CONTROL** for storms with over **10** YEAR return period

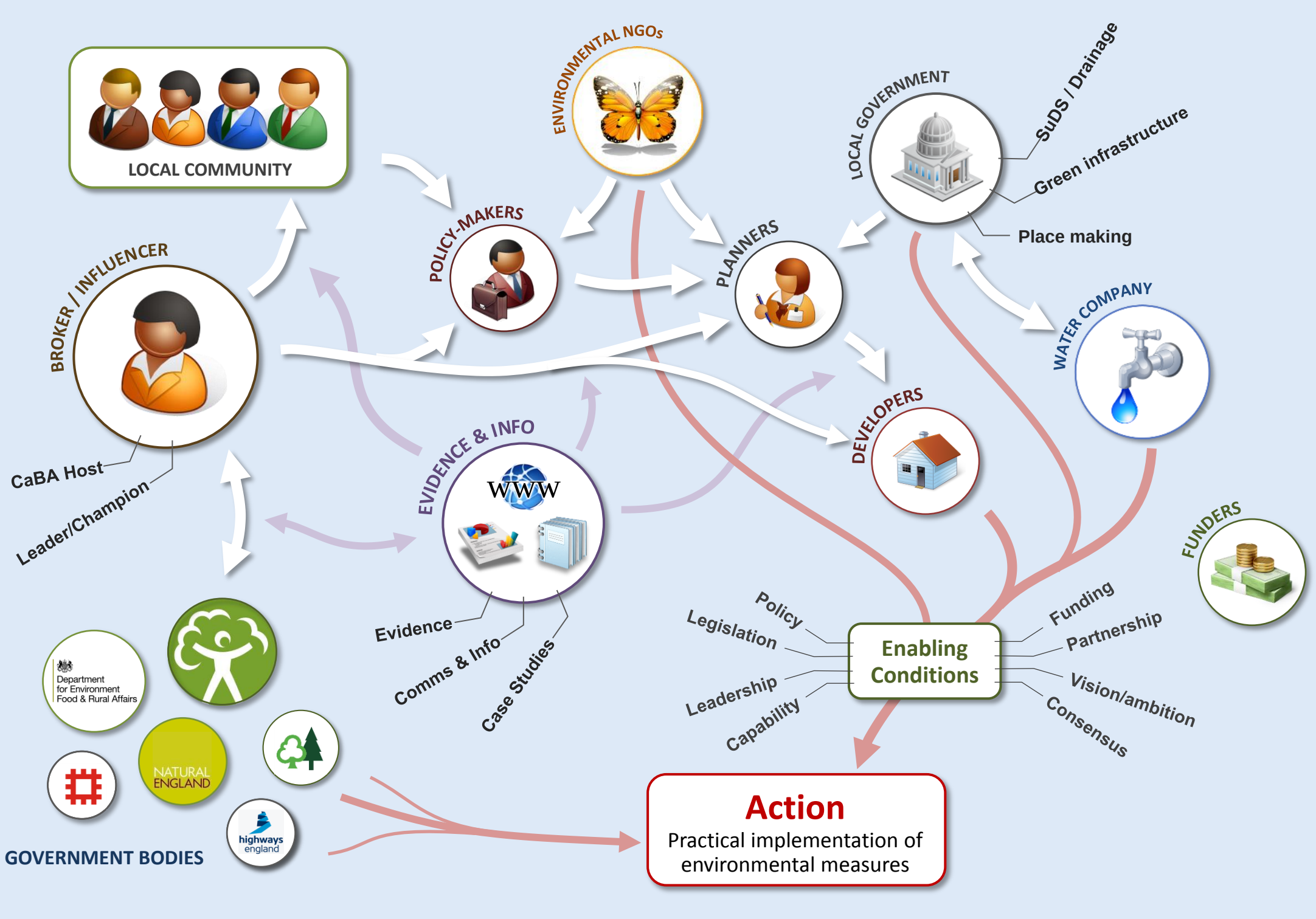
2.4kgC per square meter per year can be stored by **CONSTRUCTED WETLANDS**

a view of wetlands can increase property values by **28%**

a square meter of sedum green roof can remove **200g** of PM per year

a single tree can reduce air pollution (PM) by **20%**

LOCAL ACTION PROJECT



LOCAL ACTION PROJECT

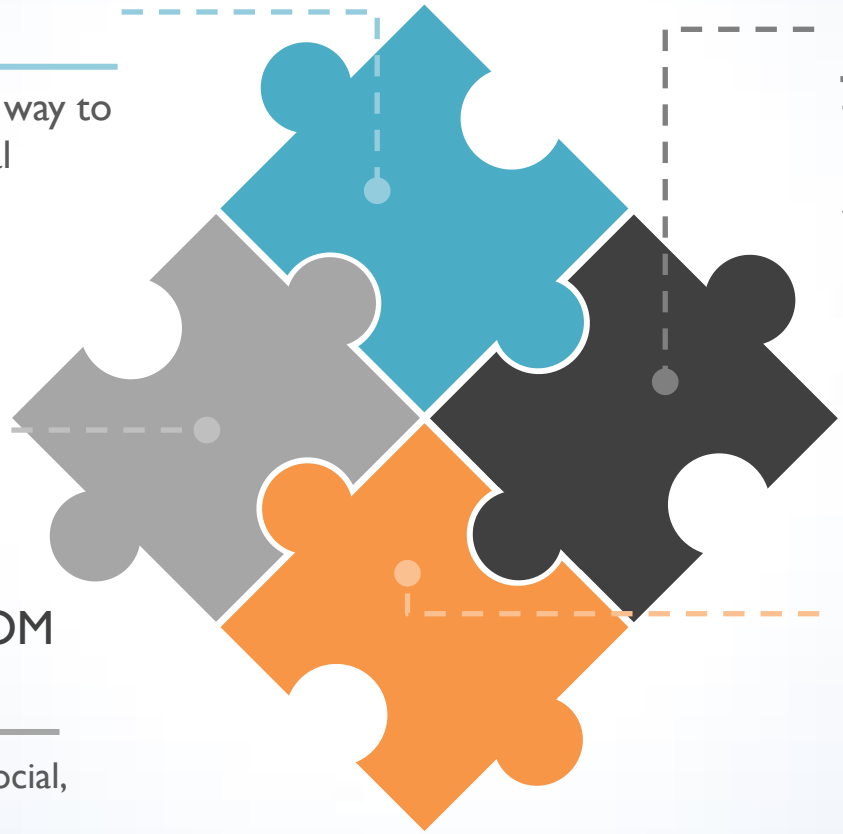
Working with local communities to enhance the value of natural capital in our towns, cities and other urban spaces to improve people's lives, the environment & economic prosperity…

STRATEGIC DATA, EVIDENCE + INFORMATION

Present robust evidence in a clear way to help build consensus, facilitate local decision-making & secure funding

LOCAL CHOICES, PRIORITIES + AMBITIONS

Talk to the local community and civil society groups to discover their future vision and ambition for where they live



VALUING THE BENEFITS FROM NATURAL CAPITAL

Develop a clear understanding of the social, cultural, environmental and economic benefits provided by natural capital in urban landscapes and estimating potential improvements

FUNDING + RESOURCES FOR ACTION

Support the formation of effective stakeholder-led partnerships by increasing engagement, mobilising local delivery organisations and tapping into funding sources

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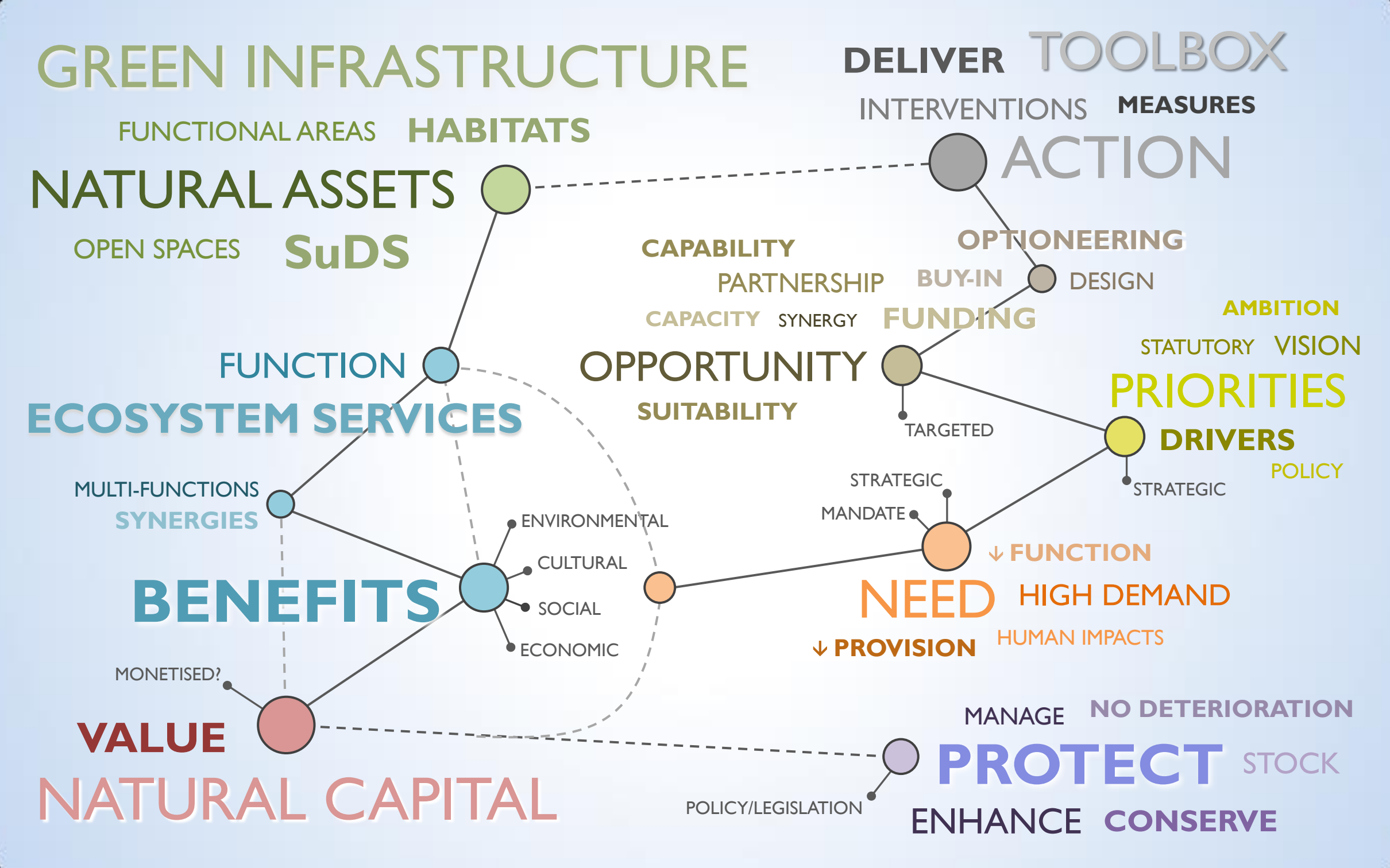
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↓ PROVISION
HUMAN IMPACTS
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MANAGE
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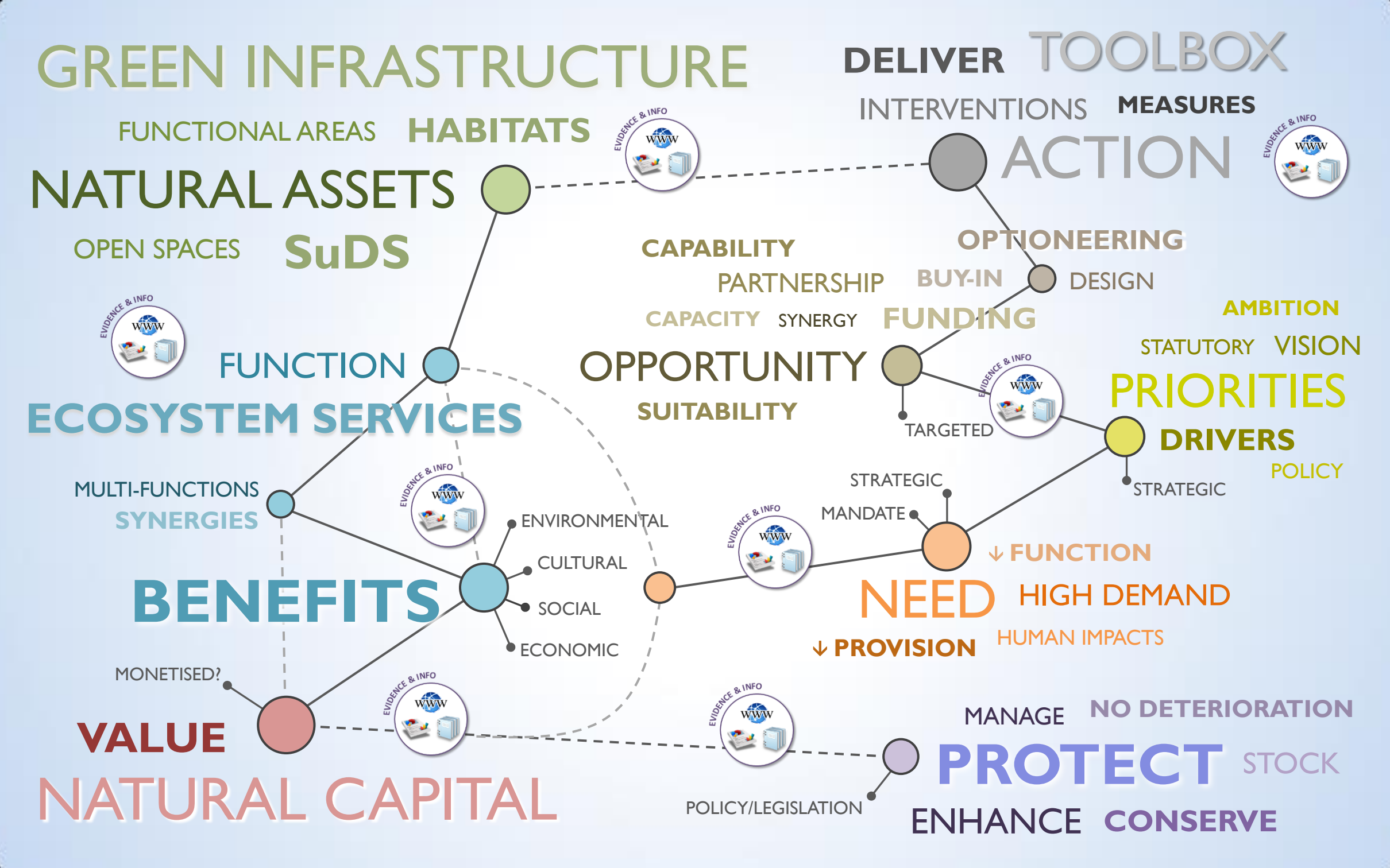
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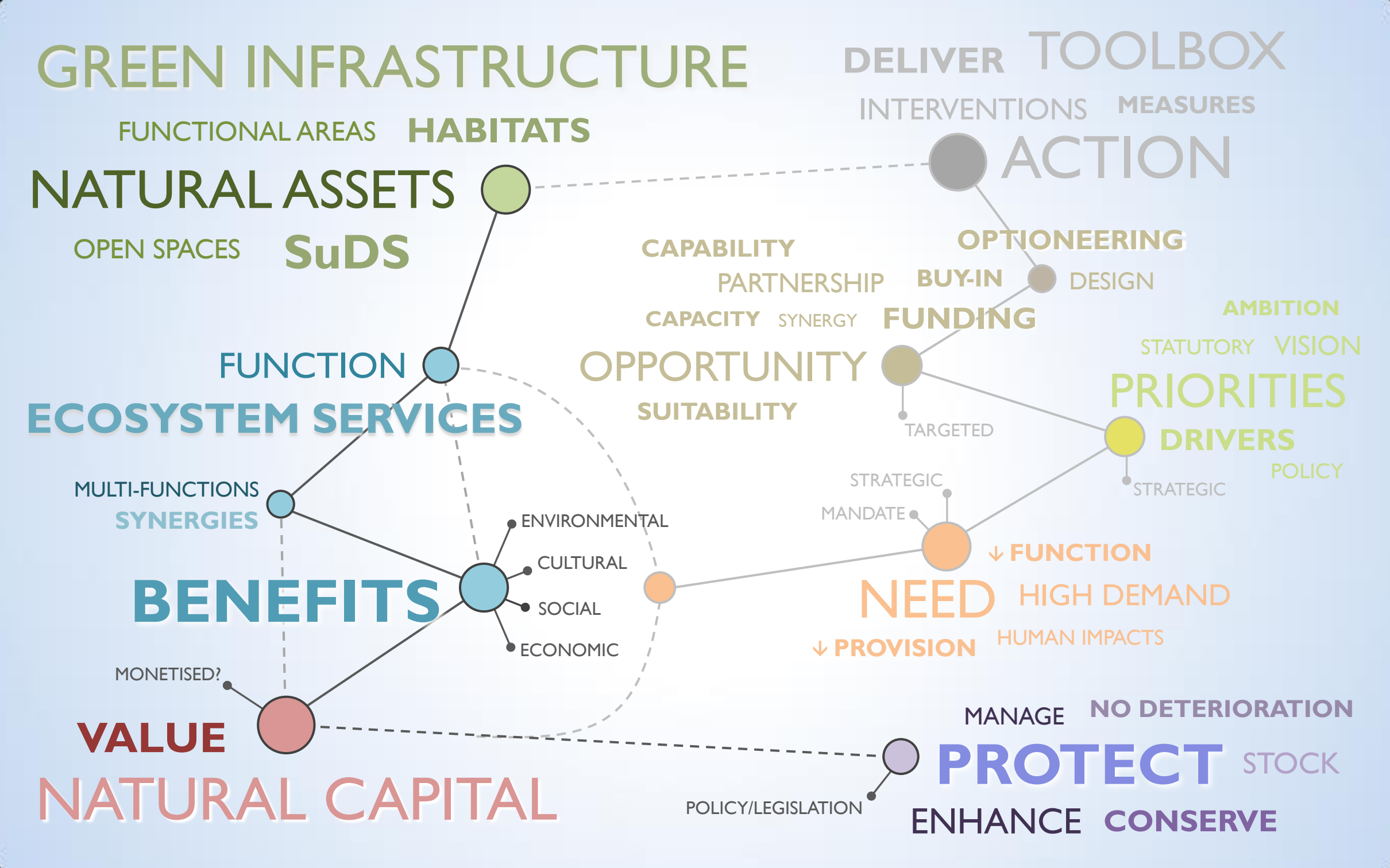
EVIDENCE & INFO
WWW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LOCAL ACTION PROJECT

LOCAL ACTION PROJECT

CURRENT ASSETS

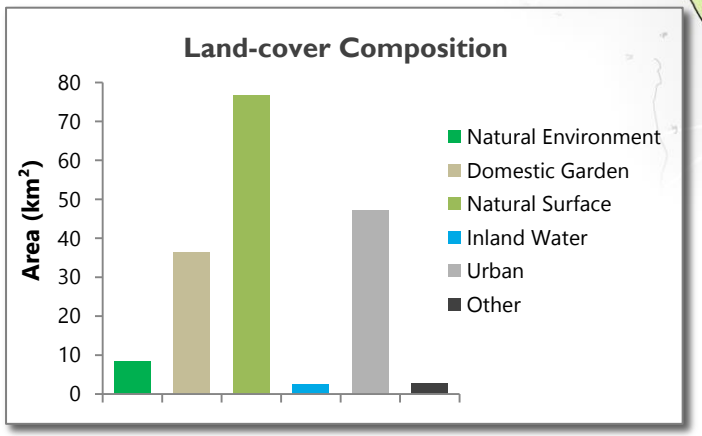
This map shows the main areas of natural infrastructure across Leicester and the surrounding wards. There is a diverse collection of natural habitats and green/blue spaces across the area; including the wetlands and riverine habitats to the north of the city, around Watermead, and species-rich grassland to the south at Aylestone Meadows Local Nature Reserve.

Green Wedges
These areas of land offer a space for recreation and nature conservation, providing a "green lung into urban areas". They have been included in the planning policy for Leicester and Leicestershire for many years.


Spinney Hill Park


Allotment

Environmental Infrastructure:
- Natural Environment
- Domestic Garden
- Natural Surface
- Inland Water
- Green Wedge
- Parks and Gardens
- Allotment



River Sence
This is the longest tributary of the River Soar at around ~28km in length.

Wanlip
Birstall
Thurmaston
Anstey
Beaumont Leys
Rothley Brook
Melton Brook
Willow Brook
Bushby Brook
Glenfield
Scraptoft
LEICESTER
Kirby Muxloe
Thurnby
Houghton on the Hill
Leicester Forest East
Evington
Stoneygate
Stoughton
Saffron Brook
River Soar
Braunstone Town
Knighton
Oadby
Enderby
WIGSTON
River Sence
South Wigston

CURRENT ASSETS...*continued*

These maps illustrate the high level of detail that is available for mapping green and blue infrastructure, in Leicester. Data is mapped for two example wards; Rushey Mead Ward and a detailed section of Abbey Park and the surrounding area in Abbey Ward.

Due to the detailed mapping and high resolution datasets provided by Leicester City Council, we are able to view features such as outdoor sports areas, play areas and street trees.

Abbey Park in Abbey Ward

Rushey Mead Ward

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PARKS & GARDENS

In addition to examining the number of people with access to greenspaces, it is also important to look at the value of parks and the pressure they are put under on the 'supply side' of the equation.

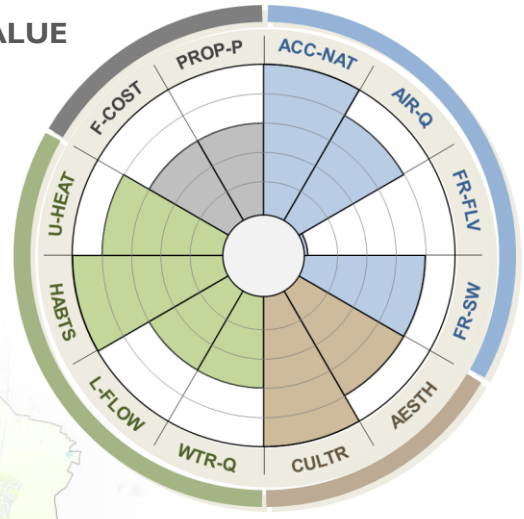
- >10% of people access their local parks every day
- >50% access their local park > once a month
- Parks + open spaces are the 3rd most frequently used public service (after GPs + hospitals)

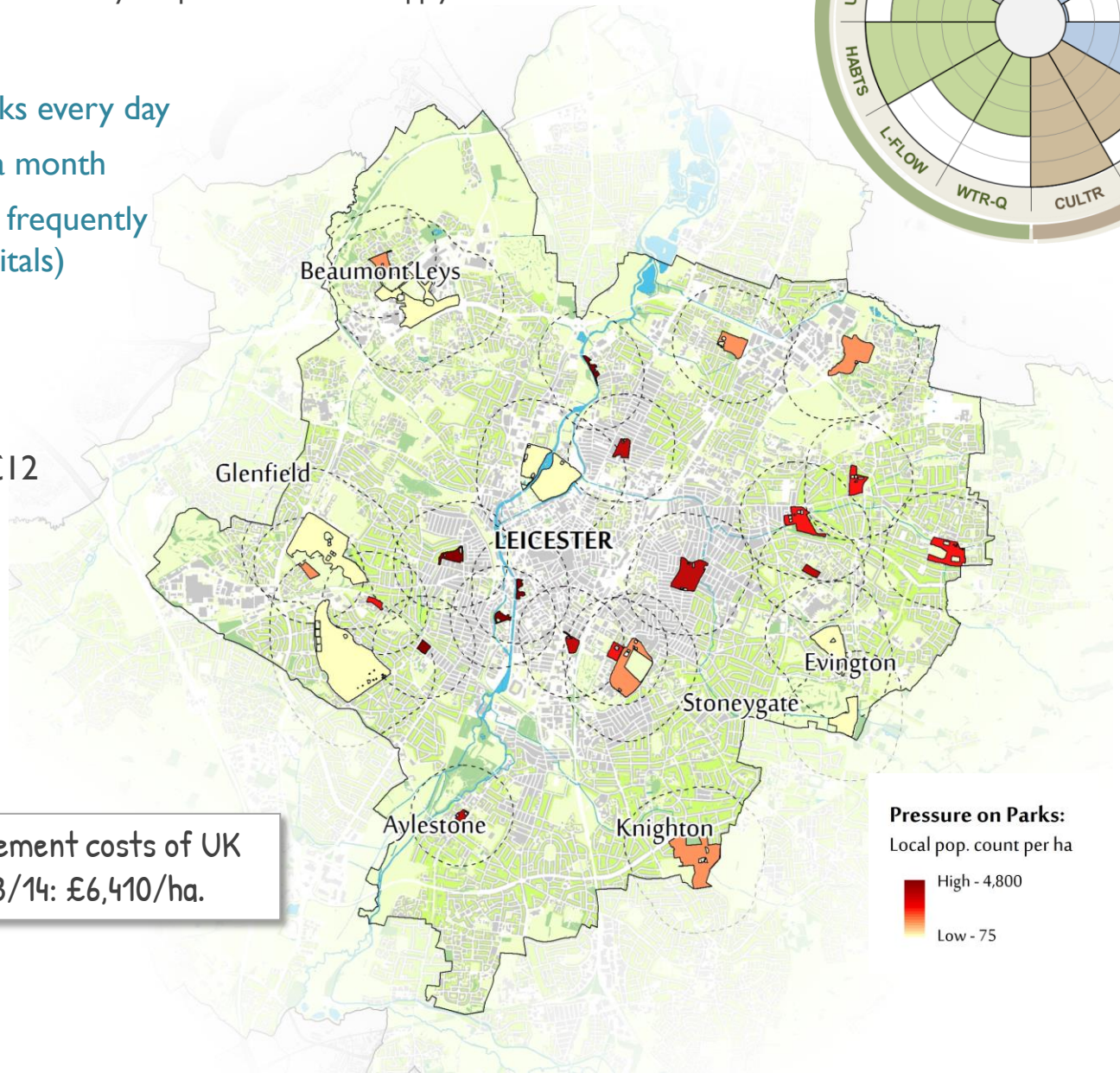
Edinburgh:

Public parks give a SROI of on average £12 for every £1 invested

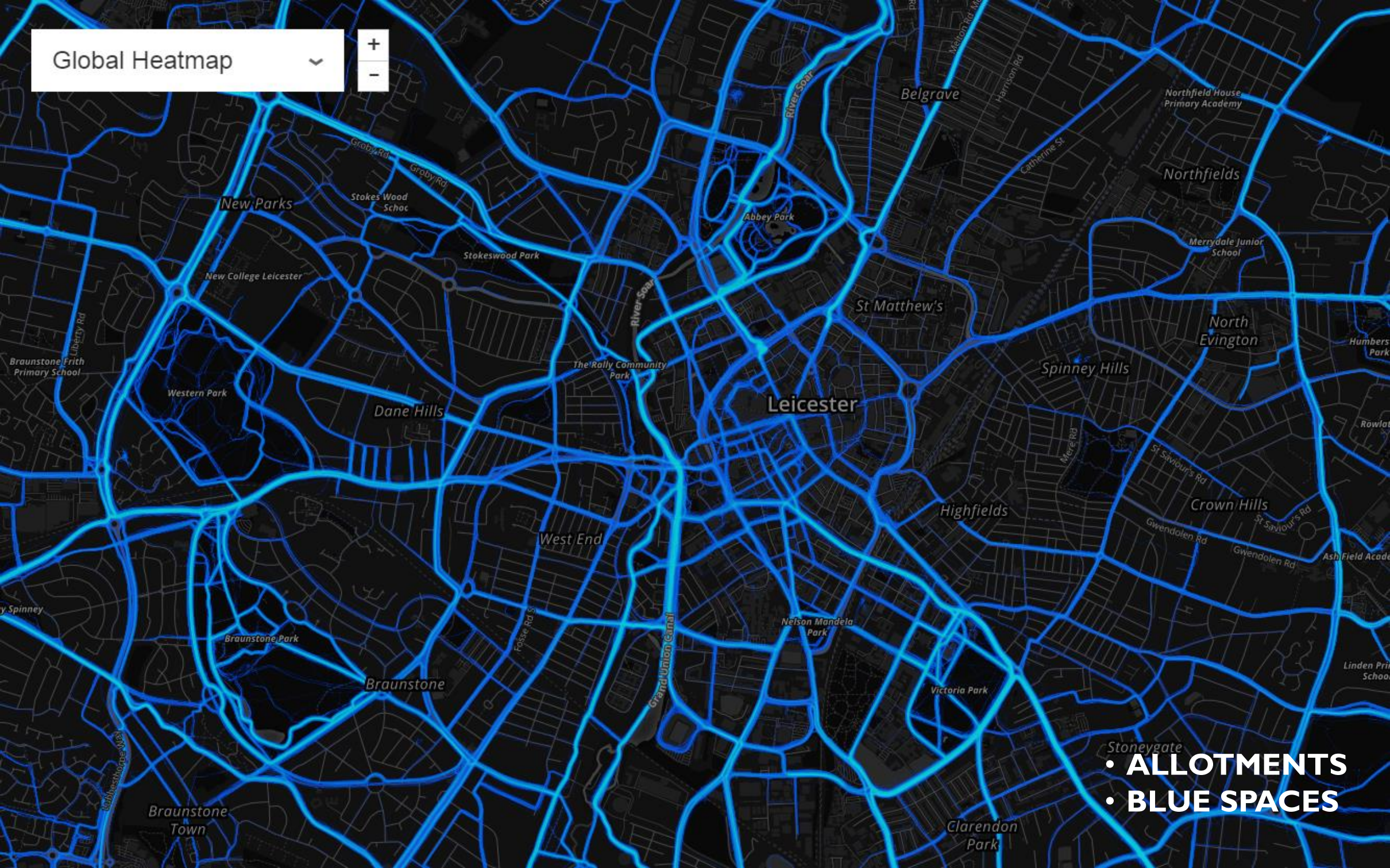
Camley Street Park (London):

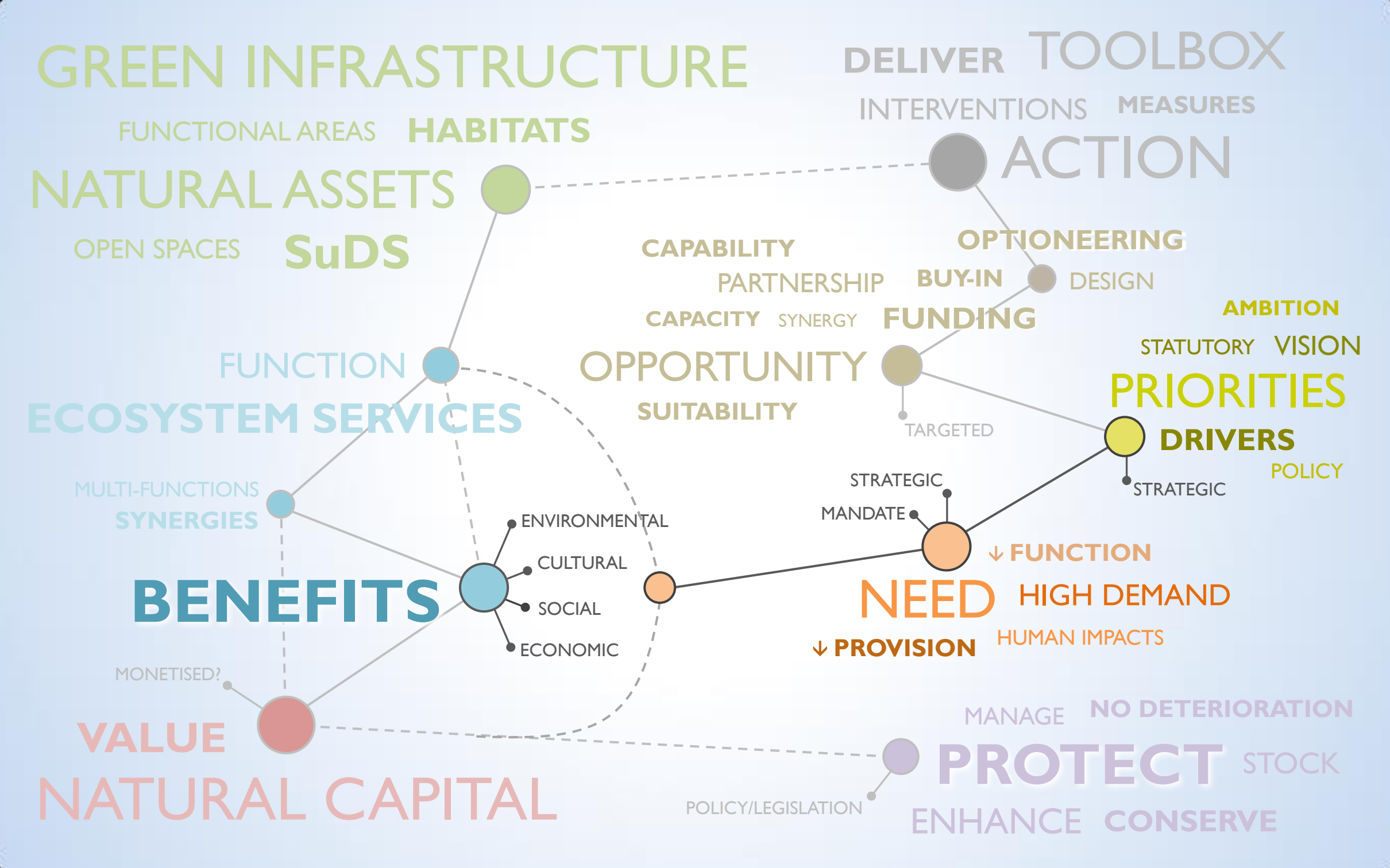
Provides £2.8 million in ecosystem service benefits per year





Average management costs of UK parks in 2013/14: £6,410/ha.


Global Heatmap
+
-
Belgrave
River Soar
Harrison Rd
Northfield House Primary Academy
Catherine St
Northfields
Abbey Park
Merrydale Junior School
New Parks
Stokes Wood Schoc
Groby Rd
Stokeswood Park
New College Leicester
St Matthew's
North Evington
Spinney Hills
Liberty Rd
Braunstone Frith Primary School
The Rally Community Park
Western Park
Dane Hills
Leicester
Mere Rd
St Saviour's Rd
Crown Hills
Highfields
West End
Gwendolen Rd
Nelson Mandela Park
Grand Union Canal
Braunstone Park
Braunstone
Victoria Park
Stoneygate
Braunstone Town
Clarendon Park
• ALLOTMENTS
• BLUE SPACES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LOCAL ACTION PROJECT

BENEFITS ASSESSMENT

BENEFITS
Economic
Cultural Social
Environmental

To target and implement interventions that enhance natural capital effectively have developed a series of metrics that assess the current benefits being experienced by people and the environment.

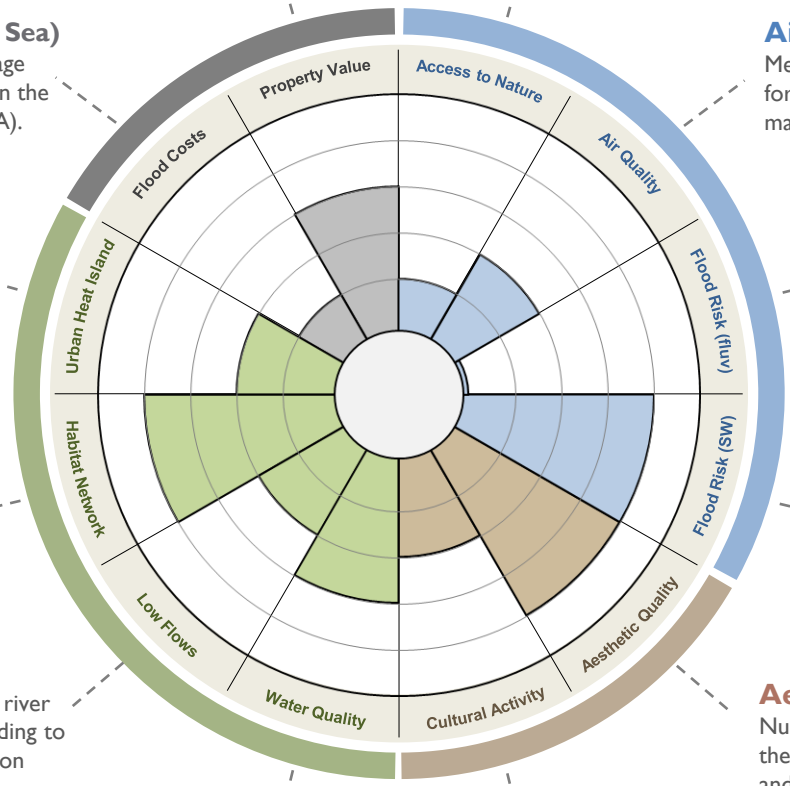
Each metric is a measure with the potential to be enhanced through natural solutions.

Average House Price
Mean price for a two-bedroom house in December 2015.

Access to Greenspace
Percentage of people that meet the criteria outlined in Natural England's ANGSt (Accessible Natural Greenspace Standard).

Flood Damage Cost (Rivers and Sea)
Estimated costs incurred due to flood damage from rivers and sea, based on figures used in the EA National Flood Risk Assessment (NaFRA).

Air Quality (PM10)
Mean concentration of PM10 modelled for 2016, derived from background maps from the UK-AIR data archive.



Local Climate Regulation
Urban heat island effect measured using Landsat 8 satellite thermal imaging data.

Flood Risk (Rivers and Sea)
Number of buildings that have a greater than 1 in 100 year chance of flooding from rivers and/or sea.

Habitats for wildlife
Percentage of ward area that is described as a priority habitat in Natural England's Priority Habitats Inventory.

Flood Risk (Surface Water)
Number of buildings that have a greater than 1 in 100 year chance of flooding from surface water.

Low Flows
The water availability value of river waterbody catchments, according to the EA's Catchment Abstraction Management Strategy (CAMS).

Aesthetic value of landscape
Number of nature-related photos taken in the area that have been uploaded to Flickr and tagged accordingly.

WFD Pressures/RFFs
The 2014 Water Framework Directive ecological status for the surrounding river waterbody catchment.

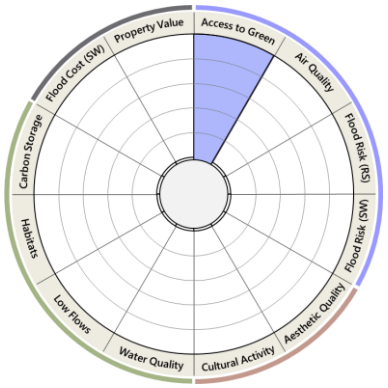
Cultural Activity
Number of recreational facilities per 1000 people, including places such as allotments, sports clubs.

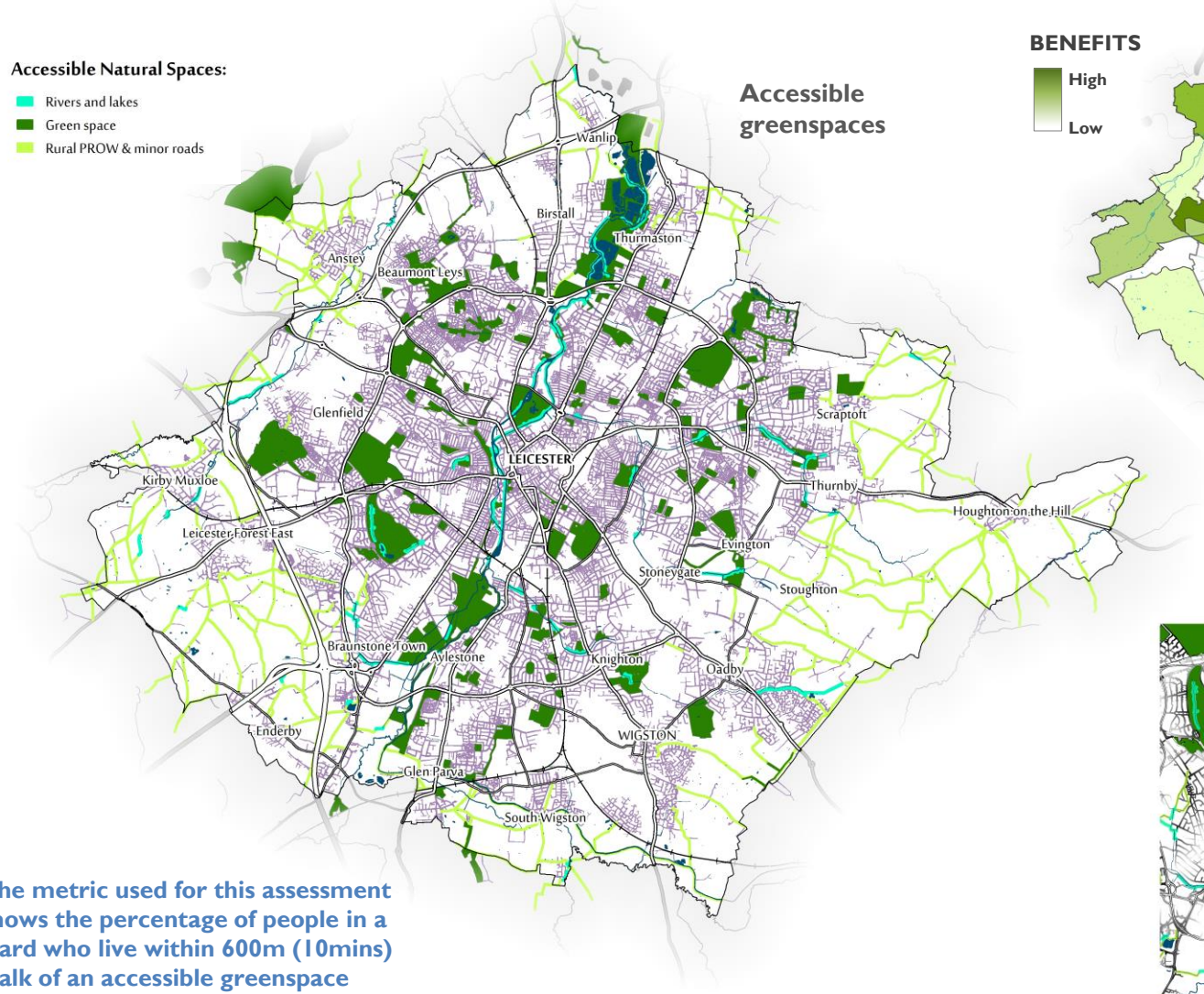
- MSOA-scale analysis
- Metrics represent range of values in Leicester
- White spaces represent opportunity for improvement

LOCAL ACTION PROJECT

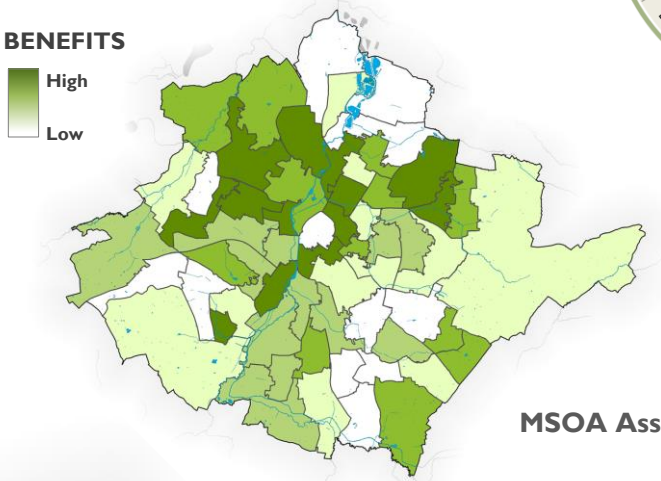
ACCESS TO GREENSPACE

Many studies have shown that spending time in natural green spaces can significantly improve mental and physical health. These spaces not only provide the opportunity to do fitness or recreate but they also provide non-physical benefits, such as emotional or spiritual benefits.





Accessible greenspaces



MSOA Assessment

Analysis outputs

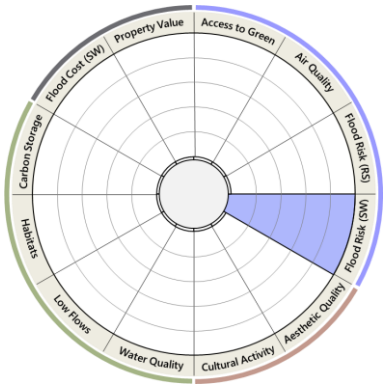
The metric used for this assessment shows the percentage of people in a ward who live within 600m (10mins) walk of an accessible greenspace

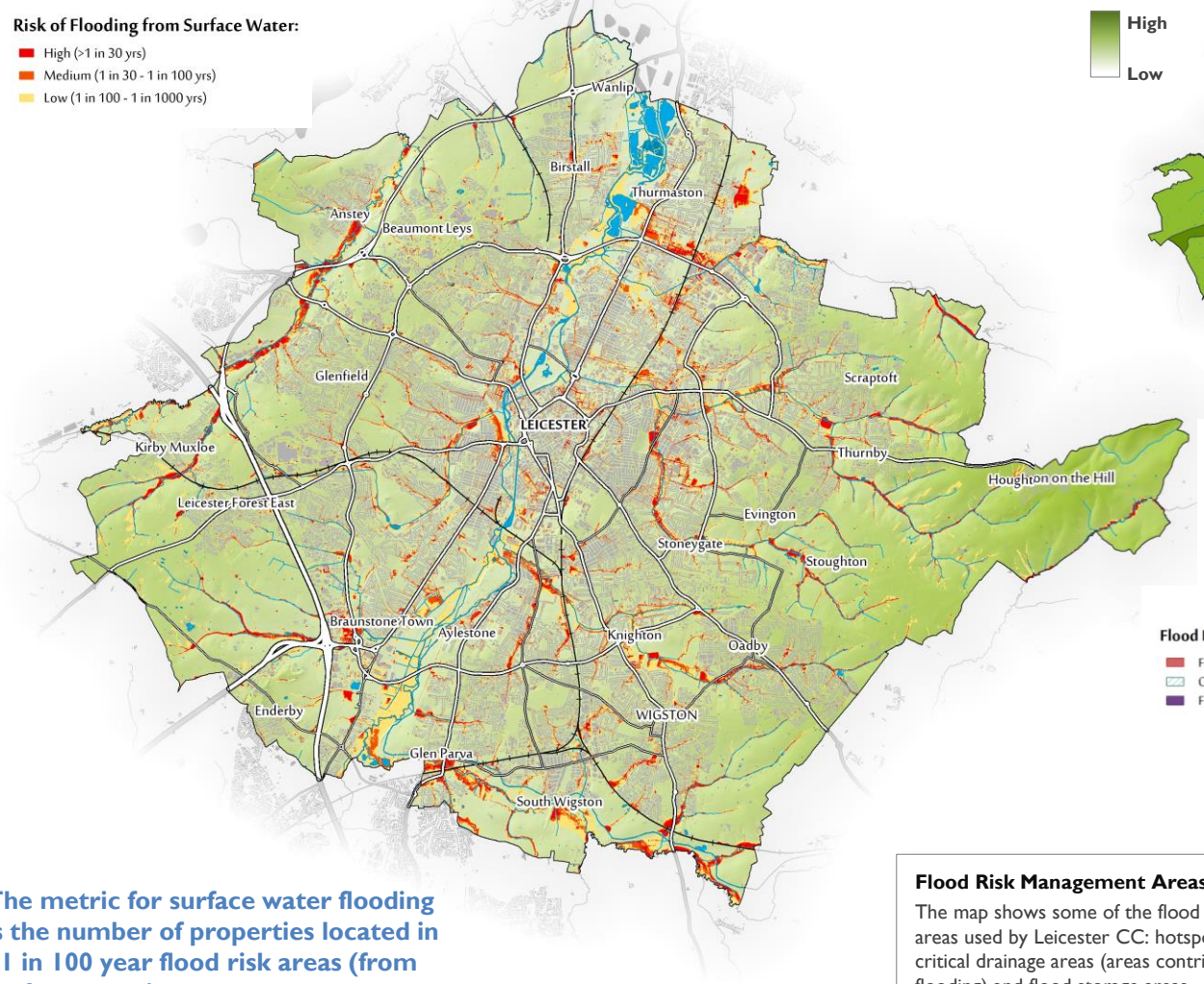
SOCIAL BENEFIT

LOCAL ACTION PROJECT

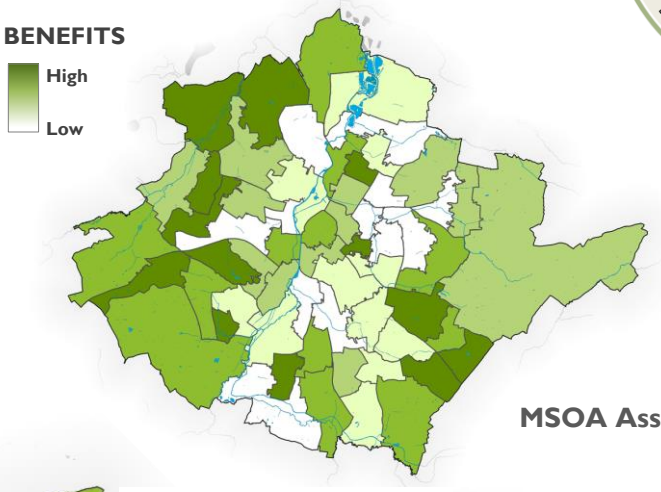
FLOOD RISK (SURFACE)

Surface water (pluvial) flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. Surface water flooding can cause serious problems for urban communities, particularly as it can often be contaminated with untreated waste water.

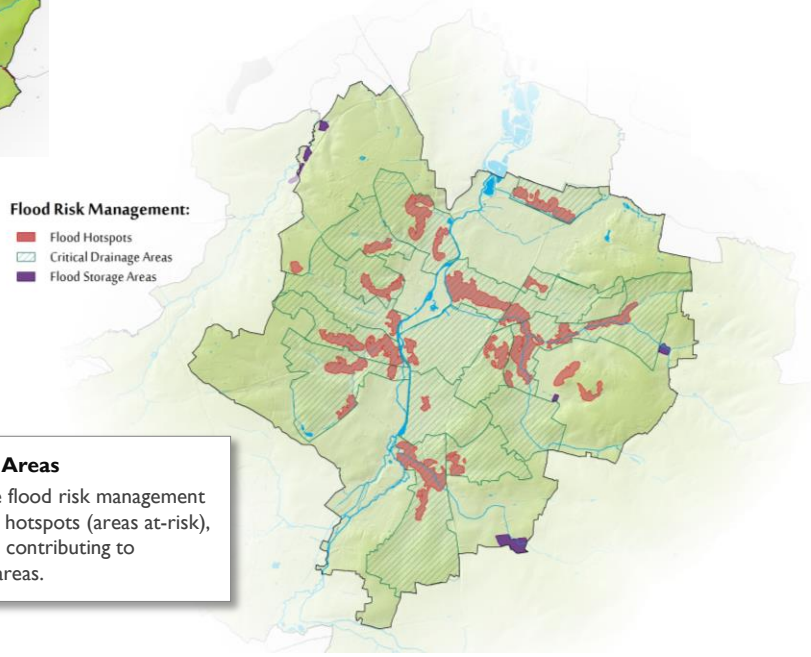




The metric for surface water flooding is the number of properties located in >1 in 100 year flood risk areas (from surface water).



MSOA Assessment



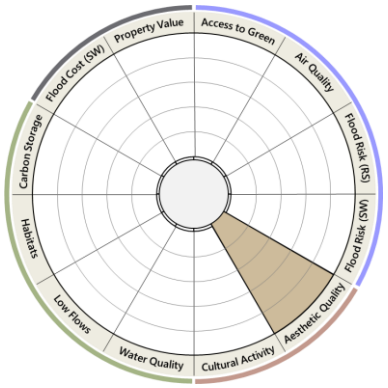
Flood Risk Management Areas

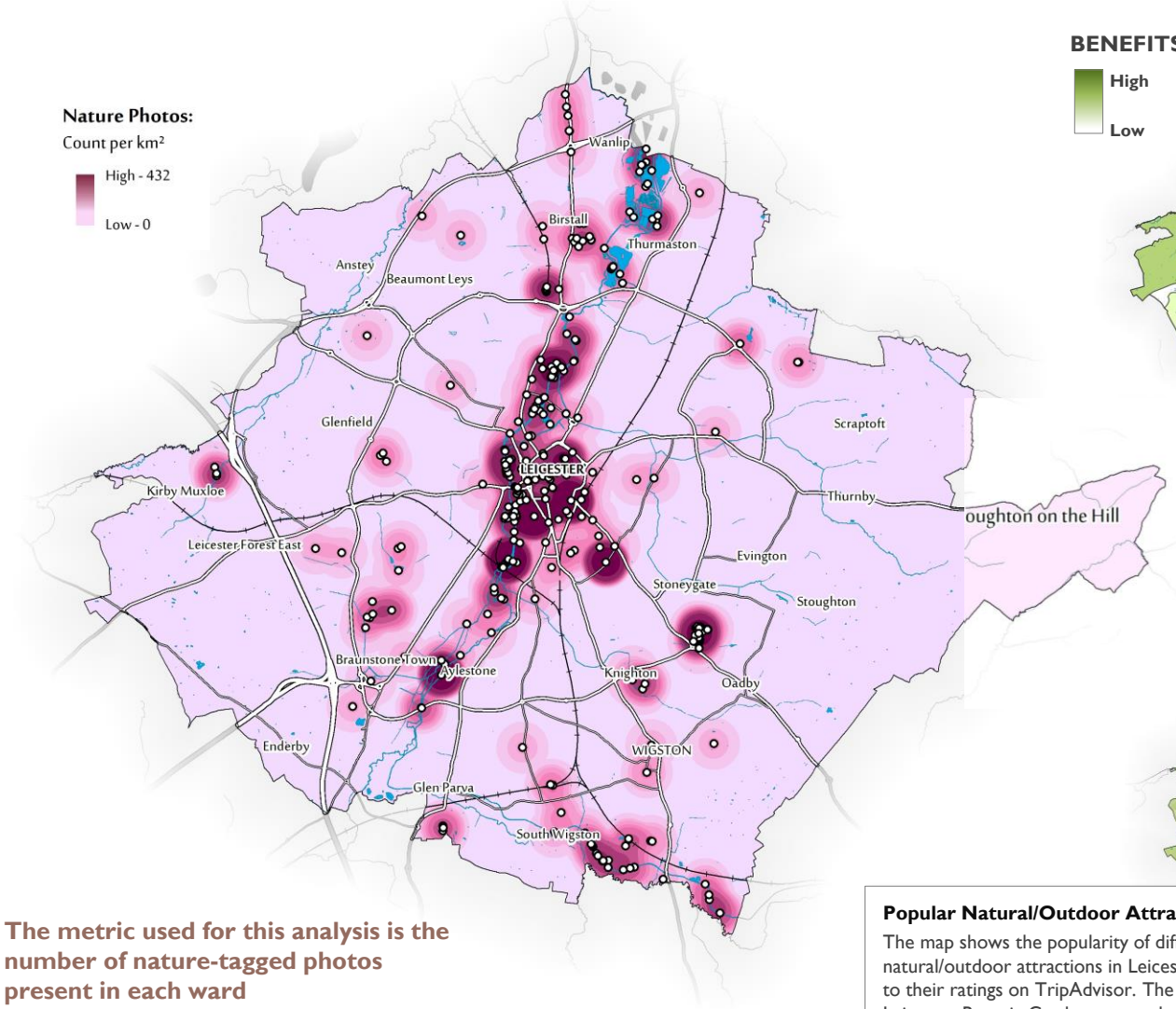
The map shows some of the flood risk management areas used by Leicester CC: hotspots (areas at-risk), critical drainage areas (areas contributing to flooding) and flood storage areas.

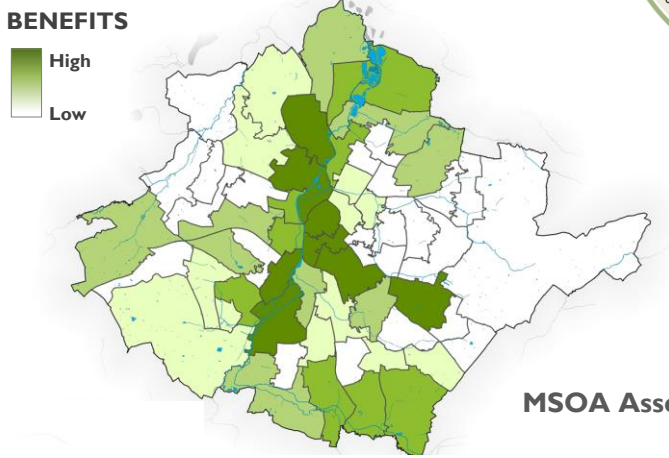
SOCIAL BENEFIT

AESTHETIC VALUE

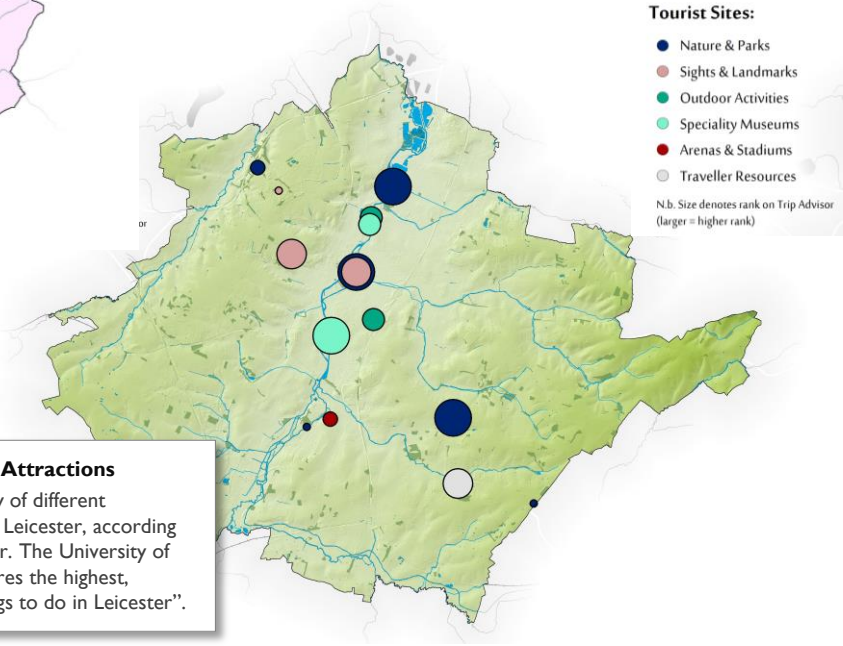
It is generally accepted that the higher the quality and aesthetic value of a landscape, the more likely people are to take photographs of it. A number of studies have now used the distribution of photos taken and uploaded to the internet as an indicator of high quality and culturally important natural resources.







MSOA Assessment



The metric used for this analysis is the number of nature-tagged photos present in each ward

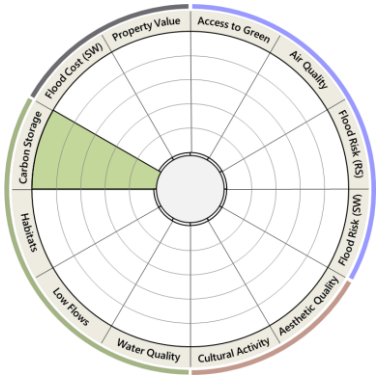
Popular Natural/Outdoor Attractions

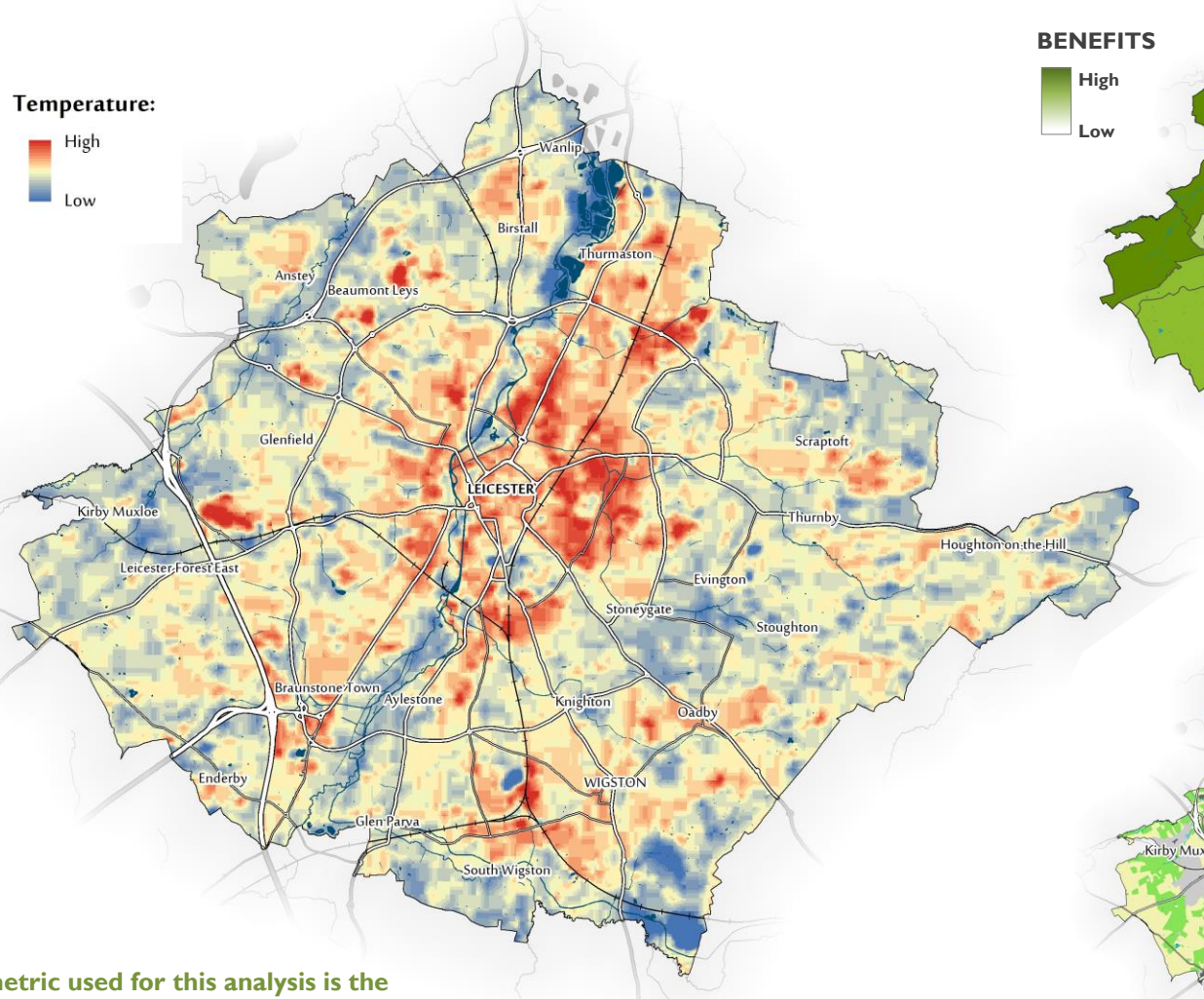
The map shows the popularity of different natural/outdoor attractions in Leicester, according to their ratings on TripAdvisor. The University of Leicester Botanic Garden scores the highest, ranking 11 out of 94 for "things to do in Leicester".

LOCAL ACTION PROJECT

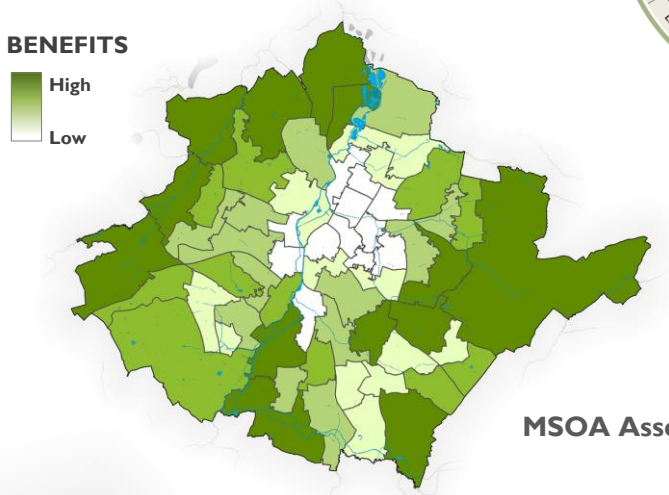
LOCAL CLIMATE REGULATION

There is increasing pressure on governments and communities to make efforts to alleviate the impacts of future climate change. It is important to protect or enhance existing stores of carbon, where possible, to prevent carbon emissions from rising further. The main environmental features that store carbon are trees, grassland, wetland and peat bogs.

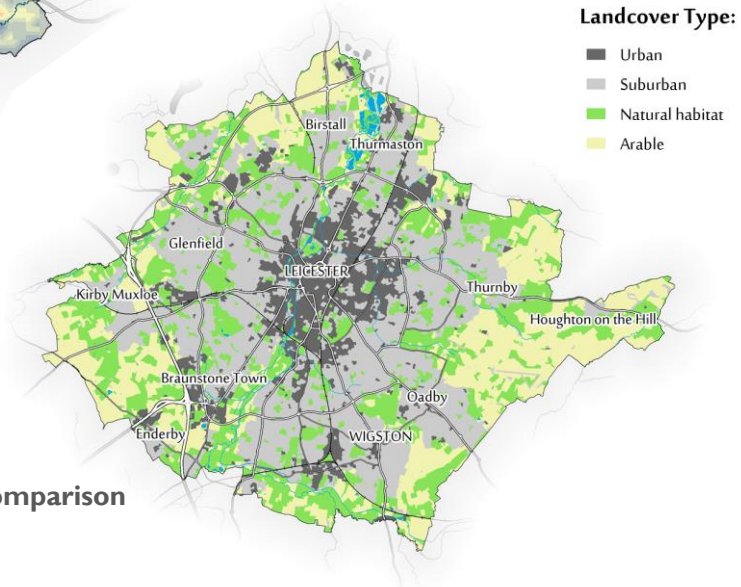




The metric used for this analysis is the average temperature in each MSOA as shown by Landsat 8 thermal imaging



MSOA Assessment



Landcover Comparison

ENVIRO. BENEFIT

PROPERTY VALUE

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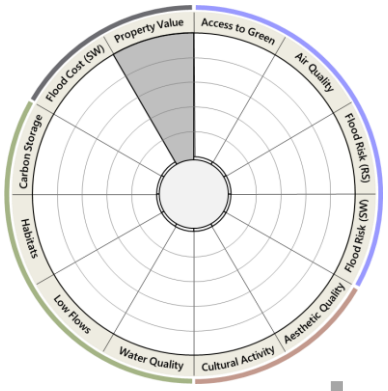
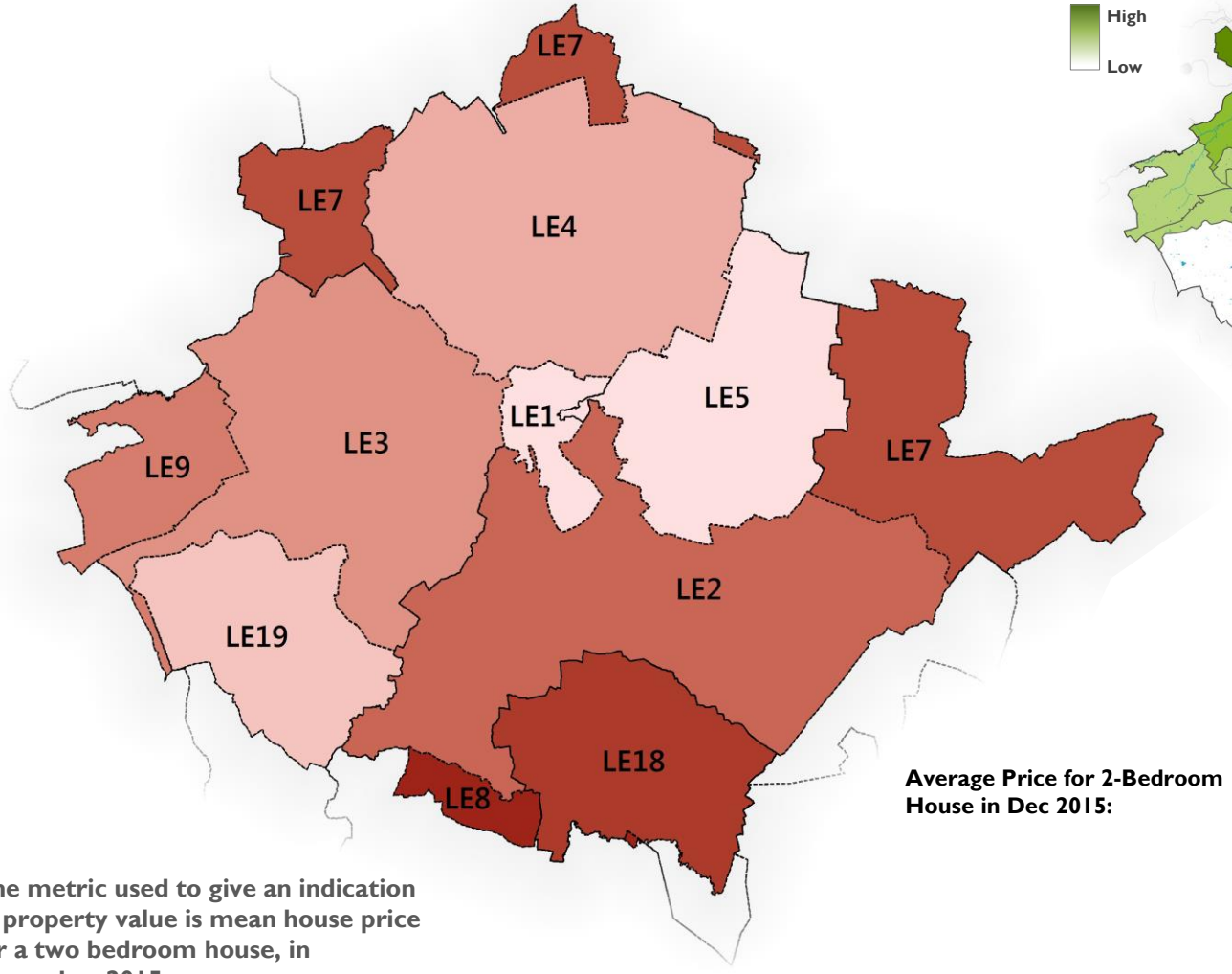
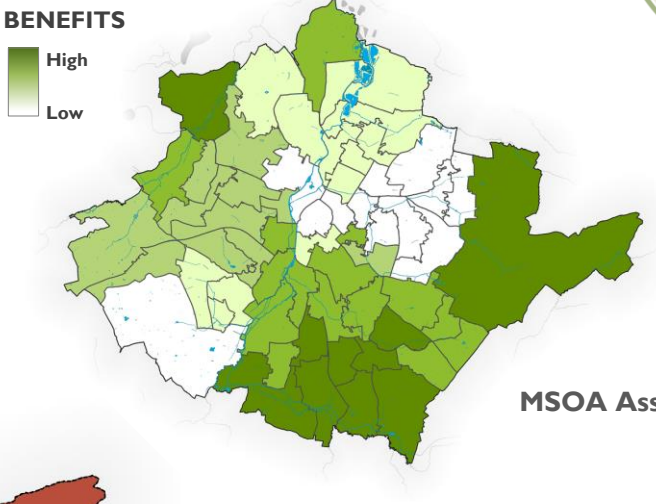




The metric used to give an indication of property value is mean house price for a two bedroom house, in December 2015.



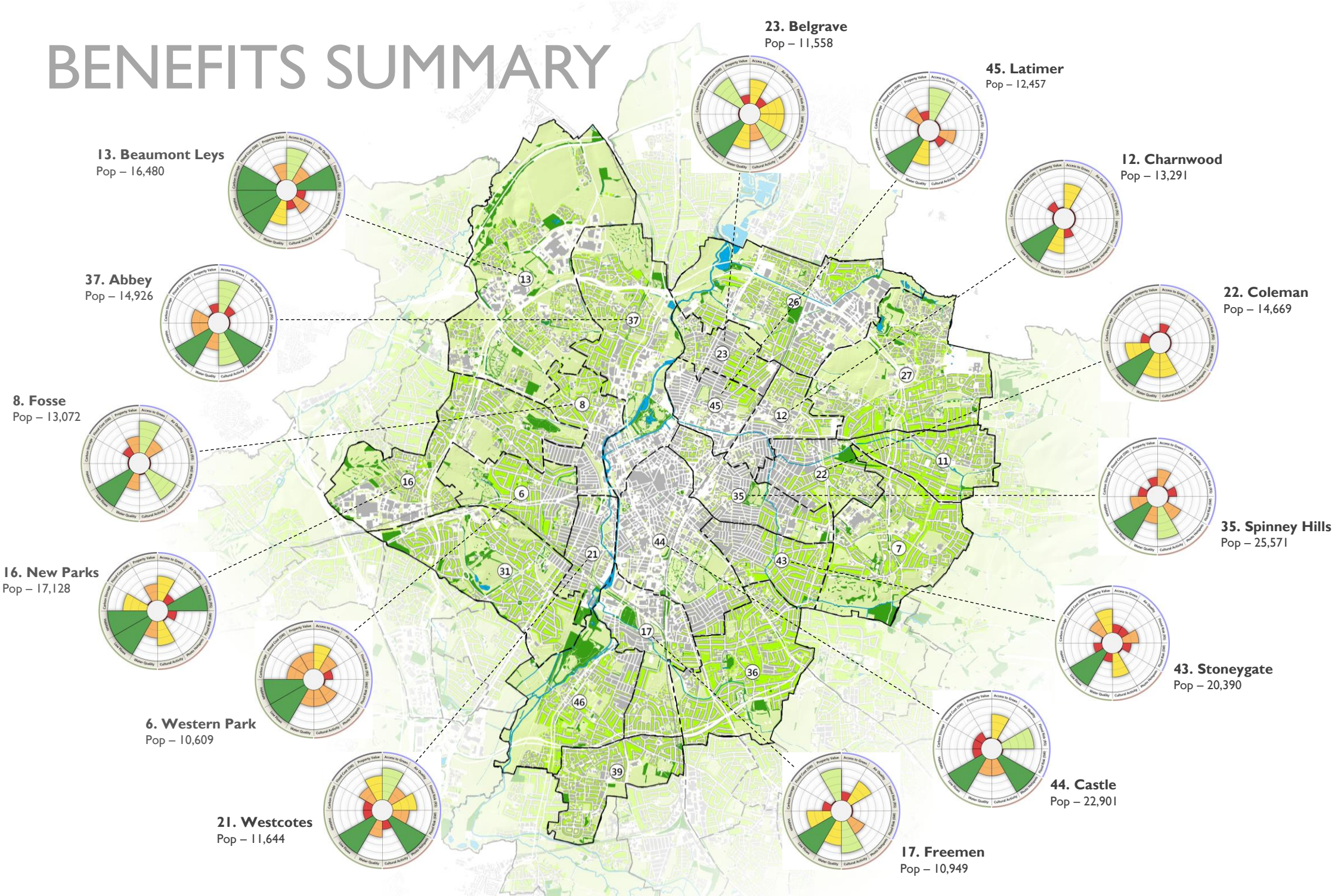
MSOA Assessment

Average Price for 2-Bedroom House in Dec 2015:

Postcode District	Average House Price (£)	Count
LE1	125,930	326
LE2	141,804	1427
LE3	136,281	798
LE4	135,811	465
LE5	133,270	590
LE7	141,899	2549
LE8	155,171	892
LE9	136,305	886
LE18	146,792	231
LE19	133,481	86

LOCAL ACTION PROJECT

BENEFITS SUMMARY

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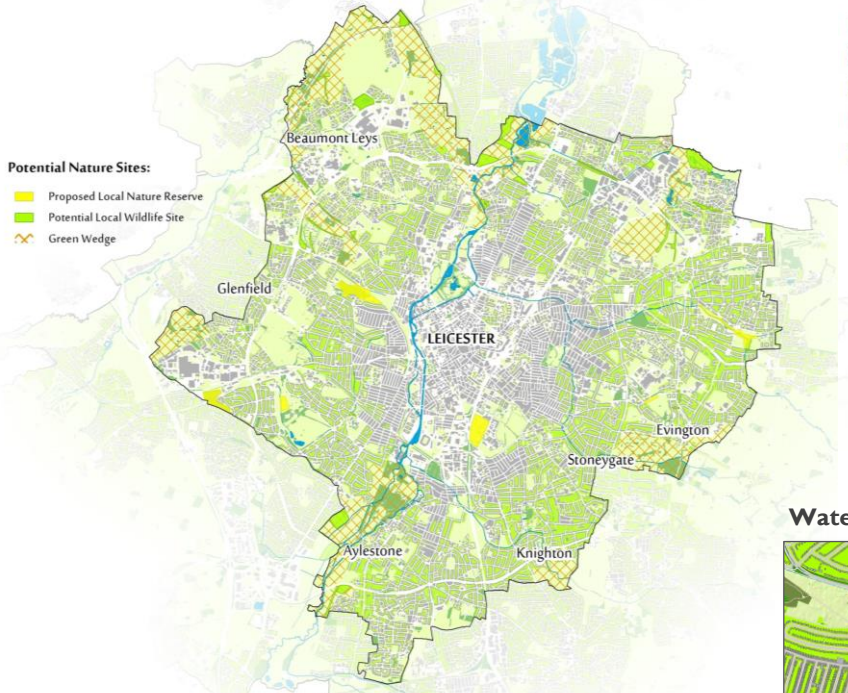
FUNDING
AMBITION
STATUTORY
VISION
FUNCTION
OPPORTUNITY
PRIORITIES
ECOSYSTEM SERVICES
SUITABILITY
TARGETED
DRIVERS
POLICY
STRATEGIC
MULTI-FUNCTIONS
SYNERGIES
STRATEGIC
MANDATE
ENVIRONMENTAL
CULTURAL
↓ FUNCTION
BENEFITS
NEED
HIGH DEMAND
SOCIAL
HUMAN IMPACTS
ECONOMIC
↓ PROVISION
MONETISED?
MANAGE
NO DETERIORATION
VALUE
PROTECT
STOCK
NATURAL CAPITAL
POLICY/LEGISLATION
ENHANCE
CONSERVE

LOCAL ACTION PROJECT

OPPORTUNITY AREAS

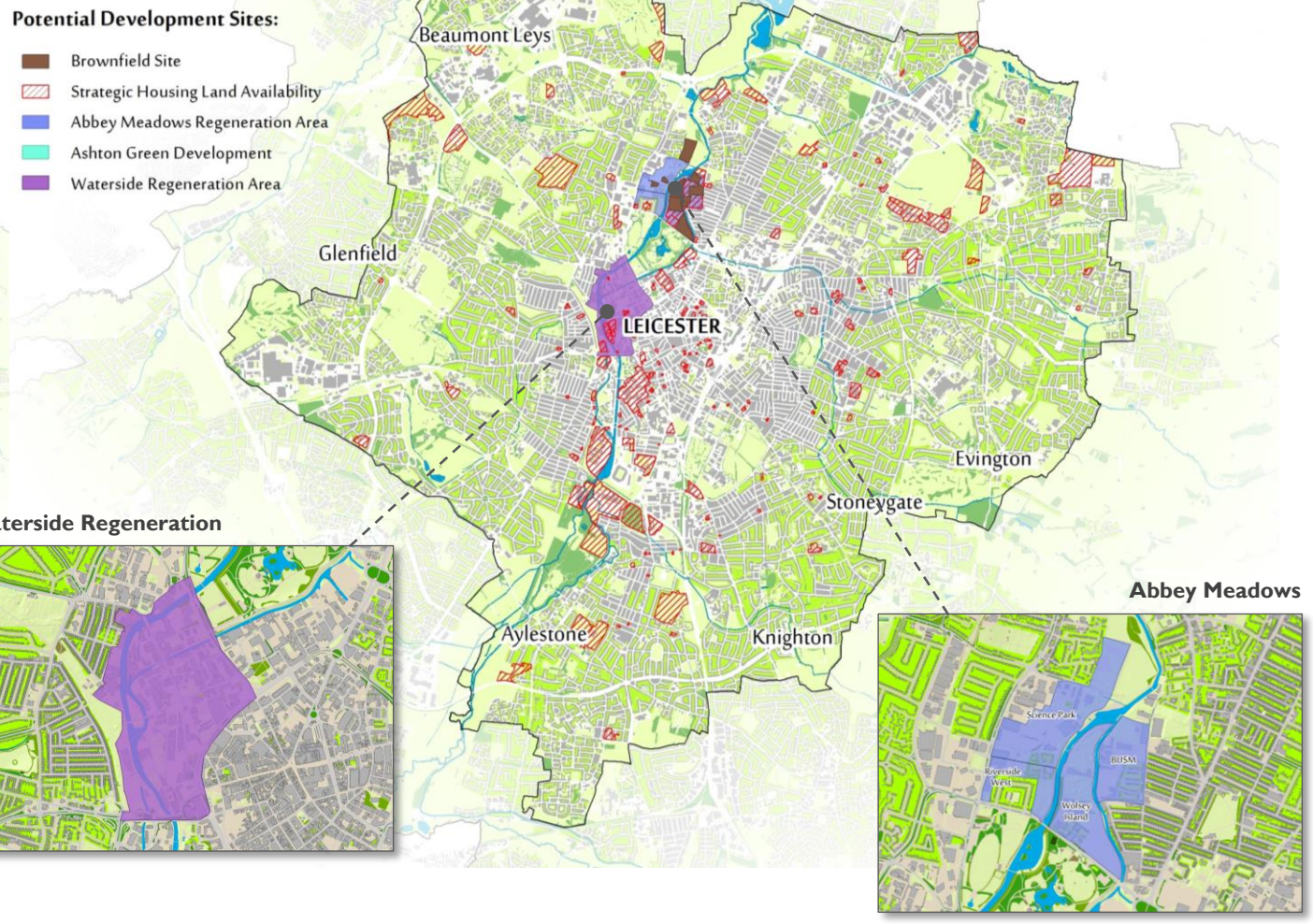
The final step of this assessment is to identify key areas for improvement and investigate areas of priority, opportunity and feasibility for implementing measures at these sites.

1. Key areas of opportunity across Leicester, such as potential development sites (including regeneration and brownfield sites) and proposed wildlife sites.



Potential Sites for Nature

Potential for expanding local sites for nature in Leicester. There are a number of proposed Local Nature Reserves and Local Wildlife Sites, which if designed effectively could produce a number of benefits for the wider area.



Ashton Green

Waterside Regeneration

Abbey Meadows

LOCAL ACTION PROJECT

TARGET AREA IDENTIFICATION

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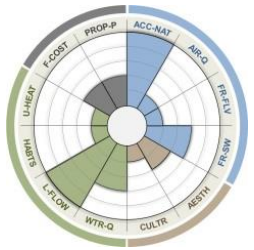

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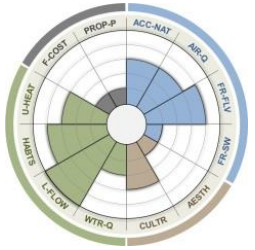

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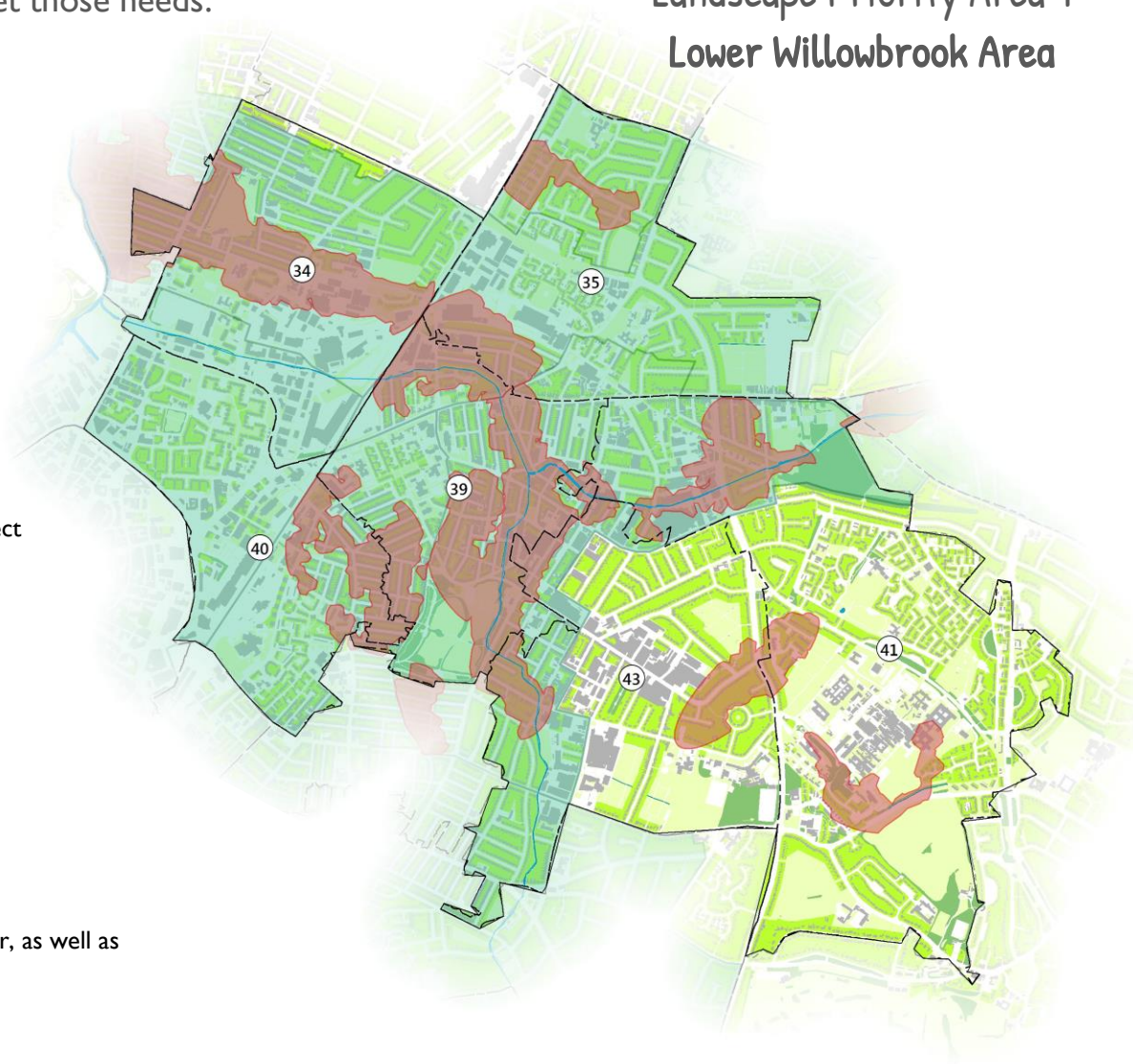
Landscape Priority Area 1

Lower Willowbrook Area



LOCAL ACTION PROJECT

URBAN TOOLBOX

Splits into FOUR broad approaches -

- Restoration / regeneration of urban environments
- GI or SuDS in new development
- Retrofit or greening actions
- Increased functionality – e.g. increased amenity or access

- For each intervention we have developed factsheets including cost and benefits info

  AND include opportunity/feasibility criteria to facilitate mapping/scenario development

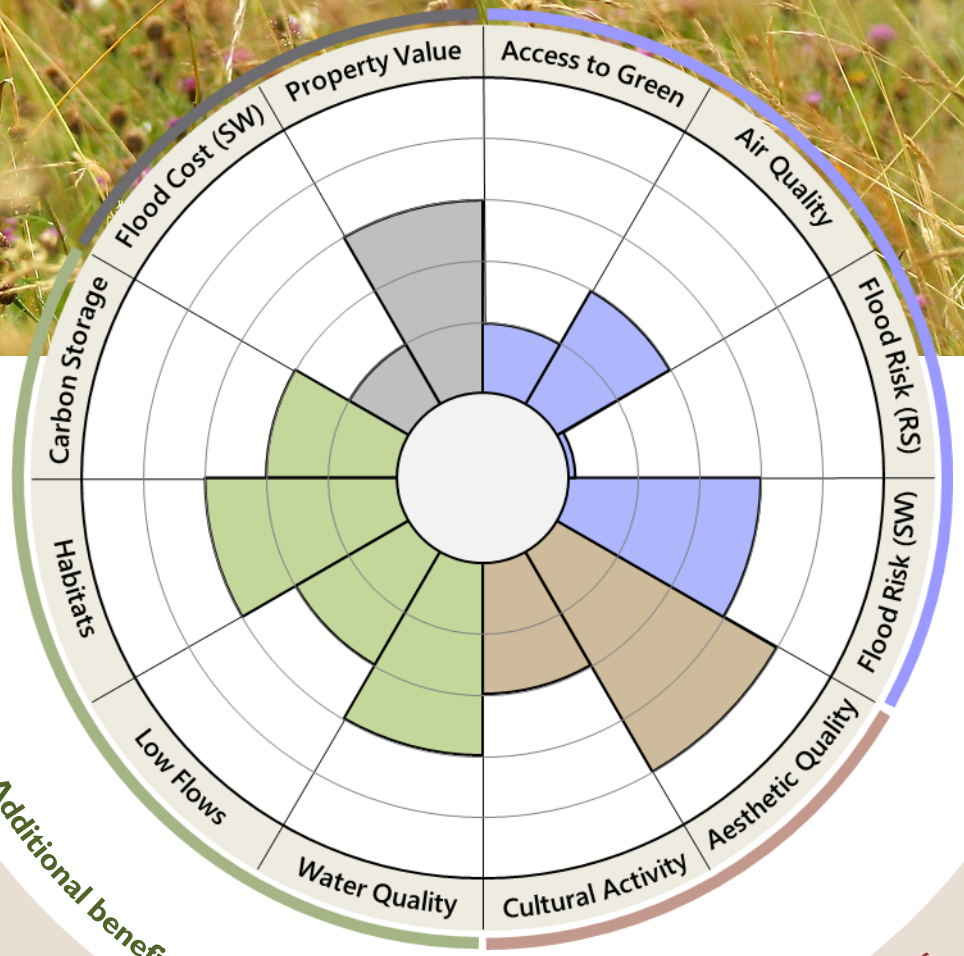
LOCAL ACTION PROJECT

RAIN GARDEN

Infiltration, bio-retention, soakaways

Rain Gardens are usually small vegetated depressions in the ground created mainly in residential areas to take surface water run-off from roofs and hard surfaces.

- They but can vary significantly in size and are sometimes also called 'bio-retention cells'
- Aid infiltration by slowing water down and increasing soil permeability
- Reducing runoff through root uptake of water and transpiration
- Can act to remove pollutants from water – especially if wetland areas are incorporated into the design
- Aesthetically pleasing and can improve QoL and landscape value



IMPLEMENTATION

Rain gardens mimic the natural water retention of undeveloped land and reduce the volume of water entering drains so they need to be hydrologically connected

£ £ £ Costs: £20-270+/m² dependent on size and context. Due to high variability of design and situation.

£ £ £ Maintenance: low dependent on context but mainly litter/sediment removal. Plants need to endure waterlogged as well as dry conditions.

Feasibility: Can be used for retrofit in residential, industrial or urban areas. Hydrological connectivity must exist or be created

Additional benefits

HEALTH & QoL
- ↓ Stress levels
- ↑ Wellbeing

EDUCATION & LEARNING
- ↑ Exposure to nature
- ↑ Outdoor Learning

Risks + challenges

- ↑ Allergy risk
- Aesthetic quality can degrade if not managed

LOCAL ACTION PROJECT

RAIN GARDEN

Infiltration, bio-retention, soakaways

The Rain Garden Guide

This guide is intended to help the homeowner or property manager to create a simple rain garden within their own property.

www.raingardens.info/the-rain-garden-guide

Rain garden: design, construction and maintenance recommendations based on a review of existing systems

N. Somes, M. Potter, Joe Crosby and M Pfitzner.

In order to better understand factors that contribute to the successful implementation of street scale Water Sensitive Urban Design (WSUD) assessments were undertaken at 22 sites across Melbourne.

www.eng.warwick.ac.uk/ircsa/pdf/13th/Somes.pdf

Evaluating rain gardens as a method to reduce the impact of sewer overflows in sources of drinking water

Autixier L, Mailhot A, Bolduc S, Madoux-Humery AS, Galarneau M, Prévost M, Dorner S.

Science of the Total Environment (2014) 499:238-47

Rain gardens were evaluated for their reduction of volumes of water entering the drainage network and of CSOs.

www.ncbi.nlm.nih.gov/pubmed/25192930

CASE STUDIES

SuDS for Schools -

The SuDS for Schools project is working with ten schools in the Pymmes Brook catchment in North London to design and build Sustainable Drainage Systems (SuDS) in the school grounds.

www.sudsforschools.wwt.org.uk/

Ashby Grove residential retrofit rain garden, London

The Ashby Grove rain garden retrofit is designed to remove roof water from a social housing block in Islington. The aim is to disconnect one of the roof downpipes and allow water to flow directly into a newly designed rain garden.

tinyurl.com/zpowlef

Islington Raingarden

The Ashby Grove raingarden in Islington was designed and constructed as a practical example of what can be done in small landscape spaces as suggested in the Islington SuDS Design Guide.

robertbrayassociates.co.uk/projects/islington-raingarden

Strutts Centre Rain Garden, Belper

Trent Rivers Trust have just completed this National Demonstration Sustainable Drainage scheme (SuDS) designed by national expert Bob Bray, on a grade II listed building.

www.trentriverstrust.org/site/Rain-Gardens

Stakeholder dialogue

Partnership working

Benefits/value assessment

Strategic targeting

Practical delivery of measures

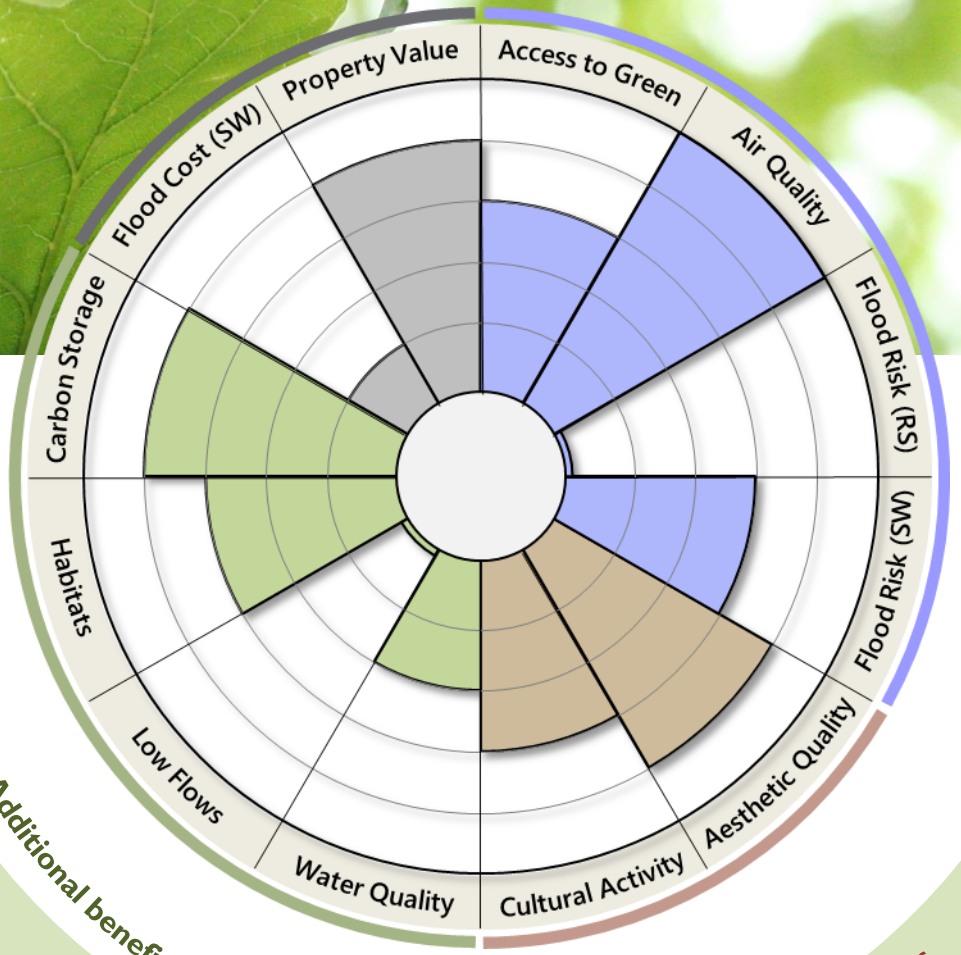
LOCAL ACTION PROJECT

TREES

Street trees, tree pits, urban forest

Trees can perform a number of functions that in turn provide a number of different benefits to people in urban landscapes -

+ Improving air quality by trapping pollutants
+ Intercepting rainfall to slow the rate of water reaching the ground
+ Increasing infiltration by creating permeable surfaces
+ Reducing runoff through root uptake of water and transpiration
+ Trees are also aesthetically pleasing natural features in an urban landscape and thus provide many less tangible benefits that improve people's quality of life, health and wellbeing



IMPLEMENTATION

Trees are very versatile and can be used in a variety of situations. The benefits produced depend on their size, species, location and style of delivery.

£ £ £ Costs per singular tree: £100-400
(including planting and initial maintenance)

£ £ £ Maintenance: mainly pruning
(as part of landscape management)

Feasibility: can be planted in pavements large enough to receive them. Cab planted on existing GI or in new developments

Additional benefits

HEALTH & QoL

↓ stress levels
↑ exercise frequency
↑ New-born health

ENERGY SAVINGS

kWh

↑ exercise frequency
↑ New-born health

Risks + challenges

↑ allergy risk
Can block views
Property damage: roots, litter, shading

LOCAL ACTION PROJECT

TREES

Street trees, tree pits, urban forest

Urban Forest Effects Model (UFORE) & i-Tree Eco

The Urban Forest Effects Model (UFORE) is a science-based, peer-reviewed computer model designed to assess and quantify urban forest ecosystem services, based on field data inputs and external datasets (e.g. weather and pollution). It was adapted for inclusion with the i-Tree software suite from the USDA Forest Service, and was subsequently renamed as i-Tree Eco.

www.itreetools.org

Longitudinal effects on mental health of moving to greener and less green urban areas.

Alcock I, White MP, Wheeler BW, Fleming LE, Depledge MH.

Environmental Science & Technology (2014) 21; 48 (2):1247-55.

Moving to greener urban areas was associated with sustained mental health improvements, suggesting that environmental policies to increase urban green space may have sustainable public health benefits.

Torbay's Urban Forest

The study (the first of its kind in the UK) used the i-Tree Eco model (developed by the US Forest Service, and based on peer reviewed research) to quantify the structure, and some of the major environmental benefits delivered by Torbay's trees.

www.torbay.gov.uk/tuf.pdfitreetools.org

Street Tree London

Street Tree is a non-profit making company founded on the belief that trees should form an integral part of the urban landscape. Our aim is to increase London's tree stock, working with Local Authorities, Fund-holders, and business partners, to promote street trees and the many benefits they bring.

www.streettree.org

Red Rose Forest – Green Streets Case Studies

Red Rose Forest's Green Streets team is dedicated to making our towns and cities greener and more attractive places to live, work and invest. They plant street trees, deliver bespoke street greening projects, create places to grow food, greenspace improvement, plant community woodlands and orchards, build green roofs and improve school grounds.

tinyurl.com/j3vhpxm

Wirral Street Trees Programme

A tree planting programme that is helping to transform Wirral into a thriving economic hub. By April this year over 600 trees across 8km will have been planted in streets and green spaces, as part of a three-year programme to link residential areas to places of employment and training.

tinyurl.com/jn5ggpd

CASE STUDIES

Stakeholder dialogue

Partnership working

Benefits/value assessment

Strategic targeting

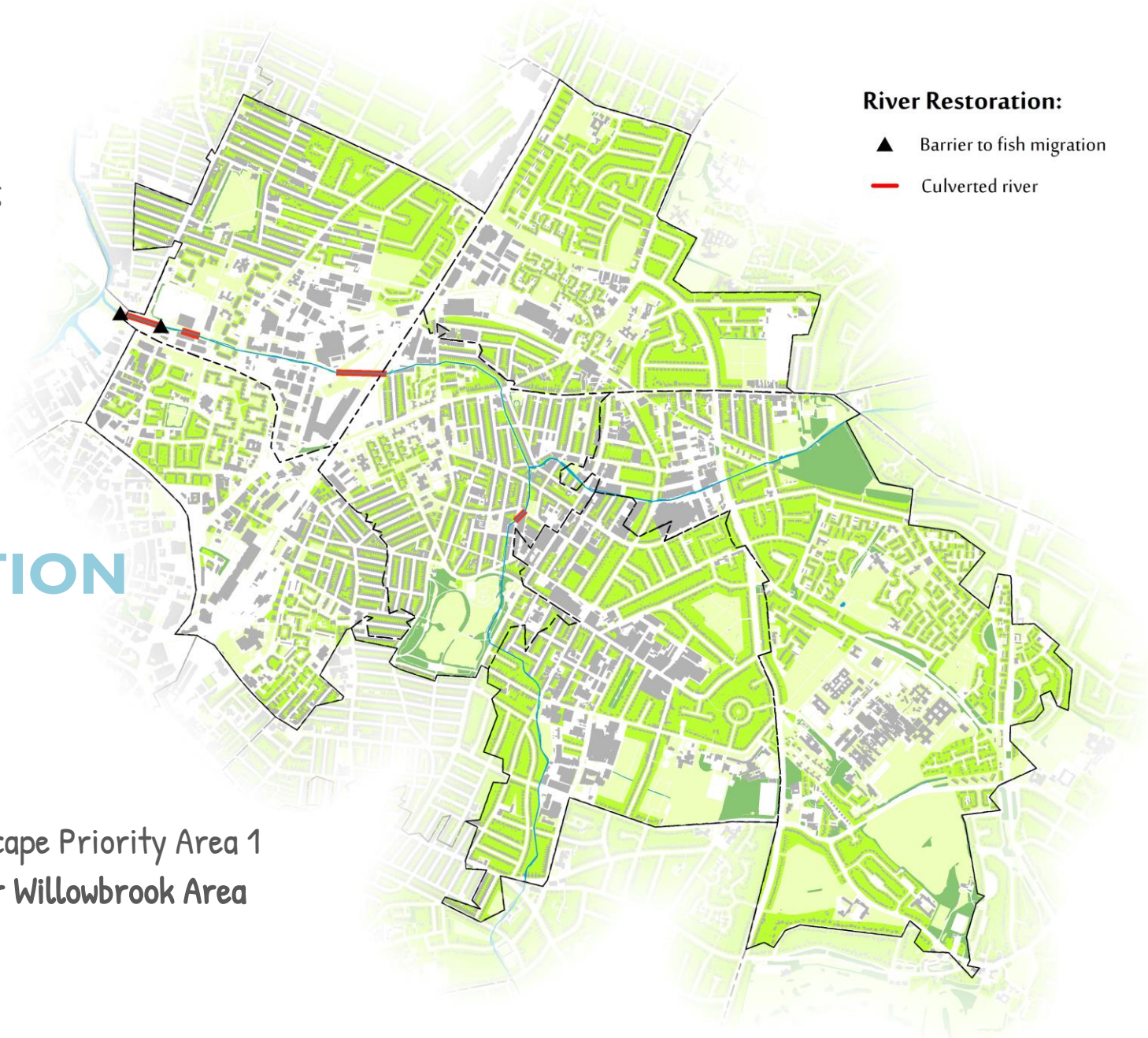
Practical delivery of measures

LOCAL ACTION PROJECT

TARGET AREA IDENTIFICATION

3. Perform high resolution hydrological and suitability analyses to identify candidate sites for specific interventions – these sites can then be 'worked-up' with resource/funding sought, community consultation, optioneering, design and delivery.

RIVER RESTORATION



Landscape Priority Area 1

Lower Willowbrook Area

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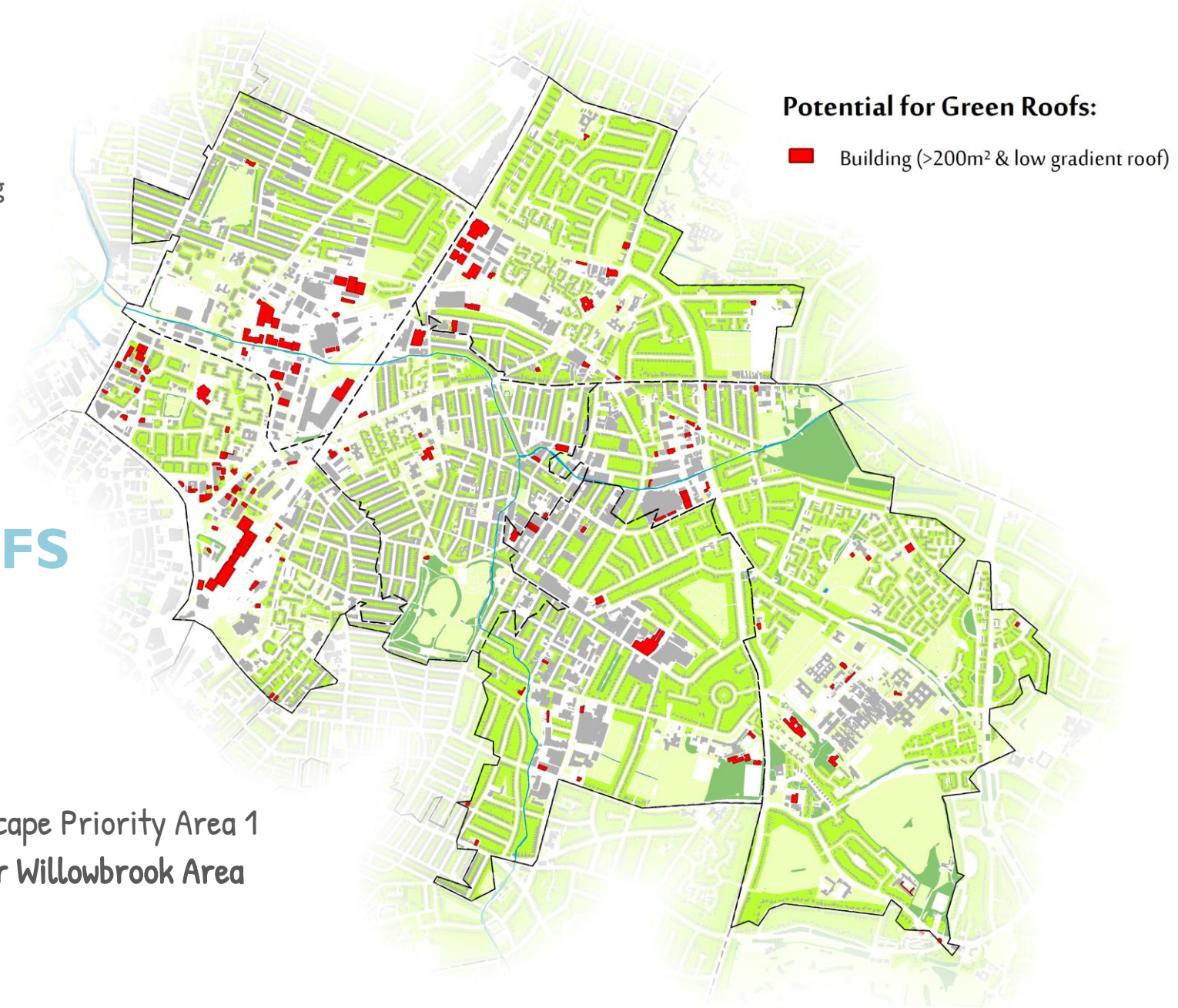
GREEN ROOFS



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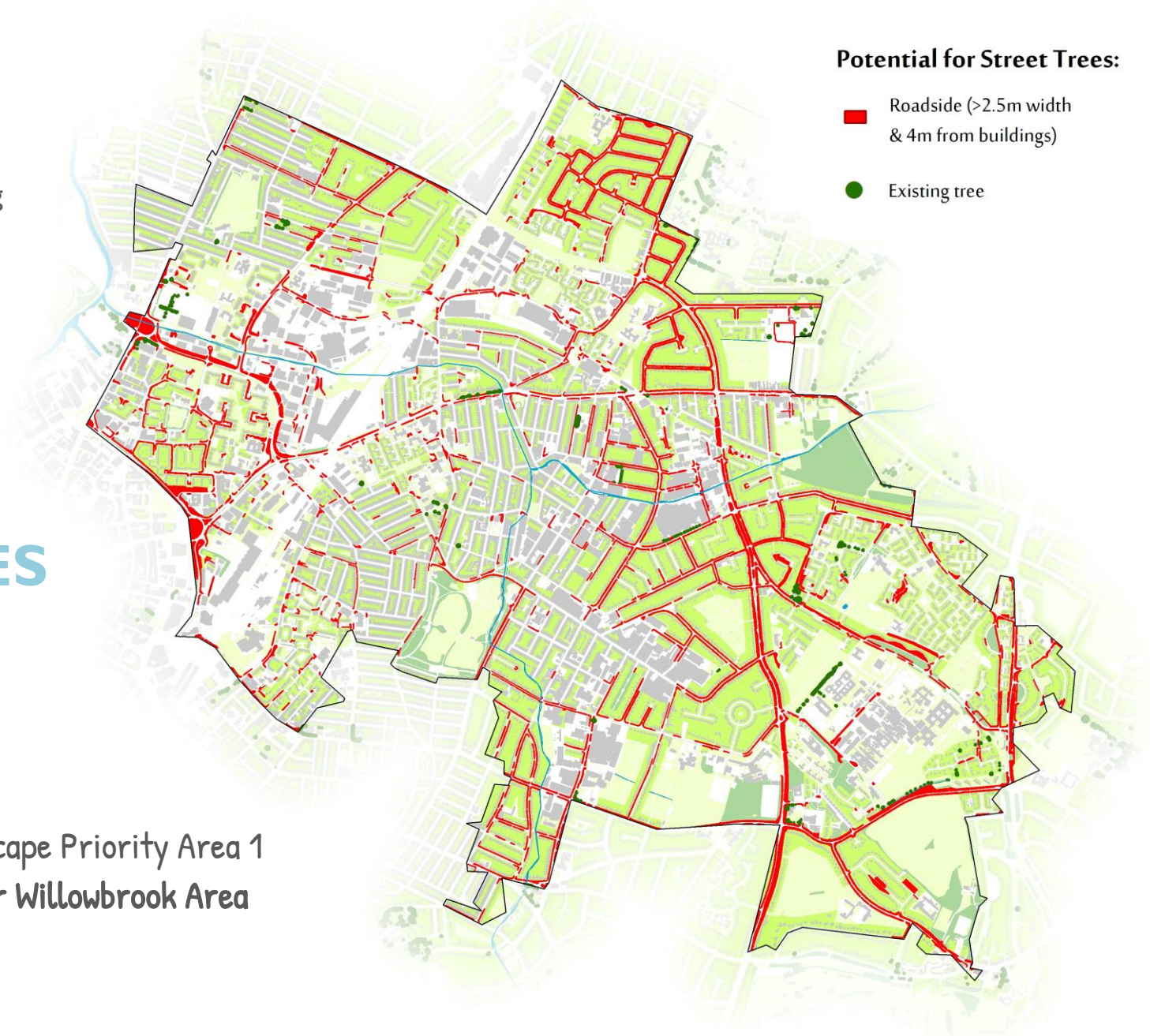
STREET TREES



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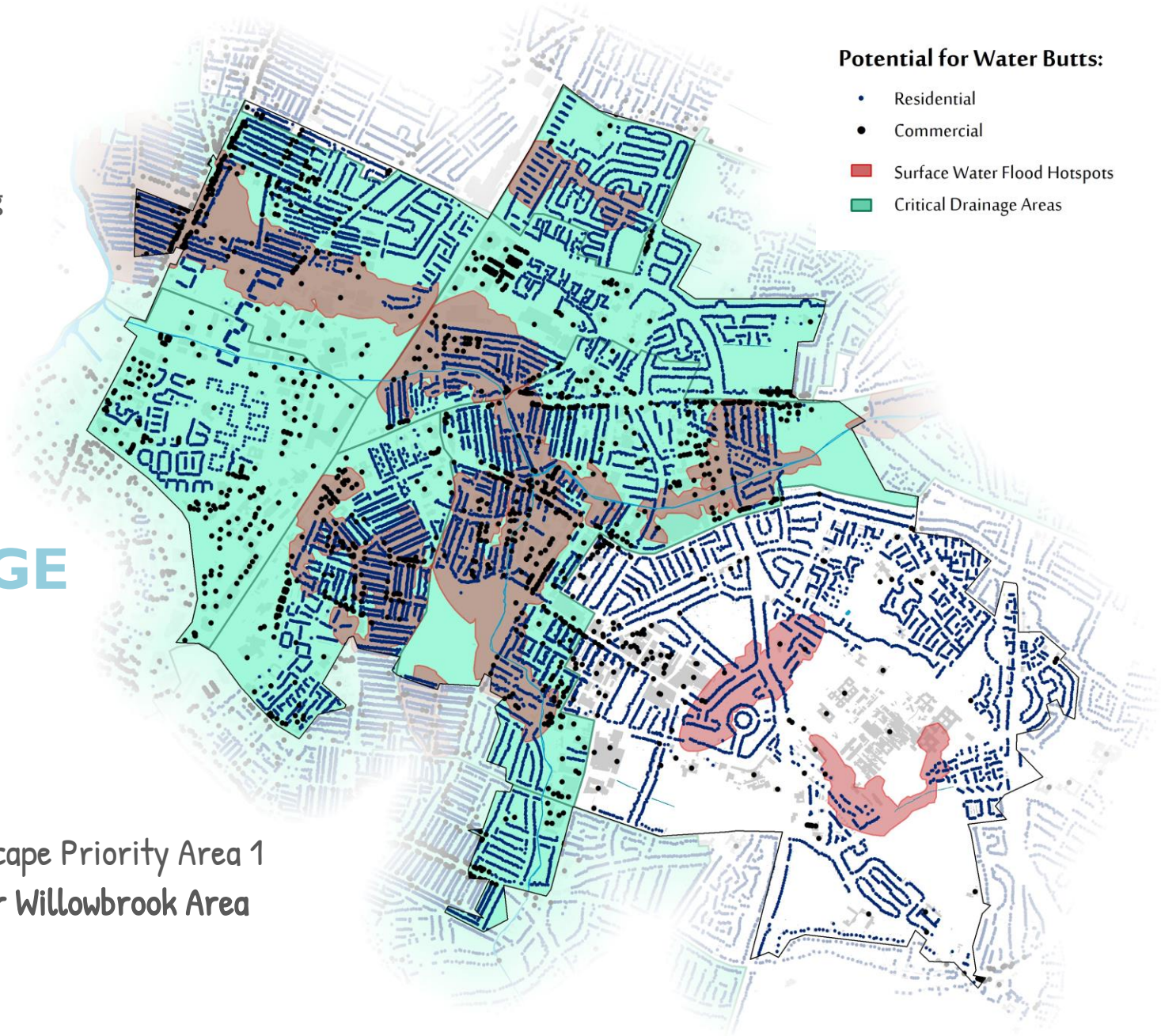

WATER STORAGE

Landscape Priority Area 1

Lower Willowbrook Area

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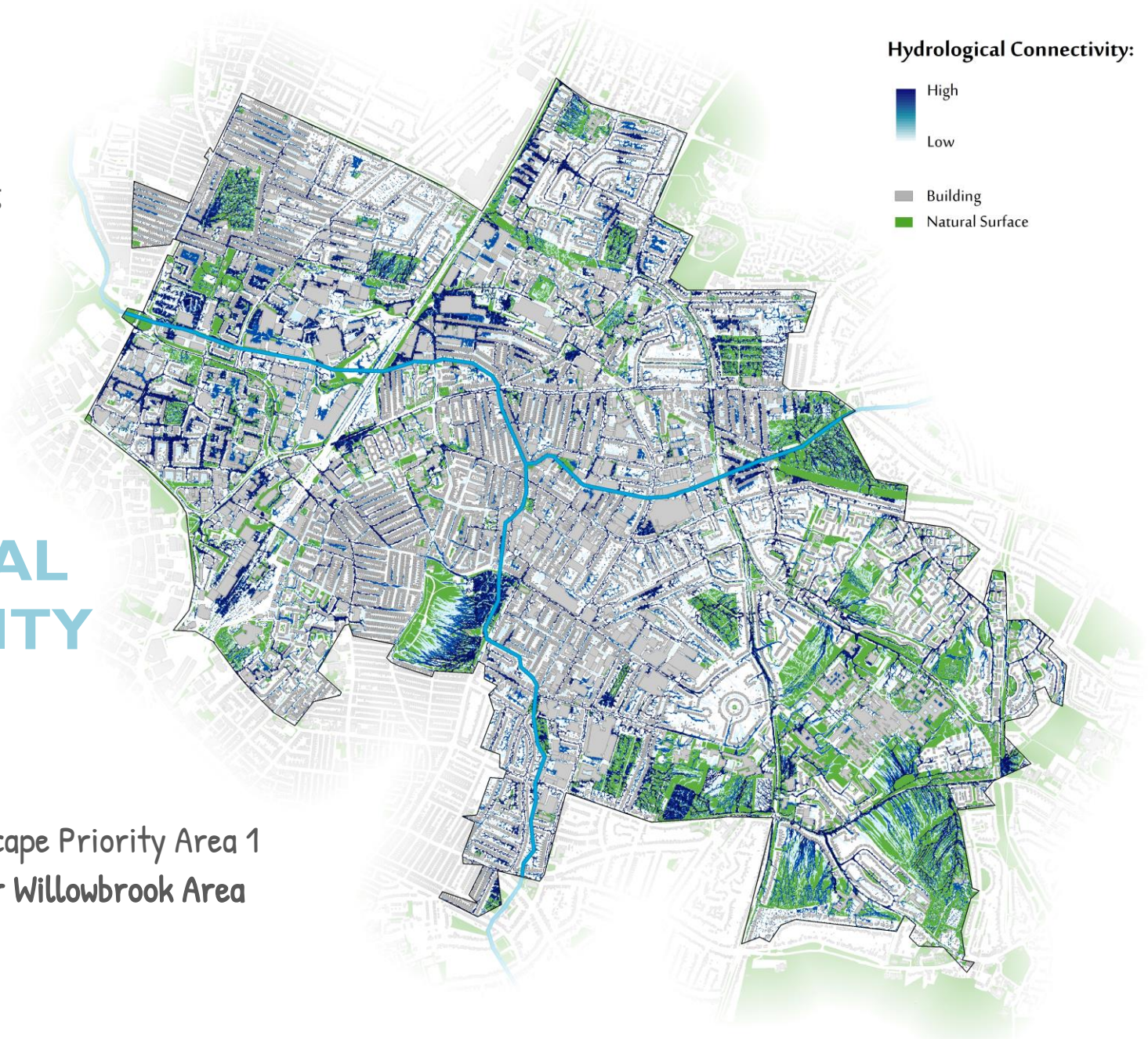
HYDROLOGICAL CONNECTIVITY



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LOCAL ACTION PROJECT

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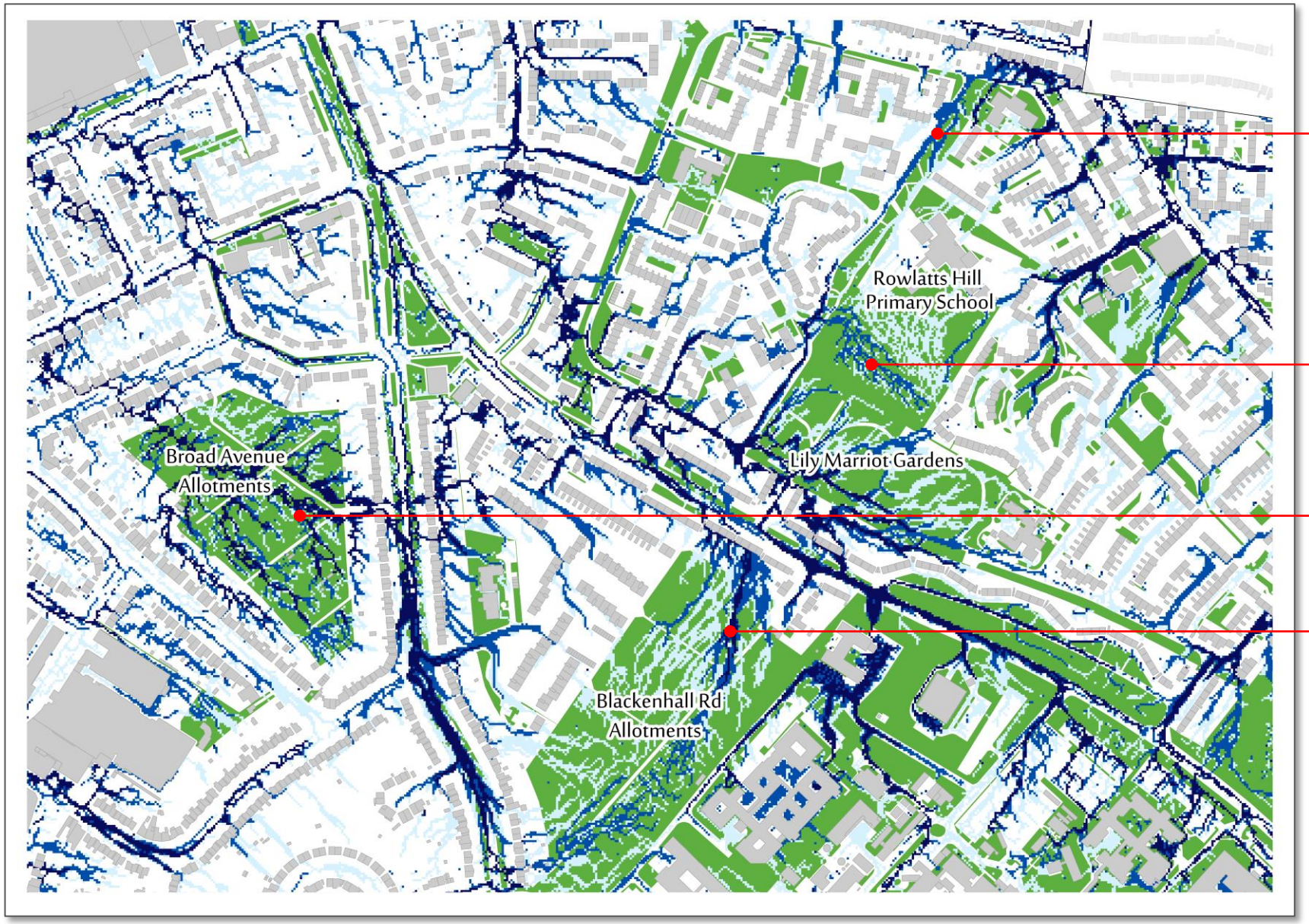

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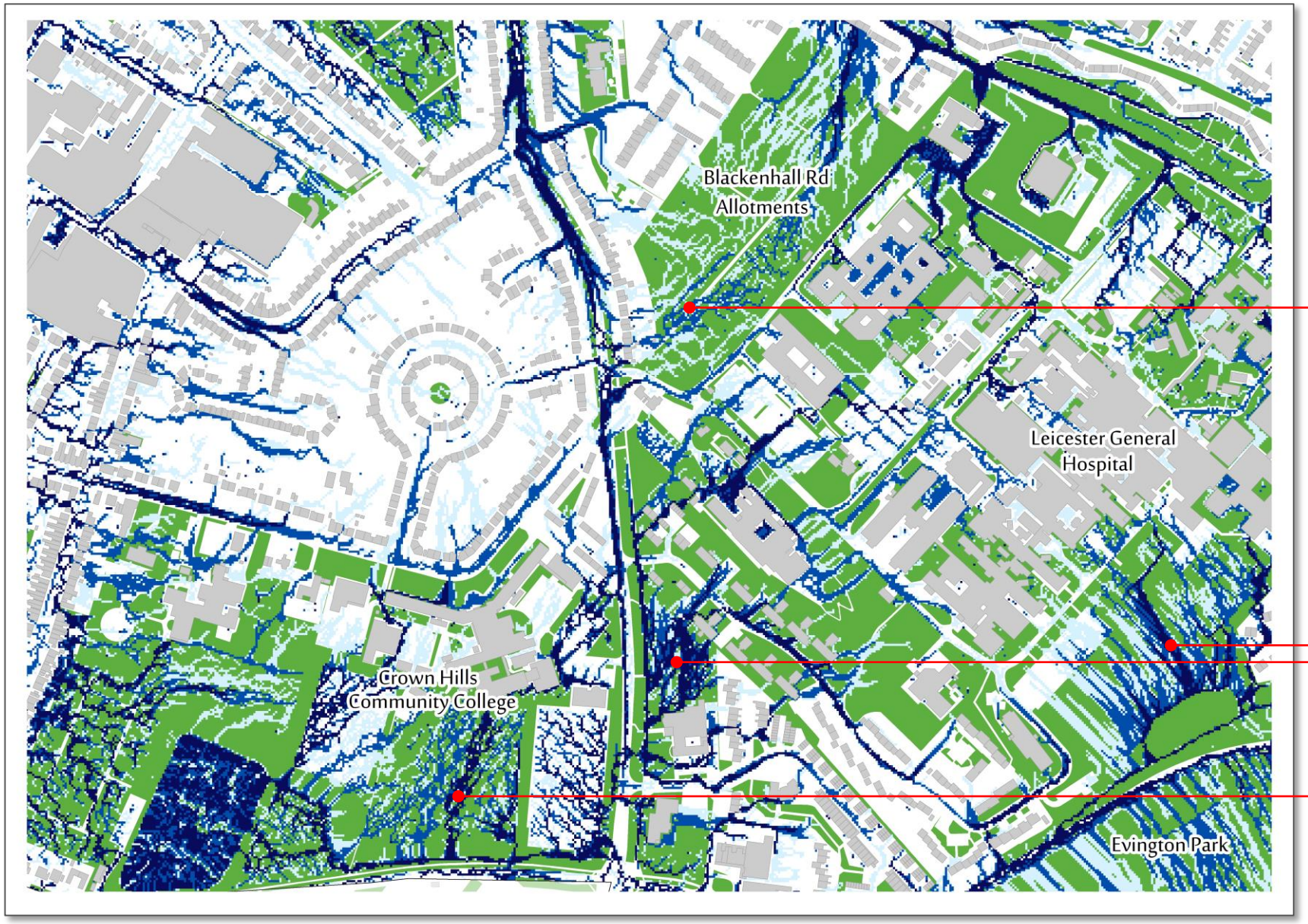

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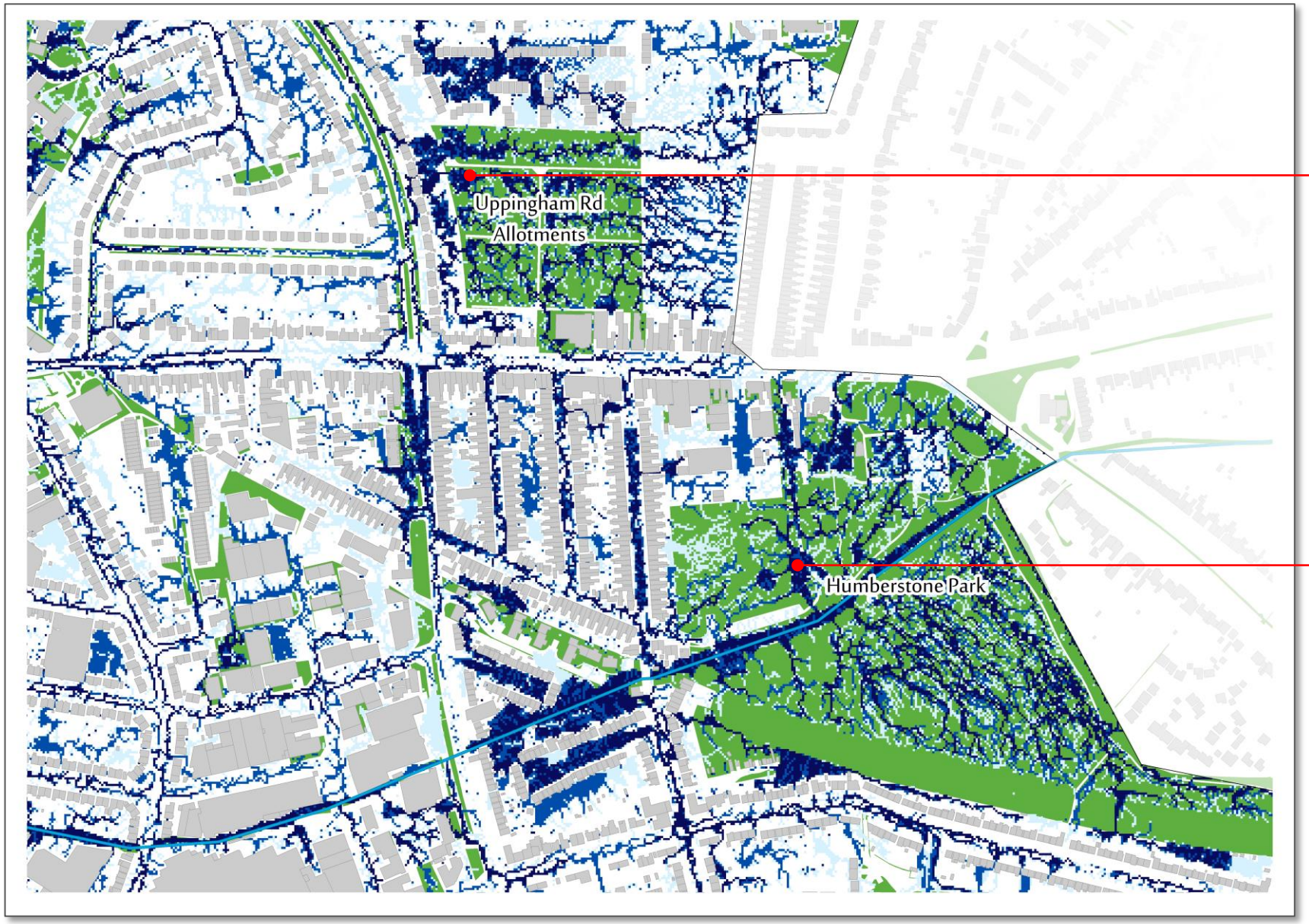

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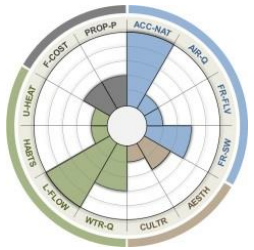

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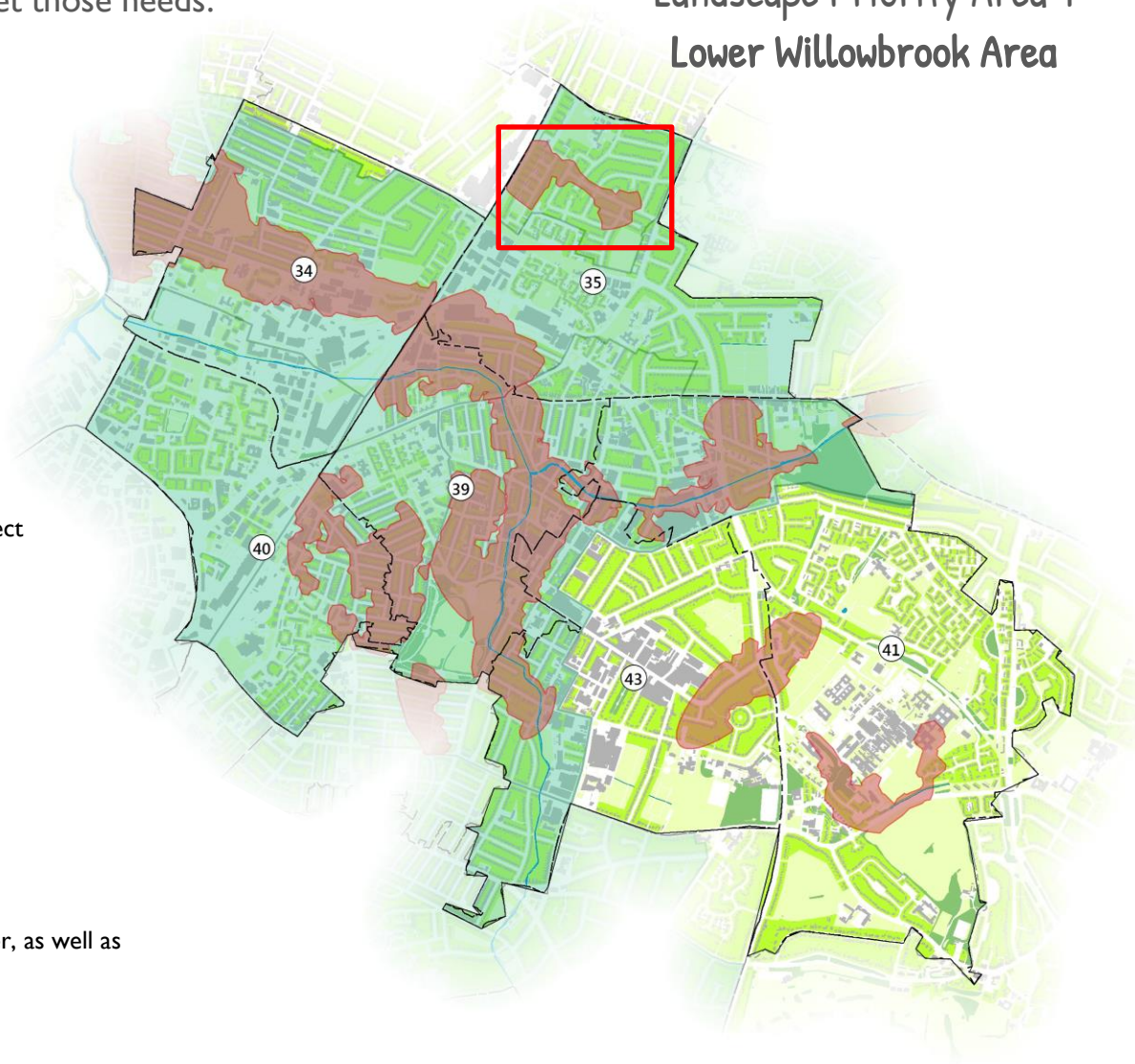

GARDENS

Aerial photo

LOCAL ACTION PROJECT

GARDENS

Aerial photo

Front gardens

LOCAL ACTION PROJECT

GARDENS

LOCAL ACTION PROJECT

GARDENS


GREEN INFRASTRUCTURE
FUNCTIONAL AREAS
HABITATS
NATURAL ASSETS
OPEN SPACES
SuDS
DELIVER
TOOLBOX
INTERVENTIONS
MEASURES
ACTION
CAPABILITY
OPTIONEERING
PARTNERSHIP
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Leicester | Manchester | Thames Estuary | Newton Abbot

Ecosystem **Benefits** in **Urban** Water **Environments**

defra | Environment Agency | Westcountry Rivers Trust