Technical Appendix: Green Infrastructure

June 2014

1 SUMMARY

The land use planning system is one of the most important means of delivering green infrastructure. It provides a spatial perspective to co-ordinate individual actions in order to create and reinforce the network of walking and cycling routes, recreation areas, habitats, green corridors and townscapes. It helps ensure that the right kinds of green space are created in the right place, and that the widest possible range of benefits results[1].

Perth and Kinross has adapted a GIS approach first developed by the GCV Green Network Partnership to identify strategic opportunities for delivery of green infrastructure in the Green Infrastructure Supplementary Guidance. The analysis uses a wide range of spatial datasets to identify locations where the planning process and targeted resources can deliver multiple benefits[2].

This work will help us clearly target and communicate green infrastructure areas with the highest strategic opportunity. The strategic opportunities identified were as follows:

[1] TAYplan Topic Paper 4: Strategic Place Shaping, Green Networks, Climate Change Adaptation and Town and City Centres

[2] Glasgow and the Clyde Valley Strategic Development Plan, Background Report 08, Glasgow and Clyde Valley Green Network Prioritising Delivery, September 2010

1. Perth Core North West
2. Perth Core North East
3. Perth Core South East
4. Perth Core South West
5. Dunkeld/Birnam
6. Aberfeldy
7. Pitlochry
8. Kinross/Milnathort
9. Creiff
10. Carse of Gowrie

This report describes the method and outputs generated through the spatial analysis. It is recommended that the results be used to

- Identify the best places for improvements, for example, large scale habitat enhancement, flood regulation or improving connectivity for people and nature
- Guide development away from particularly sensitive areas and instead towards areas where the green infrastructure can be improved through a development proposal
- Identify multiple benefit areas where compatible land uses which support healthy ecosystems are favoured over single purpose developments

2. Introduction

2.1 What is green infrastructure

Green infrastructure provides multiple benefits and can help deliver better, more sustainable places, promote healthier lifestyles, connect and enhance natural habitats and attract and retain investment in the area. Green infrastructure can provide sustainable regenerative solutions for the challenges we face now and into the future. With careful planning and funding it can help our cities adapt to climate change and improve resilience to extreme weather events. The greatest benefits will be gained when it is designed and managed as a multifunction capable of delivering a wide range of ecosystem services (environmental and quality of life benefits) for communities. These services may include:

- **Cultural services** including historical and recreational experiences, improved health and quality life
- **Provisioning services** including support of plant and wildlife diversity and community food growing
- **Regulatory services** including carbon sequestration, climate change regulation, water and air protection[3]

2.2 What are the components

Green infrastructure is not an isolated or solely an ecological concern. It is a **network** of green, blue and open spaces that lie within and between cities, towns and villages. Map 1 shows the existing green infrastructure which will be built upon in Perth and Kinross to deliver the above vision for multiple benefit green infrastructure.

[3] 'Green Infrastructure – Valuation Tools Assessment' Natural England Commissioned report NECR126

Map 1: Existing green infrastructure

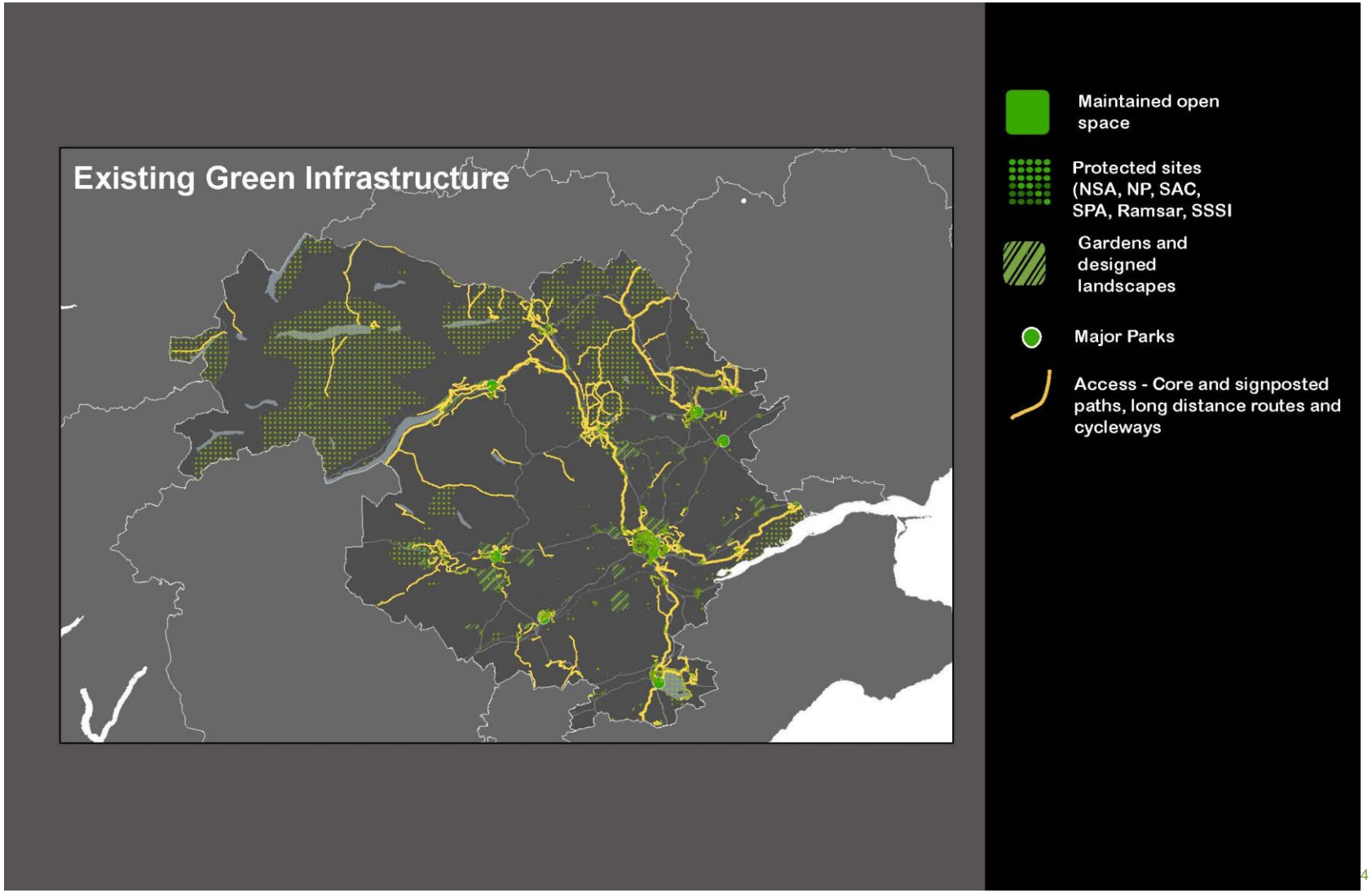

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Figure 1 shows the relationship between the components making up the green infrastructure in Perth and Kinross.

Figure 1: Green Infrastructure Components

2.3 National, Regional and Local Linkages

Green infrastructure planning works best when it is part of a clear hierarchy flowing from the national to regional to local levels and is integral to building well designed and sustainable communities.

The National Planning Framework 3 (NPF3) recognises that a "more integrated approach and 'greening' of the urban environment through green infrastructure and retrofitting can improve quality of life within our towns and cities, alongside enhancing their longer-term environmental performance and climate resilience". To deliver this outcome the NPF3 contains an expectation that all development plans identify green networks in all of the city regions. In addition to urban areas, the NPF3 also recognises the need for a "landscape-scale approach" to "address the decline in some ecosystem services by prioritising action across river catchments, as well as in and around our towns and cities. This can play a long-term role in sustaining diversity and delivering multiple benefits, not only for wildlife but also by providing sustainable food, fibre and fuel[5]".

The initial stage of delivering this framework was taken in the Strategic Development Plan (TAYplan) Main Issues Report (MIR). The MIR has a broad focus and explores the key issues and spatial alternatives at a regional level. These issues and options will cascade to each Local Authority to provide a context for local decisions and plans to achieve the agreed outcomes and priorities for the region. The TAYplan vision is central to the delivery of green infrastructure by integrating it with land use planning across the area. It should form the basis of a regional level discussion and to ensure a common approach is developed across the area[6].

3 Methodology

3.1 Approach

In order to identify the local opportunities for action and to target actions which will deliver maximum and multiple benefits it was necessary to be able to have spatial data which could answer the following questions:

1. What Green Network resource currently exists and where are the opportunities improve the resource?
2. Where are the priority areas to improve?
    - Biodiversity networks
    - recreational access and experiences
    - Cultural and landscape experiences
    - Water environment quality
    - Climate change resilience including flood regulation
3. Where are the major areas of land use change and growth?

[5] National Planning Framework 3, Scottish Government, June 2014

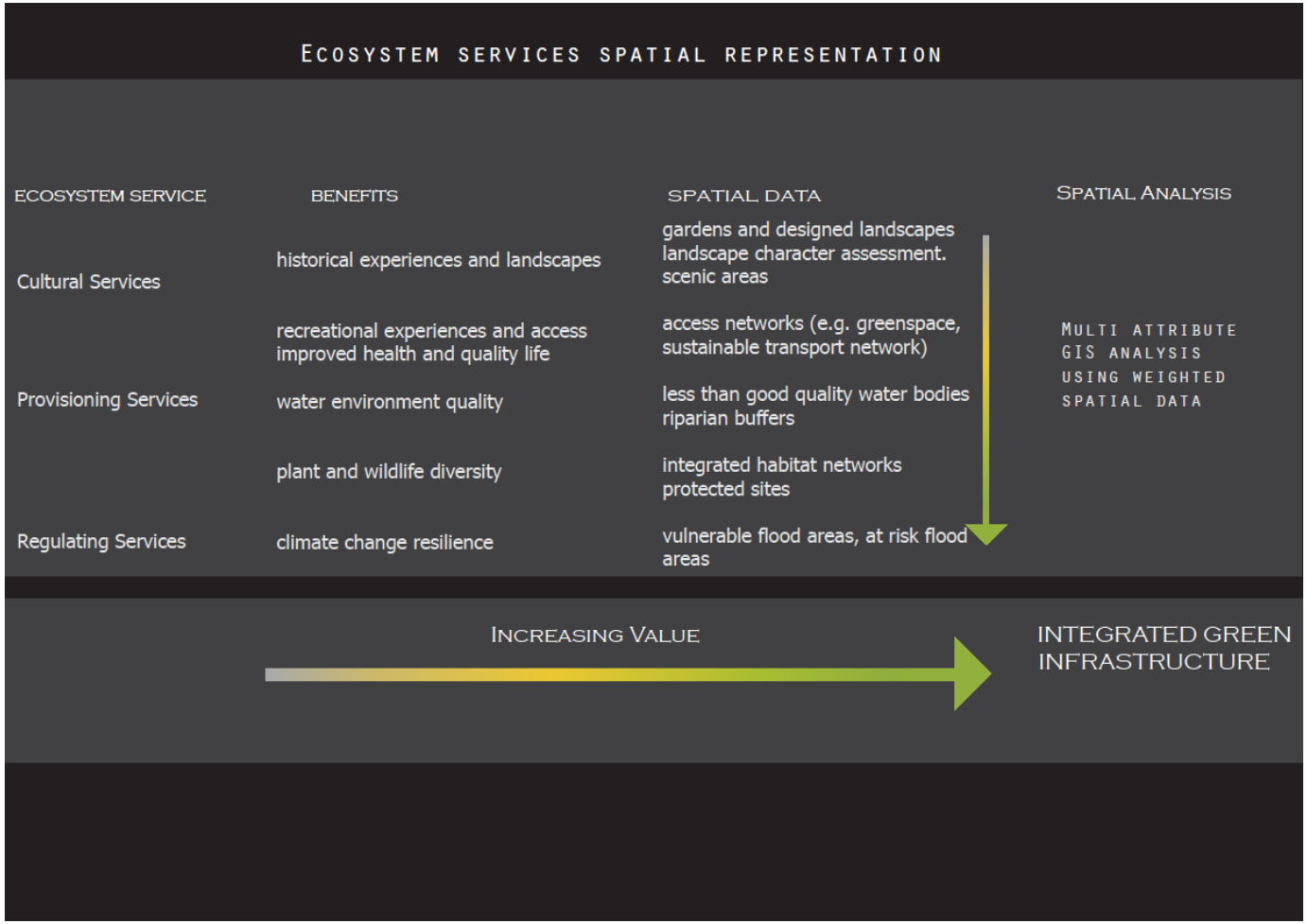
[6] Renfrewshire Local Development Plan ,Green Network Background Paper , January 2013

The key below should be used in understanding the diagrams and maps in this document.

3.2 Spatial Data Layers

A range of datasets were identified which could provide answers to these questions and address the ecosystem services they encompass. Figure 2 represents the process to spatially represent these services.

Figure 2: Ecosystem services spatial representation



The spatial datasets used target key strategic opportunity areas are described in further detail below.

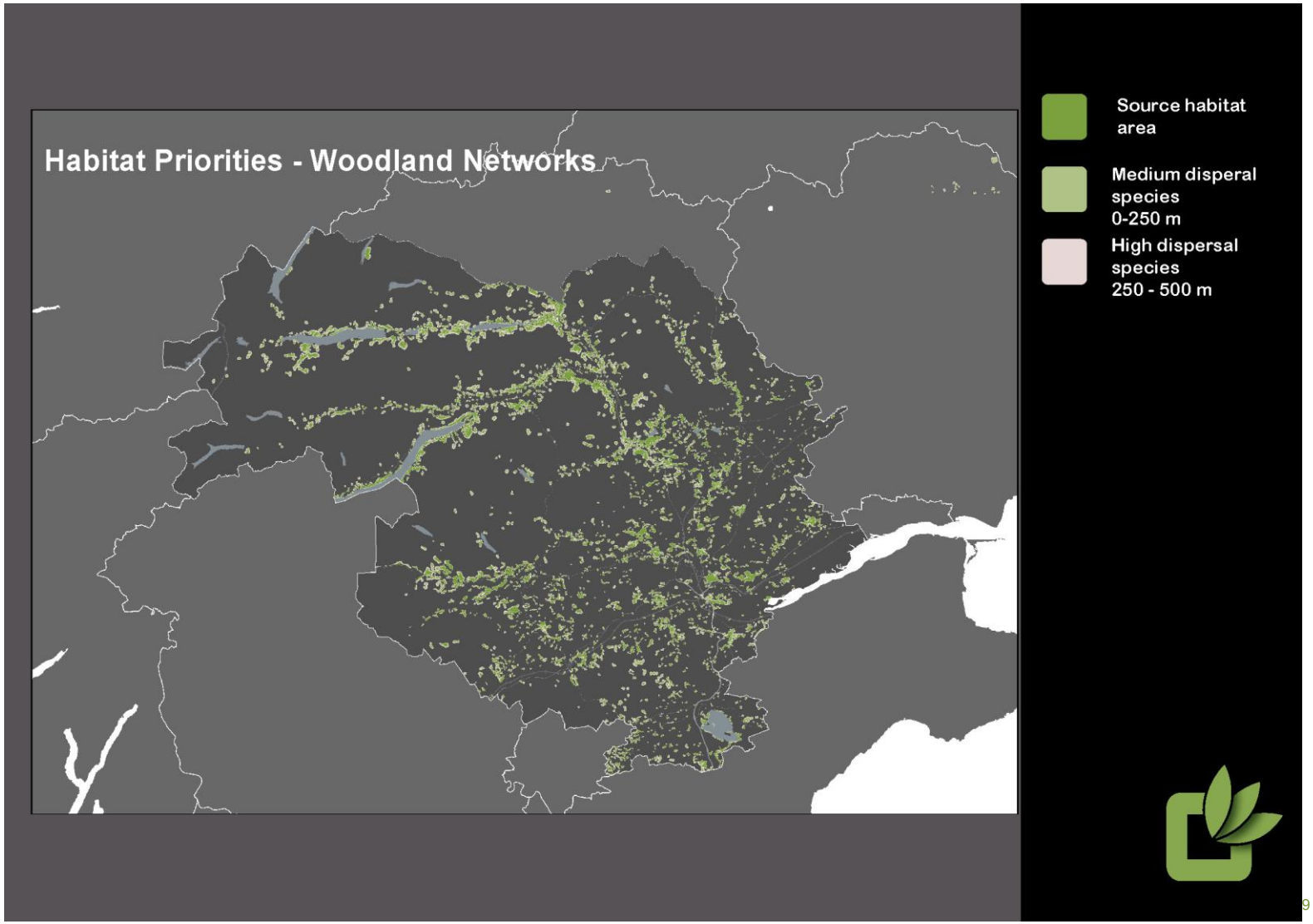
	Spatial Data layers	Base datasets
	Habitat Priorities The Integrated Habitat Network (IHN) model spatially defines strategic scale networks to effectively plan green and blue spaces for multiple benefits. The IHN provides a strategic framework for three key habitats; woodlands, grasslands and wetlands. There are inherent assumptions in the modelling approach such as ecological costs to species movement through different types of land cover and dispersal distance. The output is a habitat network showing source habitat patches and their potential connections[7]. Maps 2, 3 and 4 show this output.	Land Cover Map (LCM) 2007 (CEH) Land cover costs (wetland, woodland, grassland, SNH] Integrated Habitat Model (IHN) (SNH) Protected Sites (SPA, SAC, Ramsar, SSSI)
	Cultural and Landscape Priorities Heritage features and important views and landscapes should be respected and where appropriate enhanced through green infrastructure.	Gardens and Designed Landscapes (Historic Scotland) Greenbelt (PKC) National Scenic Areas
	Access Priorities The model approach equally defines networks for people or access networks. Access networks (Map 5) were developed to identify strategic access priorities using a similar modelling approach as the IHN. The dataset spatially defines people's access to greenspace and open space areas and active travel routes including core and signposted paths and long distance routes and cycleways. There are inherent assumptions in the modelling approach, such as the types of accessible greenspace and preference, travel routes (long distance routes), dispersal distance and matrix permeability.	Land Cover Map (LCM) 2007 (CEH) Land cover costs (people, Forest Research] Integrated Habitat Model (IHN) (SNH)
	Water management Green infrastructure (GI) can provide sustainable regenerative solutions adapt to climate change and improve resilience to extreme weather events. Green infrastructure can mitigate flood risk by slowing and reducing	Potentially Vulnerable Flood Areas (SEPA) Less than good water

[7] Integrated Habitat Network Methodology Handbook, Scottish Natural Heritage, June 2013

	storm water discharges. Green infrastructure has been implemented successfully to reduce the total volume of water entering the grey infrastructure and also to reduce the size of the peak flows. Lower discharge volumes translate into reduced combined sewer overflows and lower pollutant loads to protect water quality[8]. Areas were targeted for water management using SEPA National Flood Risk Assessment data, historical flood data and water quality data (Map 6).	quality intercatchments (SEPA) National Flood Risk Assessment (SEPA)
	Strategic Growth Areas Strategic Development Areas and Development Plan allocated sites (Map 7) have been included in analysis as they represent key mechanisms for the delivery of green infrastructure. These areas provide an opportunity to affect change in areas where development is likely to occur in the near future and to integrate green infrastructure opportunities at the outset.	Strategic Development Areas Development Plan site specific proposals

[8] "Green Infrastructure: Why Green Infrastructure", US Environmental Protection Agency , June 2014

Map 2: Habitat priorities – woodland



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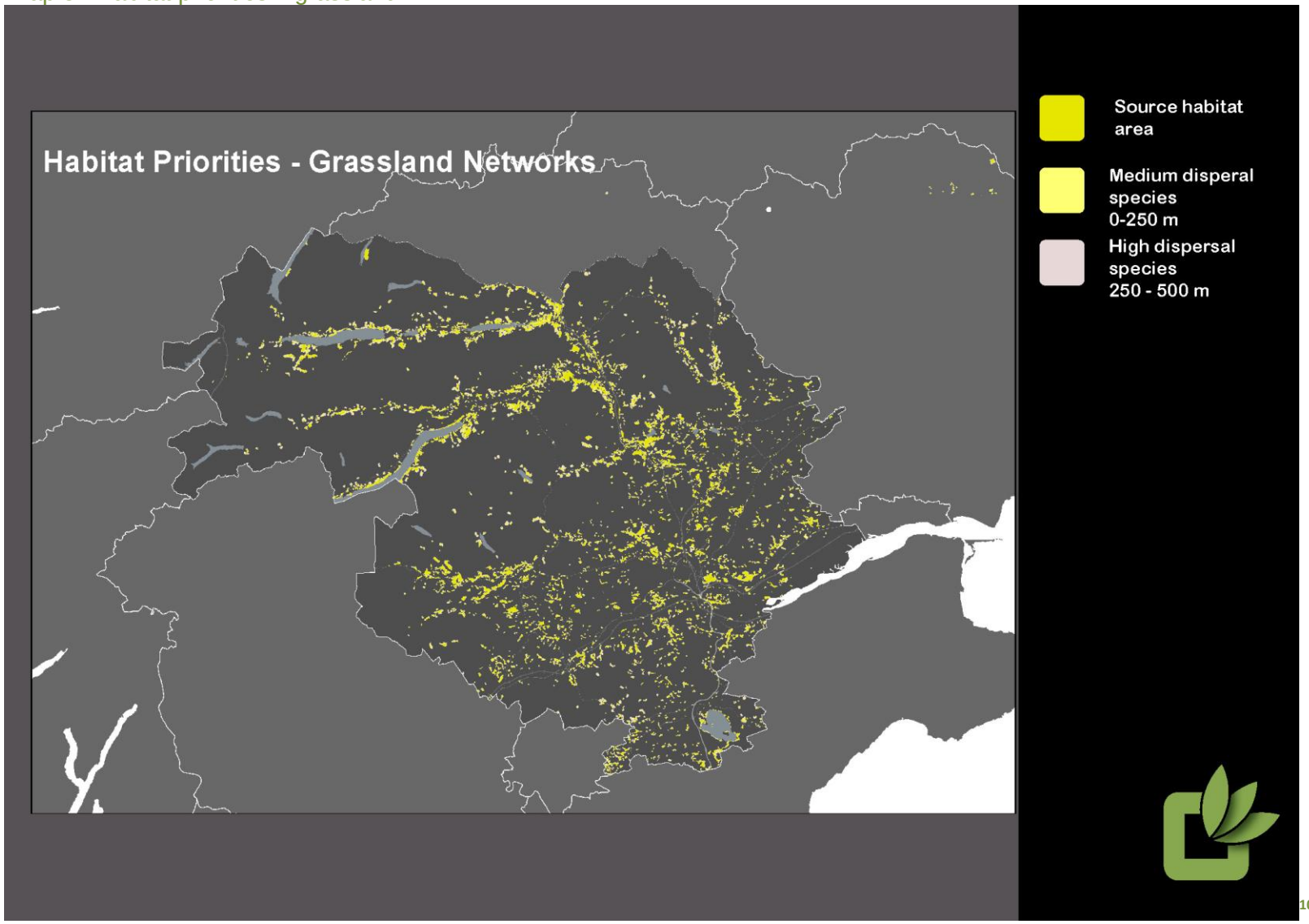
Map 3: Habitat priorities – grassland



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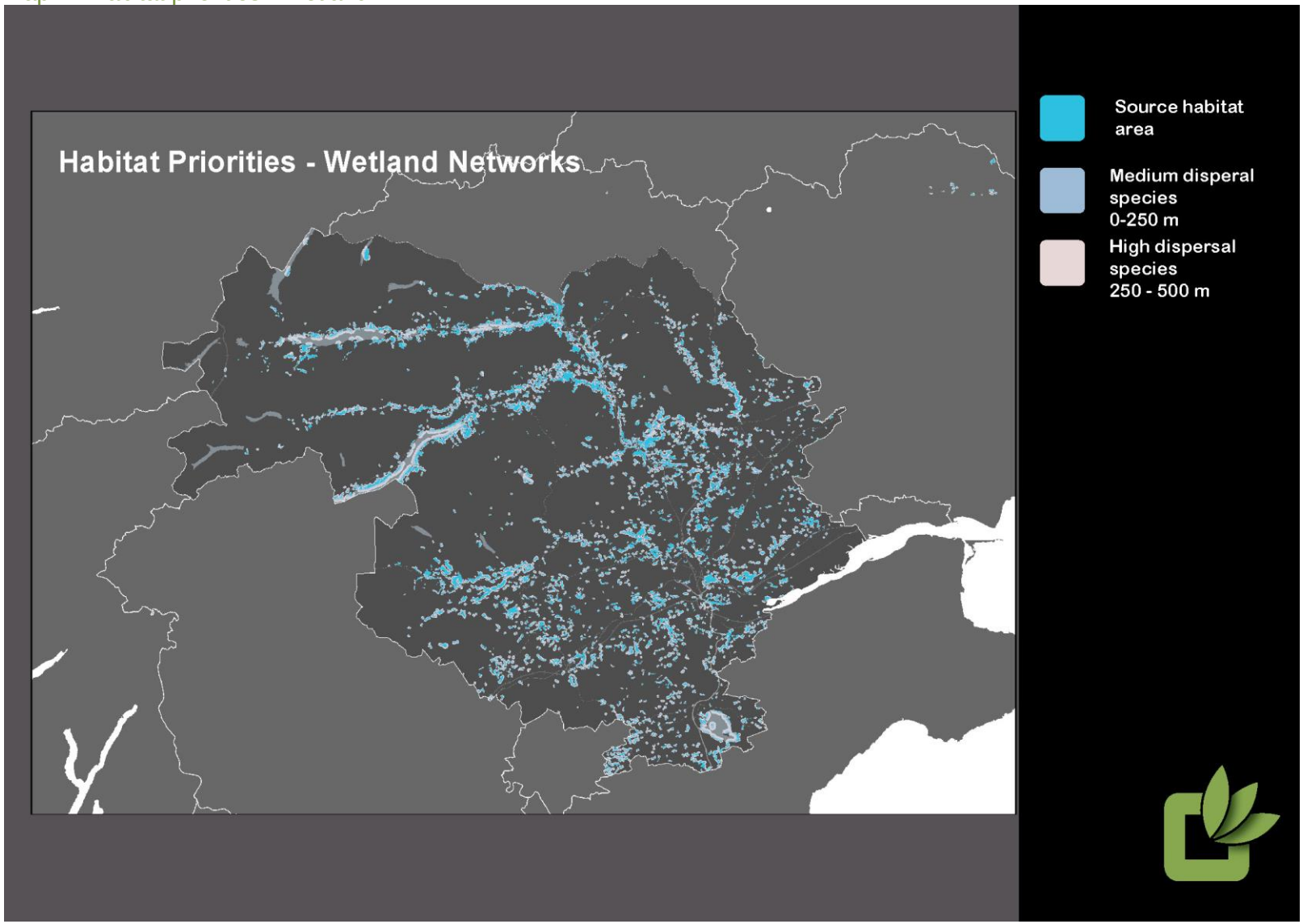
Map 4: Habitat priorities – wetland



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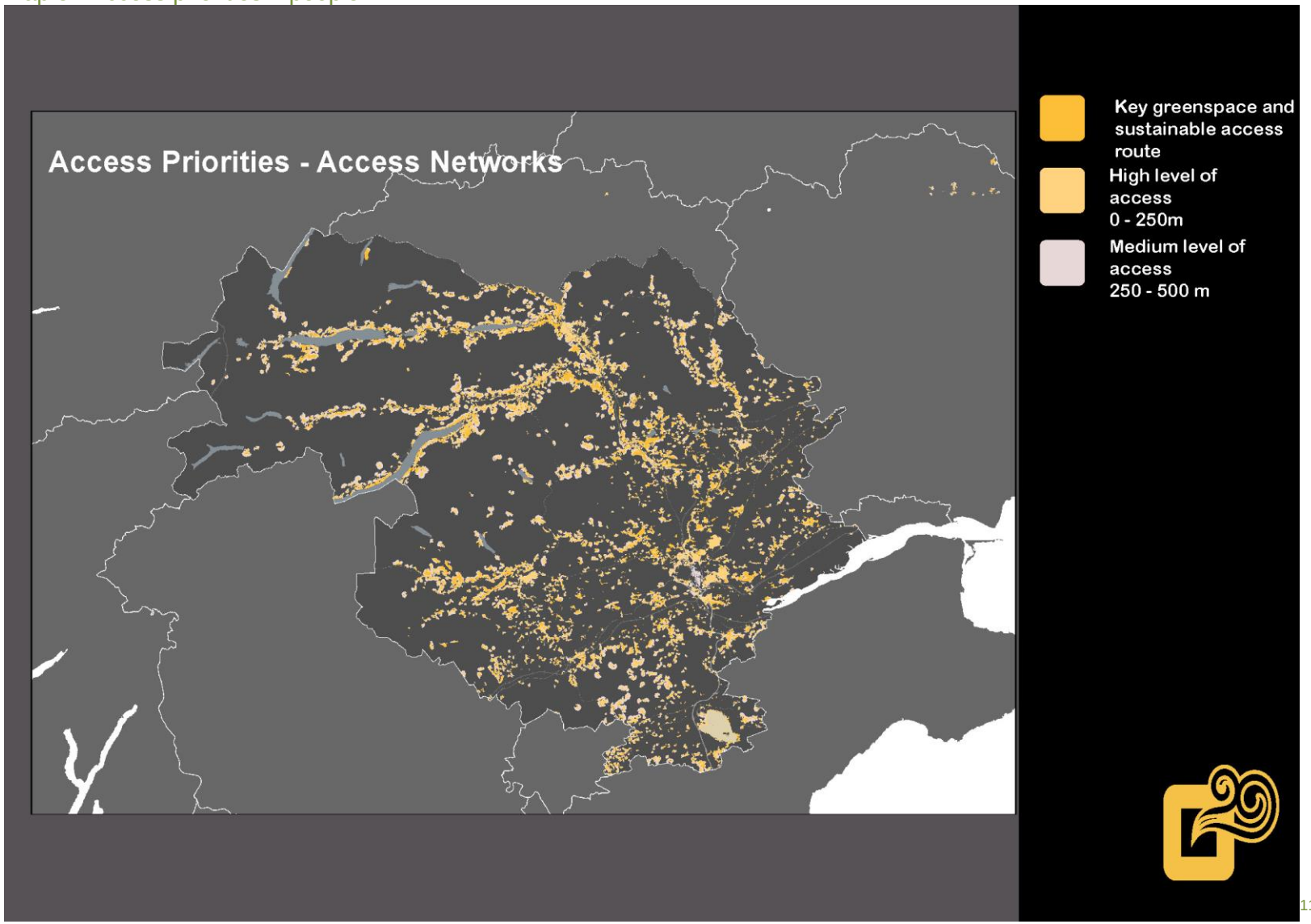
Map 5: Access priorities – people



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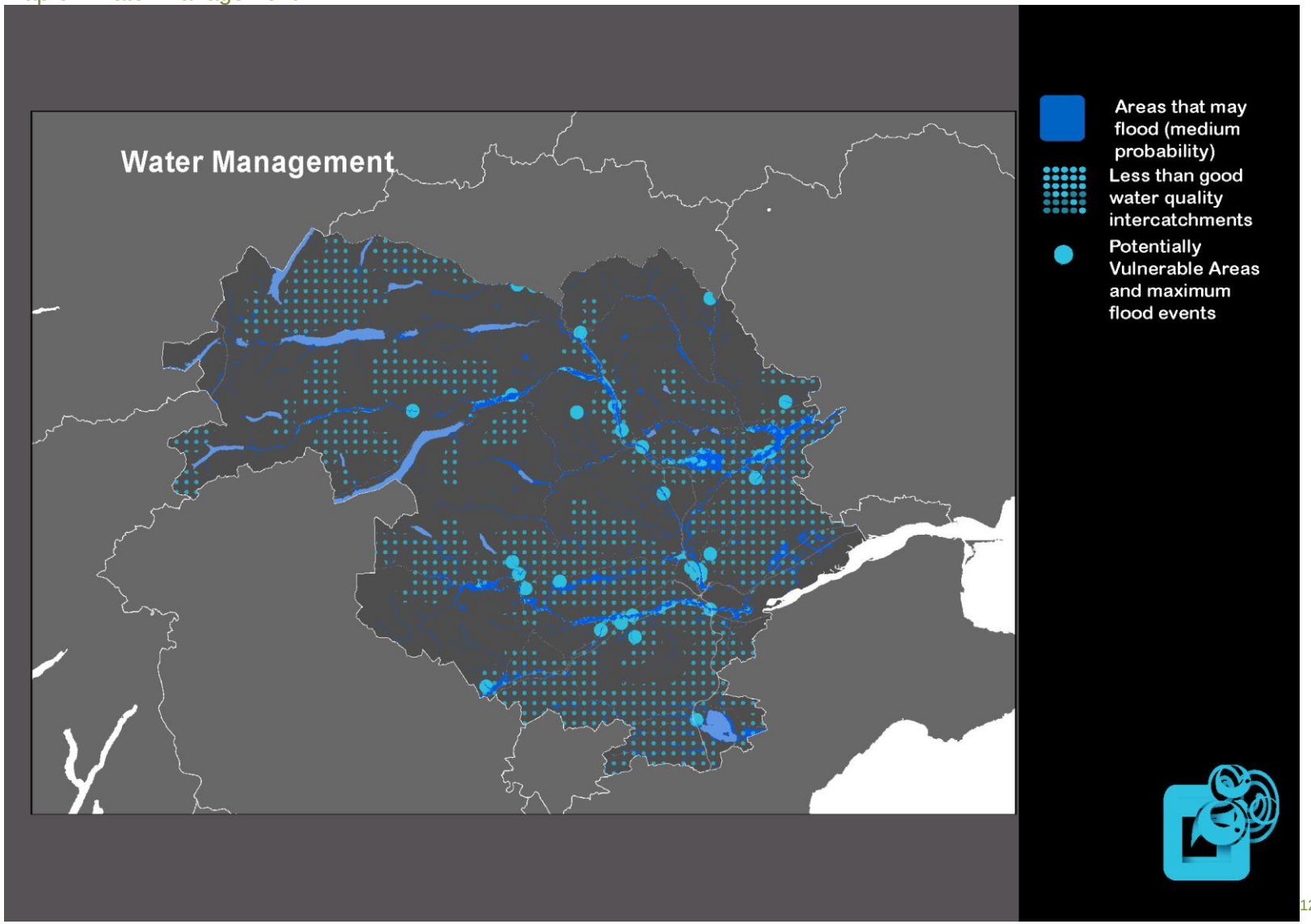
Map 6: Water management



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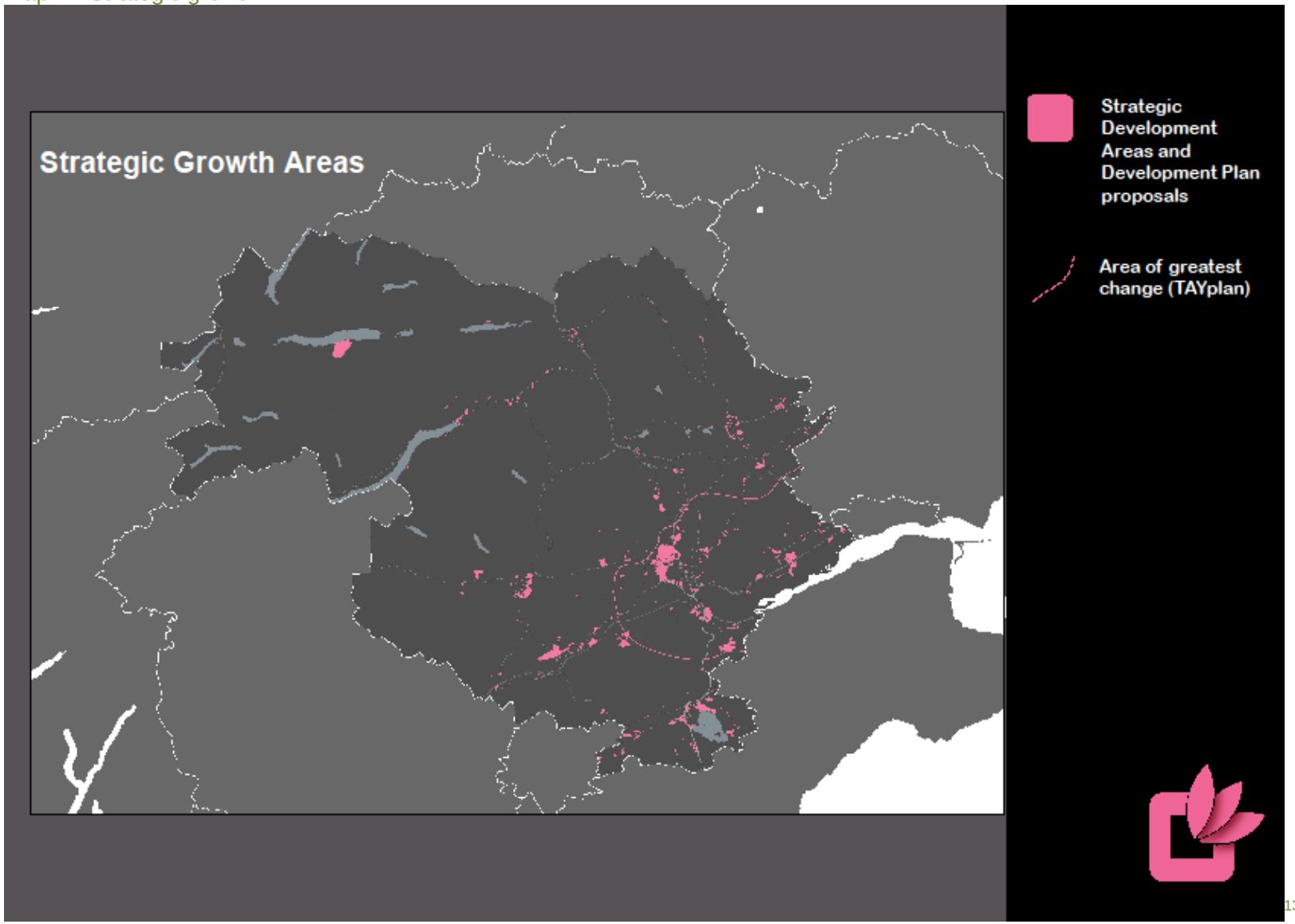
Map 7: Strategic growth



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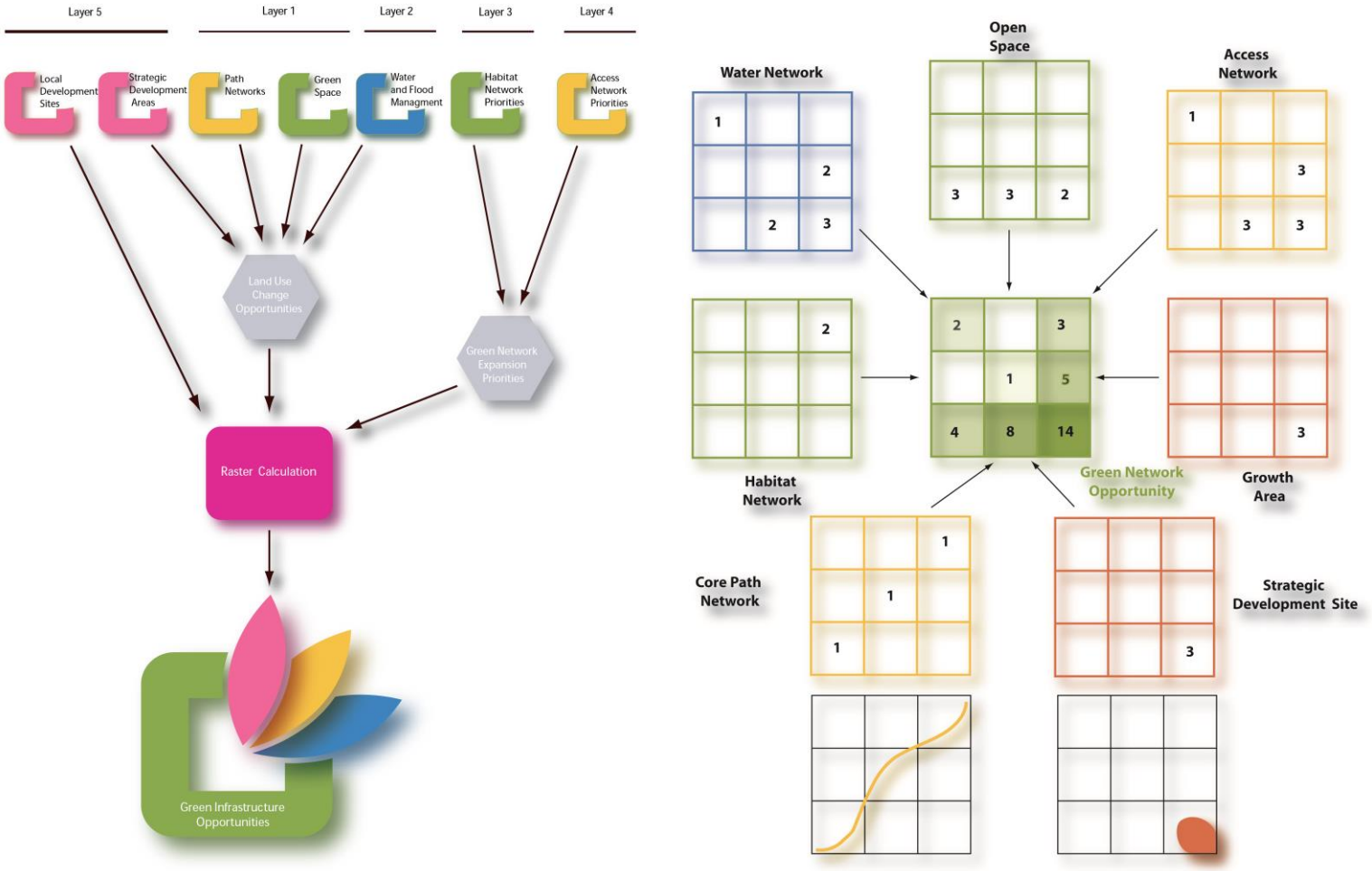
3.3 Analysis

A multi attribute GIS model was used to weight and combine the datasets detailed above to produce the final Green Infrastructure map (Map 7.1). The final map identifies strategic priority areas or 'hotspots', which represent those areas where the most public benefit will be derived from delivery of the green infrastructure. These strategic opportunity areas are defined by the highest scoring clusters of 100m cells (Figure 3).

Figure 2: Multi attribute GIS Analysis and raster calculation



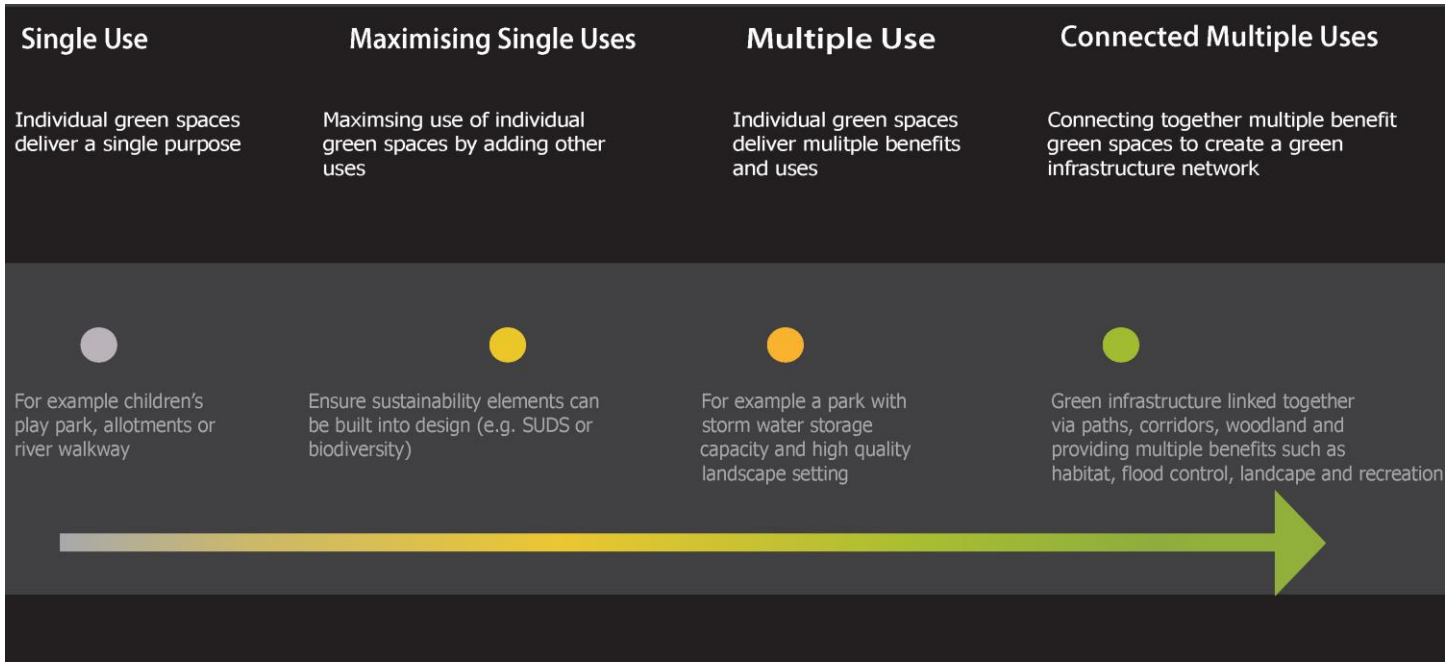
4. Analysis Outputs

Green infrastructure strategy map outputs are provided for each of the three scales – strategic, local and an example of site scale. Map outputs are

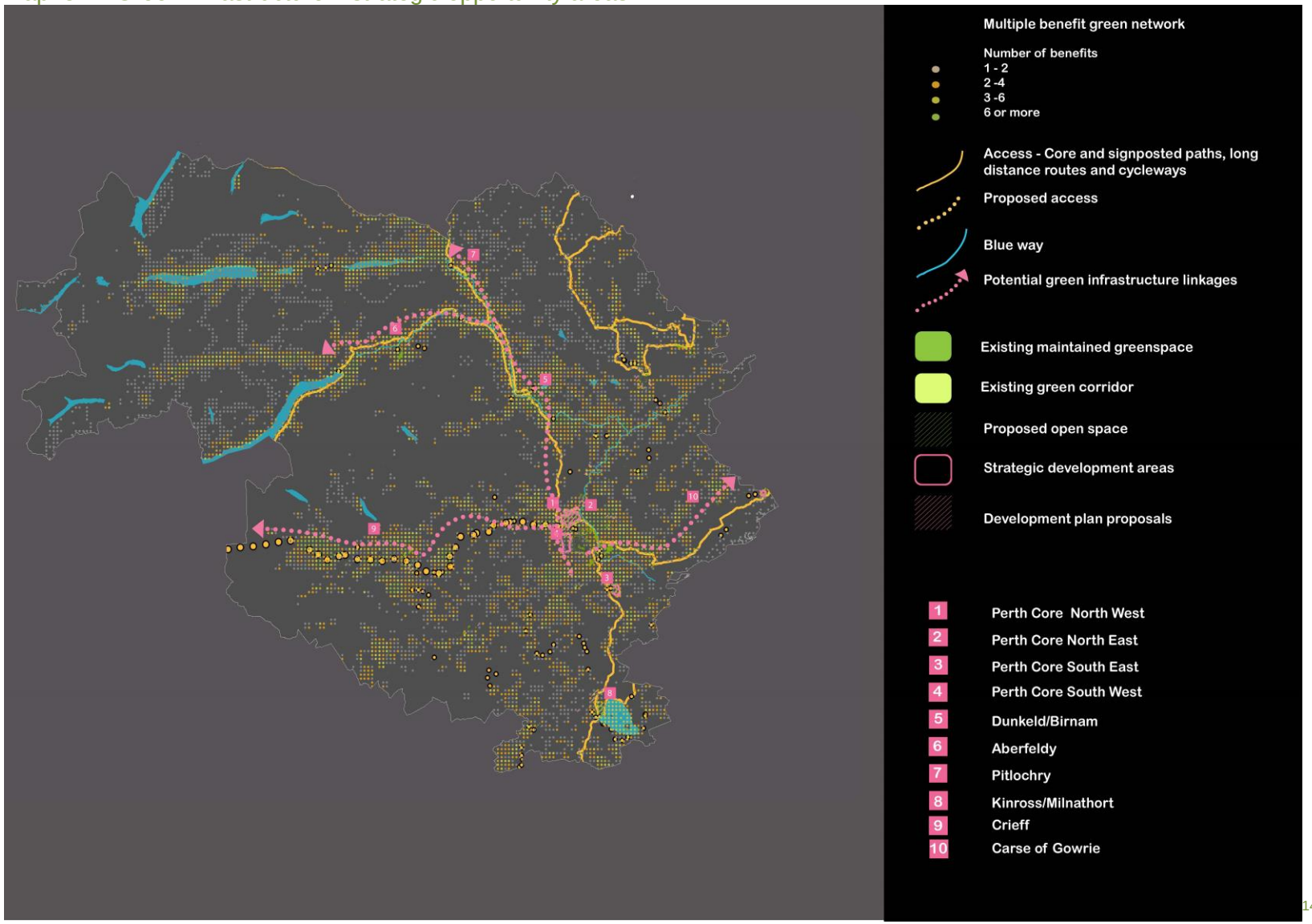
- Individual data layers for each of the strategic landscape level opportunities (habitat, access, culture and landscape and water management
- Green Infrastructure maps which provide an indicative picture of **strategic opportunities** where multiple benefits can be delivered, and the connections between these areas

Green infrastructure opportunity areas were defined using a hot spot analysis which identifies the highest scoring clusters of 100 m grid cells. Maps of identified opportunity areas (Map 8.1 -8.9) are color coded as shown in Figure 3 to make comparisons between locations and areas easier and to help identify which locations offer the least (1 to 2) or most opportunity (6 or more) to deliver multiple benefits (i.e. habitat, cultural and landscape, water management and land use change opportunities).

Figure 3: Green Infrastructure key



Map 8.1: Green infrastructure – strategic opportunity areas



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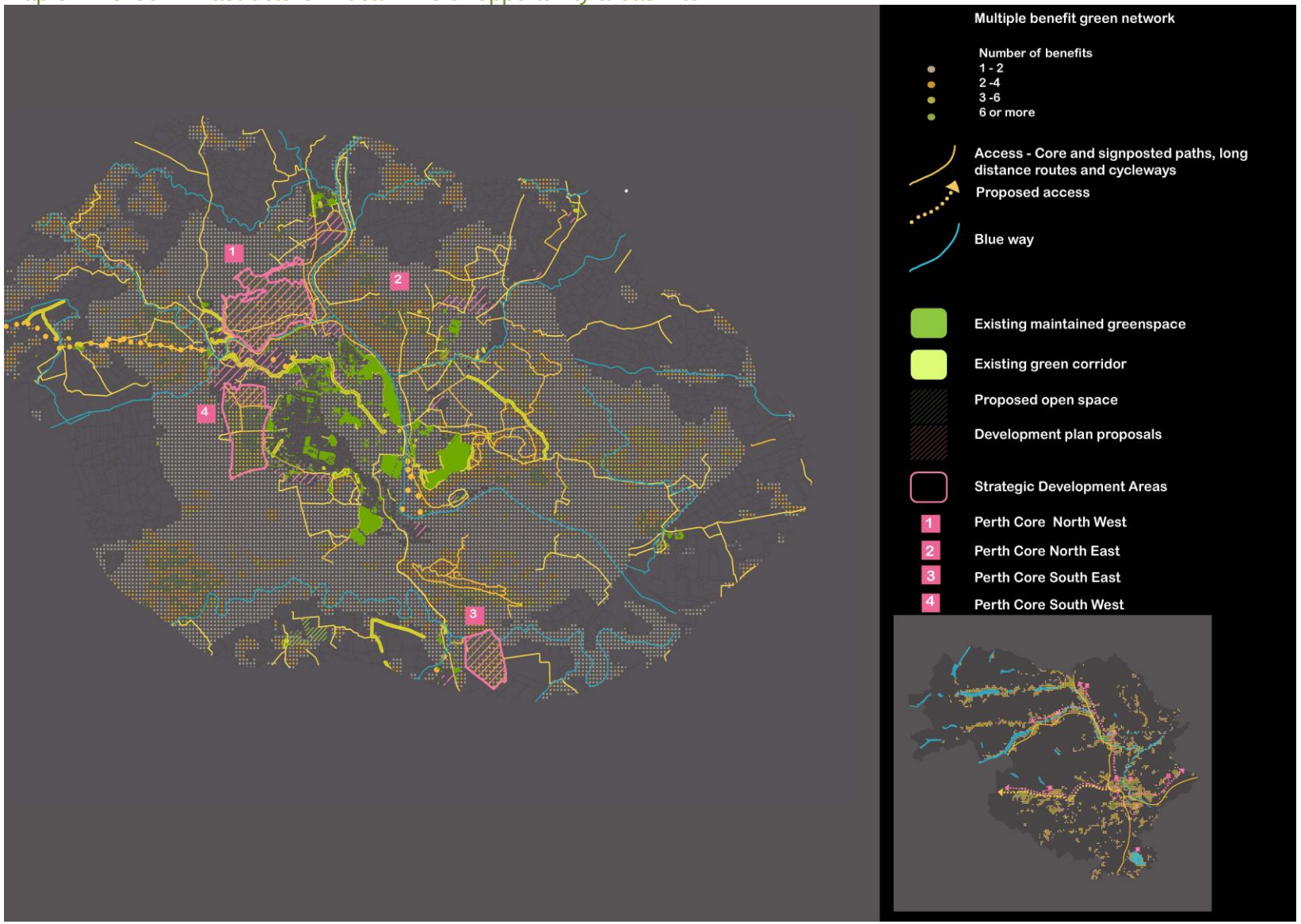
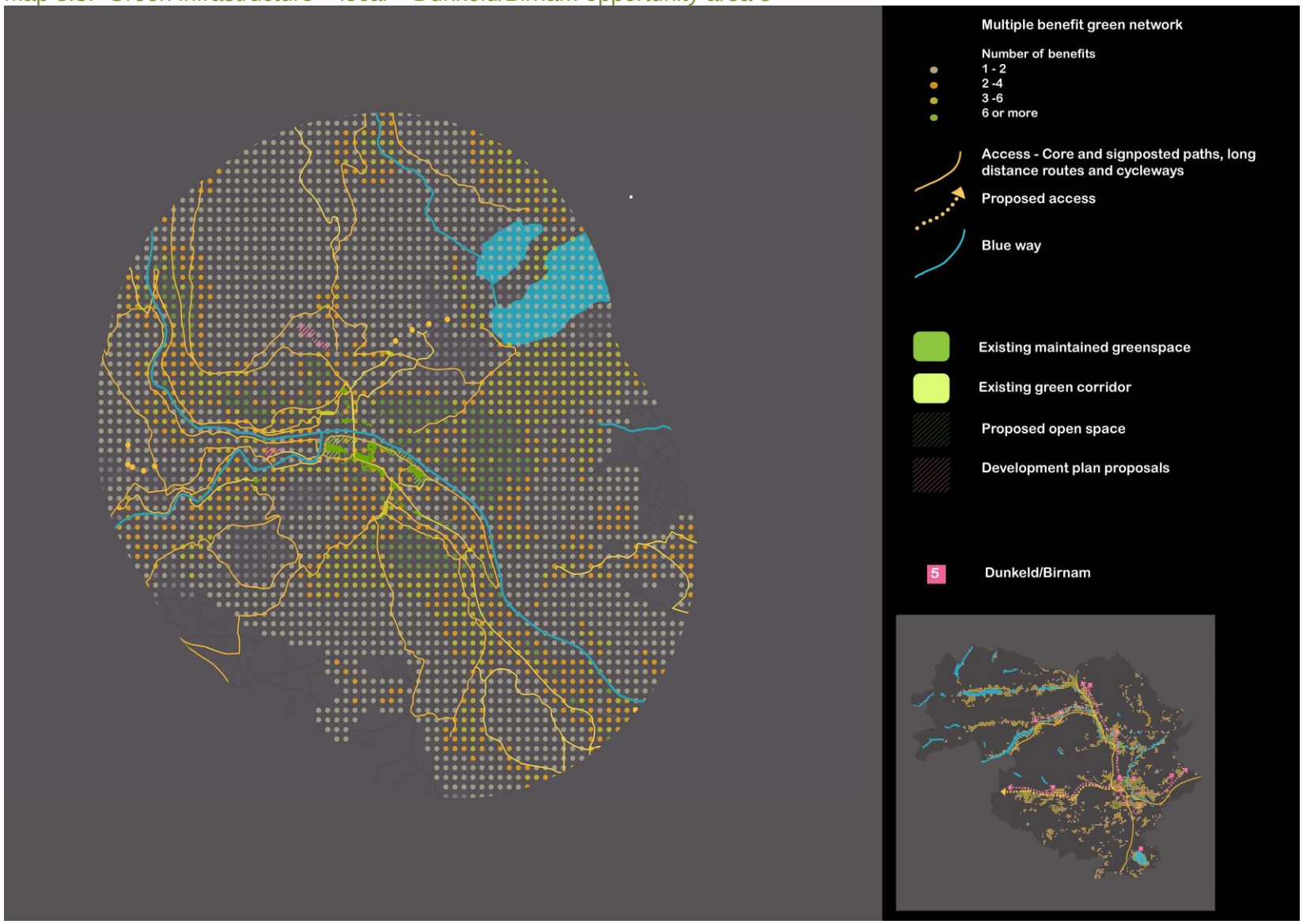
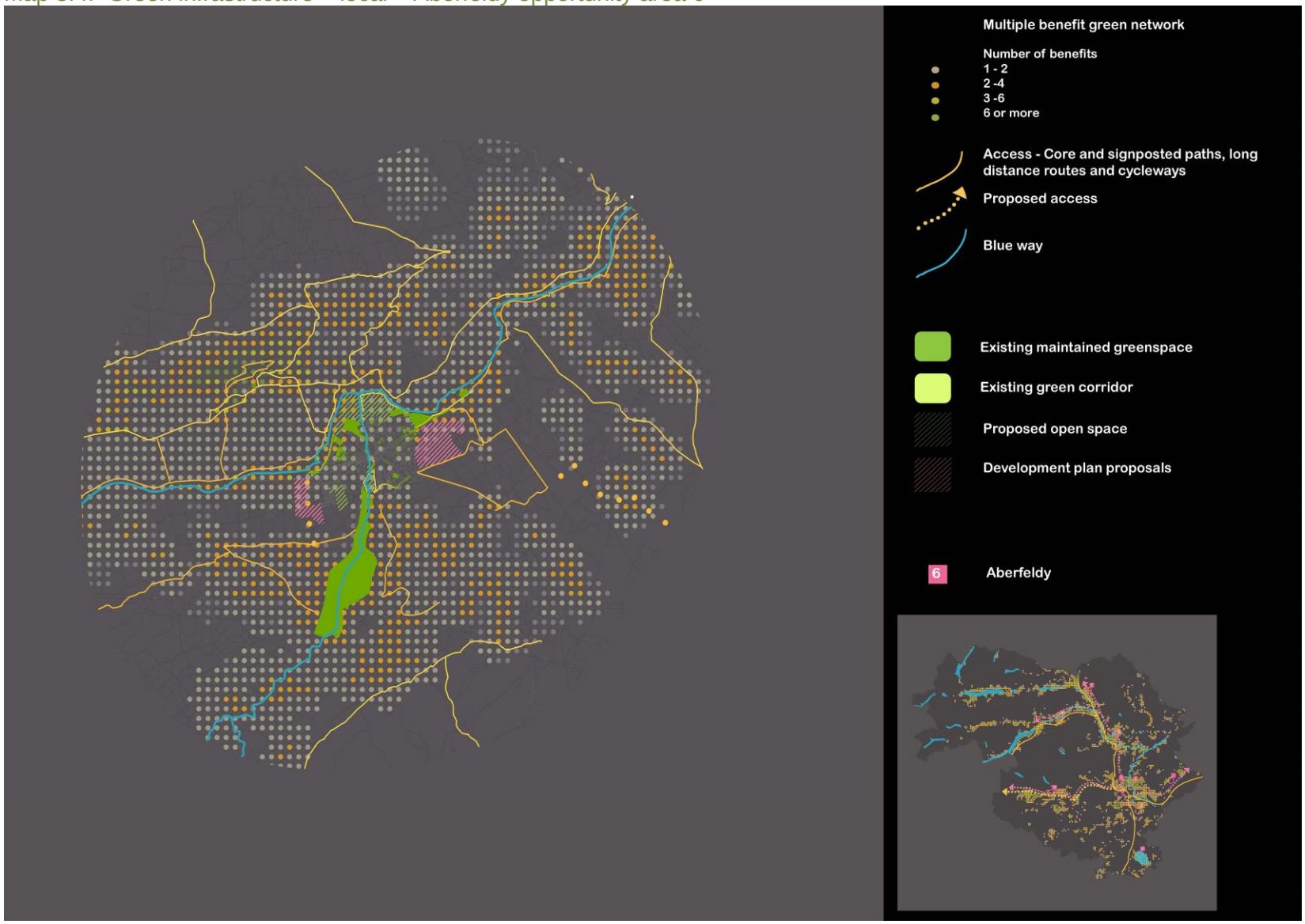
Map 8.2: Green infrastructure – local – Perth opportunity areas 1 to 4



Map 8.3: Green infrastructure – local – Dunkeld/Birnam opportunity area 5

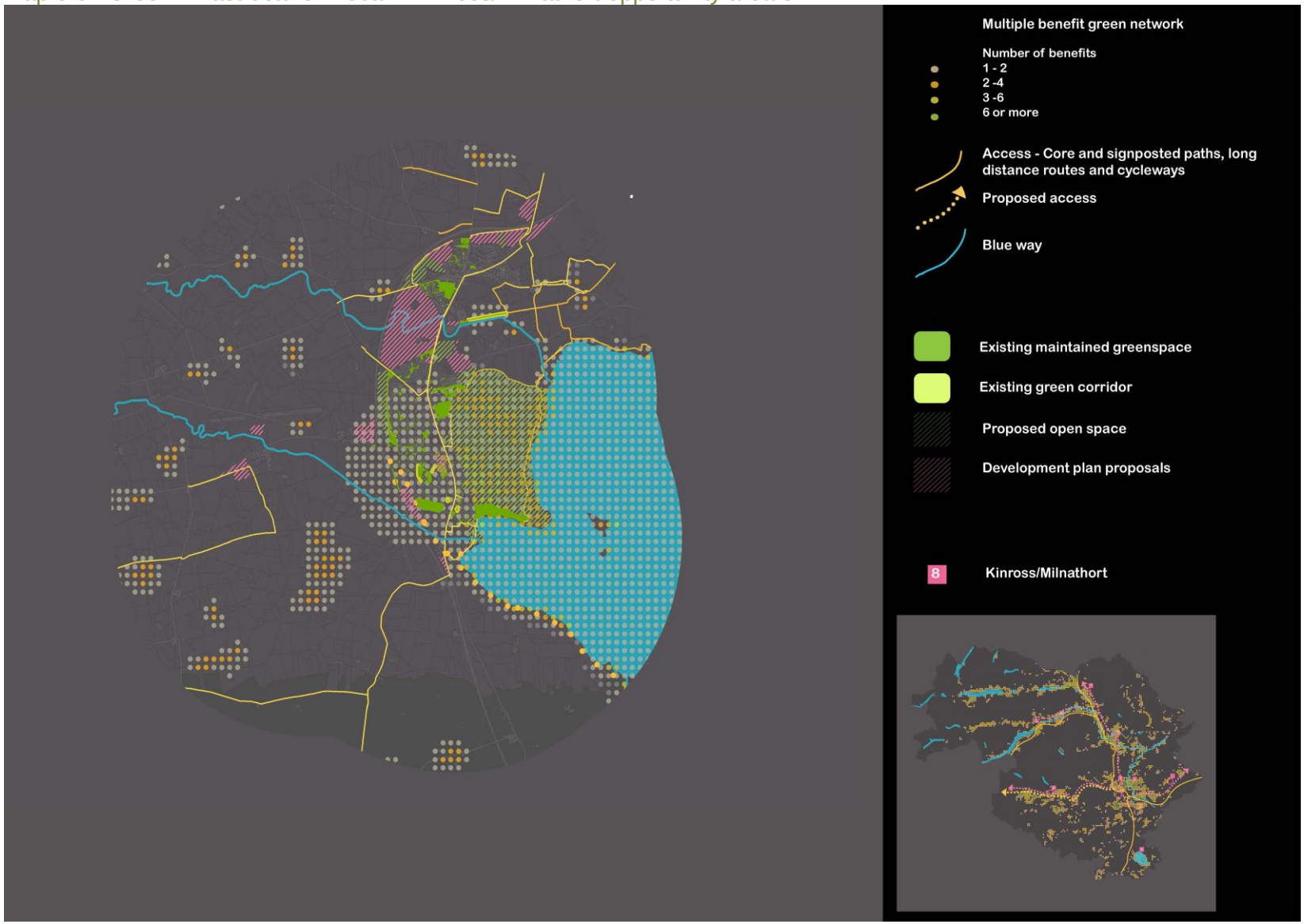


Map 8.4: Green infrastructure – local – Aberfeldy opportunity area 6

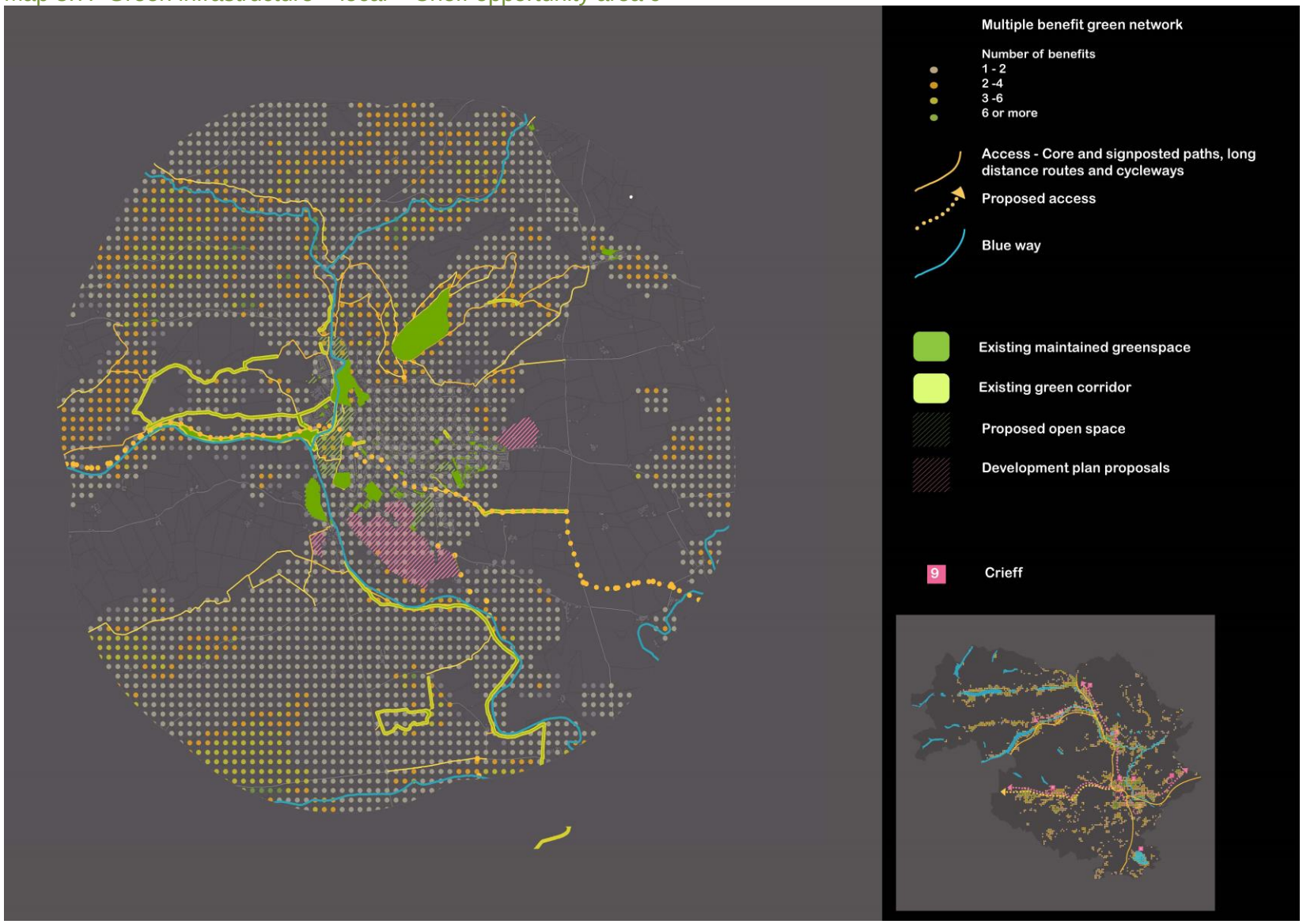


Map 8.5: Green infrastructure – local – Pitlochry opportunity area 7

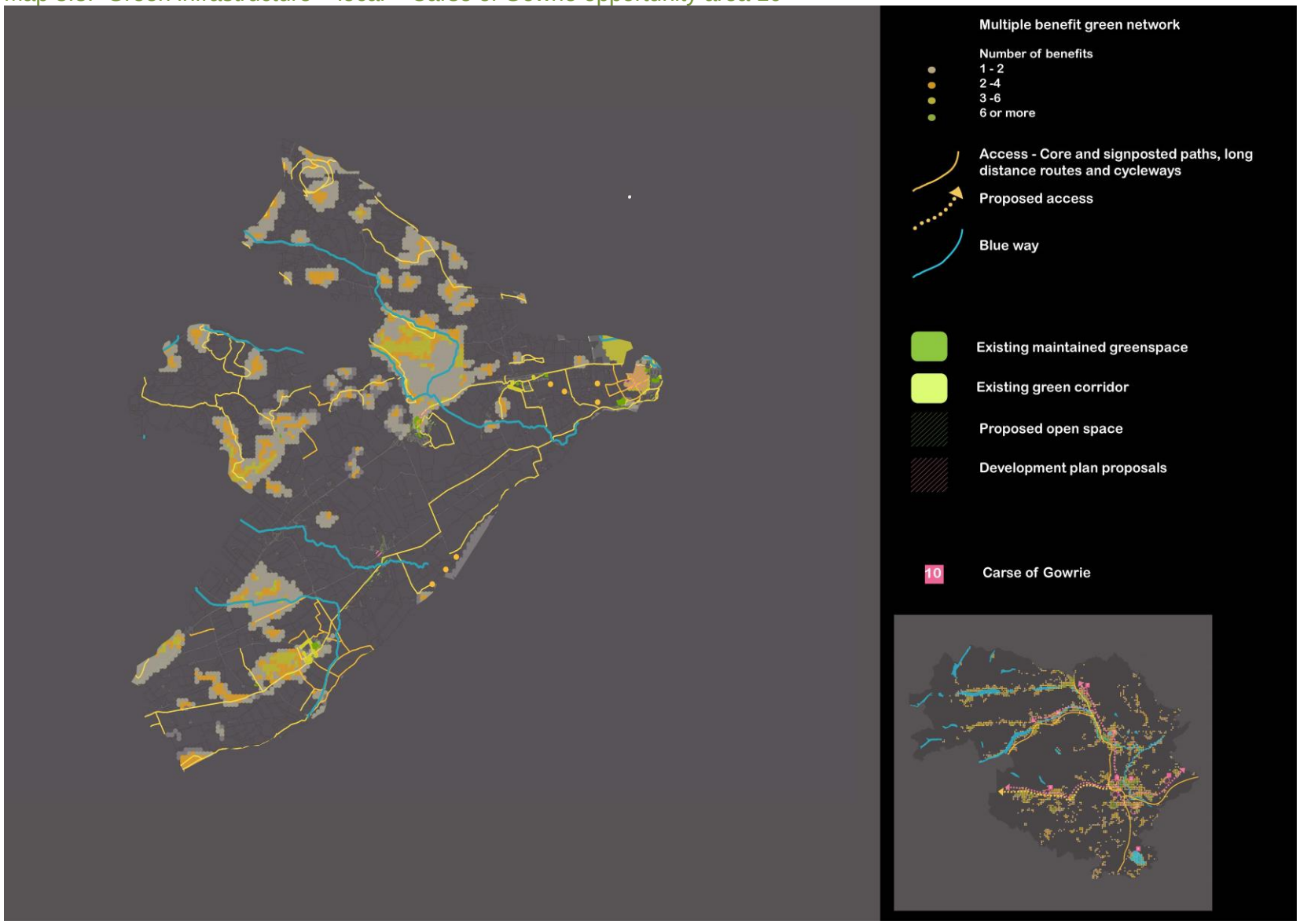
Map 8.6: Green infrastructure – local – Kinross/Milnathort opportunity area 8



Map 8.7: Green infrastructure – local – Crieff opportunity area 9



Map 8.8: Green infrastructure – local – Carse of Gowrie opportunity area 10



Map 8.9: Green infrastructure – site masterplan[15] – Bertha Park

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