Urban Green Infrastructure Target Setting

A City Review

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Executive Summary

Target setting is an important element of green infrastructure (GI) planning for cities. This report focuses on supporting the development of GI targets for Greater Manchester (GM) and its 10 districts as part of the IGNITION project. It presents the findings of a review of GI target setting in 43 international cities, based on the study and analysis of relevant strategy and planning documents. A key outcome of the review is a typology of GI target approaches. Three major categories of GI target are identified: quantitative, thematic and spatial. Each category contains a further 2 sub-categories as shown in Table 1.

Table 1: Target type descriptions for GI.

Quantitative: quantitative targets focused on GI interventions	**Thematic:** targets focus on the benefits of GI	**Spatial:** targets identifying areas for intervention
Coverage: target is specific area of GI cover to be achieved	**Aspirational:** descriptive targets related to GI benefits	**Vision:** high level schematic of future GI extent
Unit: target is specific number of GI interventions to be implemented	**Outcome-orientated:** quantified targets related to GI benefit	**Needs & Opportunities**: spatial prioritisation of locations for future GI interventions

Looking across the 43 global cities analysed within this research, the thematic category and specifically the **Thematic: Aspirational** approach are the most common GI target type. This suggests that targets are often set in relation to desired benefits of GI and tend towards open-ended aspirational statements. However, the majority of these cities have more than one GI target. This suggests there is no 'one-size-fits-all' approach. GI targets vary according to a wide range of factors including GI type, desired GI benefits, resource availability and policy context. A notable exception is London, which consistently presents a **Quantitative: Coverage** target of more than 50% green area and a 10% increase in tree cover as clear headline commitments. There is some geographical variation regarding target types. **Thematic: Outcome-orientated** targets often link to stormwater management in the US, whereas the **Quantitative: Coverage** target is prominent for Australian and Canadian cities, related to both urban forest and green space. Although they do not feature as an explicit target type within this typology, the need to protect and enhance existing GI (in addition to

creating new interventions) is recognised by certain cities and this approach feeds into different targets.

The development of GI targets related to associated set up and follow up activity, and it is therefore important to understand their relationship to baselines and monitoring. The review includes an overview of these aspects of GI planning and target setting informed by learning from the global city review. Broadly, certain types of targets more closely associated with baseline evidence: in particular the **Quantitative: Coverage** and **Thematic: Outcome-orientated** targets which are often based on existing (or in some cases potentially newly created baseline resources) quantified baseline evidence. For other target types, the relationships, as well as the depth and extent of related baselines, varies. In some cases, such as for the **Thematic: Aspirational** or **Spatial: Vision targets**, a baseline may not be needed or appropriate. There may also be cases where a quantified GI target figure is set by other means, such as via stakeholder consultation.

Regarding monitoring, based on the review of available material from the 43 global cities, there are very few fully developed GI target monitoring frameworks currently available. Many documents reference the importance of GI monitoring, but often do not present further details. Again, for certain target types, monitoring may not be possible or even appropriate. Aspirational goals around achieving GI co-benefits in particular pose a challenge here for reasons including the difficulty in attributing the impact of GI interventions to the achievement of particular co-benefits (such as changes in biodiversity or health and wellbeing).

Recognising that different GI target will be appropriate under different circumstances, this report also evaluates the six target sub-categories in terms of data, expertise and resource requirements linked to their set up and follow up. This highlights the significant variation in commitment, and resources, needed if a decision to adopt certain GI target types is taken.

The GI target typology established via the review of 43 global cities is applied to better understand the situation in GM and its 10 districts. This analysis provides a useful overview of GI target setting across GM and its 10 districts, and identifies good practice examples. Exploring localised variety in GI planning increases understanding of current practice in this field, and raises themes including whether harmonised approaches to setting and monitoring GI targets could be beneficial at the city-region scale.

In addition to informing potential next steps for GI target setting in GM and its districts, this report develops transferable learning on this theme that can benefit cities and urban areas engaged in GI strategy and planning processes.

1) Introduction

While there is a solid evidence base and a wealth of tools available to support the establishment, management and evaluation of urban GI, little attention has been paid so far to the role of and approaches to GI target setting. This encompasses questions such as whether and how cities define targets for the protection, enhancement or expansion of their GI, and what the development, implementation and monitoring of these targets means in practice. This is a significant gap as the types of targets proposed by cities, and how these are embedded in and supported by policy frameworks and governance arrangements, are all factors likely to shape urban GI planning and implementation going forward.

These questions are pertinent to the IGNITION project, which focused on developing funding and delivery mechanisms to increase urban GI in Greater Manchester (GM). The project began with a target based on increasing urban GI coverage by 10% by 2038 (from 2018 levels). Work undertaken within the IGNITION project highlighted the challenges associated with achieving this target, and demonstrated that an evolution in approach is necessary.

This report is intended to support and inform the process of developing GI targets for GM. It includes a review of approaches to GI target setting in 43 global cities, which has resulted in the development of a typology that encompasses six GI target categories. The review also shed light on the relationship between GI targets, underpinning GI baselines and approaches to monitoring GI and GI targets. An evaluation of the six GI target approaches is provided in terms of data, expertise and resource requirements linked to their set up and follow up. This highlights the significant variation in commitment, and resources, needed if a decision to adopt certain GI target types is taken.

A review of GM's current GI targets is provided and discussed. This focuses at both the city-region and district scale. This enables an outline of potential opportunities to evolve GI targets in GM to be provided, which can inform further discussion and decision-making on this theme. Looking beyond GM and its 10 districts, this report also contains valuable transferable learning that can support other cities and urban areas working on setting and monitoring GI targets.

2) Developing a GI Target for GM

Origin of the IGNITION 10% increase in GI coverage target

The headline objective of the IGNITION project was to:

- Establish innovative NBS funding and delivery mechanisms to increase GM's urban green infrastructure (GI) coverage by 10% by 2038, from 2018 levels.

The proposal form for UIA funding required quantified targets for the project to be developed. The 10% figure is cited across the IGNITION proposal. The 10% figure originates in work undertaken during the University of Manchester ASCCUE project which ran from 2003-2006 and explored how GI can support climate change adaptation goals. A publication produced to report on the findings of ASCCUE (Gill et al. 2007) presents modelling demonstrating that increasing green cover in high density residential areas (one of a range of different land cover types found across GM) by 10% can keep surface temperatures to around the 1961-1990 baseline level under a high greenhouse gas emissions scenario for 2080. The study also modelled the impact of increasing green cover by 10% in high density residential areas on surface water runoff levels following an extreme precipitation event (associated with a high greenhouse gas emissions scenario for 2080). The 10% increase in green cover reduces surface water runoff levels in comparison to a situation where GI cover stays the same, but this scenario still sees runoff 65% higher than the 1961-1990 baseline level. Therefore, increasing green cover by 10% can have a substantial positive benefit in terms of reducing surface temperatures (in high density residential areas), and a positive but less significant benefit in terms of reducing surface water runoff. Related research looked the effect on surface water runoff levels, under future climate change conditions, of increasing green cover by 10% within the river Irwell catchment. This reached a similar conclusion – that a 10% increase in green cover is not enough to keep runoff volumes at current baseline levels when climate change uplift in precipitation levels is factored in (Carter et al. 2017).

This research suggests that a 10% increase in urban GI by 2038 can be viewed as an important part of GM's climate change adaptation response but it is no silver bullet. This is particularly the case

concerning GM's key challenge of flood risk management and adapting to projected increases in precipitation extremes across the year and winter precipitation volumes. A 10% increase in GI is only part of GM's adaptation solution, and should be seen as an element of a wider set of adaptation measures.

Understanding the feasibility of the IGNITION 10% increase in GI coverage target

The IGNITION GM GI baseline provided a better understanding of GM's urban GI resource. It established that GI (green and blue space) currently covers 55.28% of GM's urban area. This figure incorporates a range of different GI cover types, including trees, scrub and grass for example (see the IGNITION deliverable D2.4.2 for further details). Increasing GI coverage by 10% to meet the original IGNITION GI target would mean increasing this figure to 60.81% by converting 5.53% of GM's urban area (or 33.88km²) that is not currently classed as GI to GI. It is unlikely that existing land cover types such as the transport network (11.83% of GM's urban area, or 77.5km²) and buildings (16.44% of GM's urban area, or 100.74km²) will be converted to GI, although interventions such as green roofs could make a small impact. This highlights that large proportions of land cover types such as carpark/manmade surface (7.62%/46.69km²) would need to be converted to GI to meet the coverage-based target originally adopted by IGNITION. The GM GI baseline highlights the scale of the challenge associated with taking an 'expansionist' approach to increasing GI in GM that is framed around increasing urban GI coverage by 10%. Without major changes in GM's urban land cover characteristics, this could prove to be a very difficult target to achieve in practice due to a lack of available space in GM's urban area to convert to GI.

In addition to the clear challenges posed by the original coverage-based IGNITION GI target in terms of land availability, this approach also leads to taking a 1-dimensional perspective of urban GI. Here, the focus is on achieving increases in GI surface cover, making it difficult to account for GI schemes that result in changes in surface cover or enhancement of existing GI. For example, GI schemes related to activities such as increasing tree cover in grassed areas (e.g. parks), where the GI surface cover area remains the same, would not be picked up if a coverage-based GI target is selected and monitored. GI quality and functionality themes are therefore less relevant to meeting this type of GI target. Accounting for these issues and challenges, a decision was taken by the IGNITION partnership to move away from an 'expansionist' GI target, based on increasing GI coverage, and to explore other target options.

Evolving the IGNITION GM GI target

The IGNITION project provided a springboard for setting a GI target for GM. However, learning generated within the project enabled the IGNITION partners to establish that the original target needed to evolve. From a practical perspective, it is recognised that GI interventions in GM will

encompass a range of activities. These include measures such as tree planting in paved areas as well as enhancing existing green spaces by, for example, tree planting in grassed areas where canopy coverage is currently low. In both cases, GI within the area of intervention and the benefits offered by this GI (e.g. shading and cooling, provision of habitat), are 'uplifted'. These types of GI interventions are important in urban contexts such as GM where space to convert larger areas of land from 'grey to green' is limited. A GI target that is reflective of these issues is therefore potentially valuable.

This provided a context for this study on GI targets, which focused on exploring alternative approaches to setting GI targets that could potentially be adopted by GM. If it is feasible to do so, the IGNITION project pipelines and funding streams could be evaluated in terms of their contribution to any new GI target(s). This will depend, in particular, on data availability on the pipelines and funding streams emerging from the IGNITION project and the specific projects that they contain. Further, depending on the GI target(s) selected, options to monitor progress towards their achievement could inform preferred GI monitoring approaches for GM.

3) City Review Methodology

This report is based on a systematic review of the GI strategies and frameworks developed and implemented by cities internationally, including a detailed evaluation of GM and its 10 districts. The main aims of this review were:

- To establish a typology of GI targets.
- To identify relationships between GI target types and related baselines and monitoring.
- To identify and report on case studies that highlight different GI target types and related themes.
- To develop transferable learning to support urban GI planning.

The review covers a range of cities that represent different geographical regions and urban contexts, enabling the study to map out the breadth of GI target types applied in practice. It also provides an in-depth look at varying GI target types and different framings of GI to enable the creation of a robust and representative typology that can be used to inform GI decision-making in different contexts. The following three steps outline the review methodology:

1) City scoping and selection

The scoping process for selecting cities to include in the review centred on identifying places with an established interest in or commitment to GI, as well as targeting major urban centres. Scoping was iterative and based on the following considerations to inform the selection of cities:

- Cities which are or had been partners, members or case studies in major European GI projects (see Appendix A for a list of projects reviewed).
- Cities highlighted as case studies in academic and grey literature.
- Cities referenced in other cities' strategies.
- The 15 most populated cities in UK based on https://www.centreforcities.org/data-tool/ (selected for size – total population), in order to develop a fuller picture of the UK context given the focus of the IGNITION project on GM.
- The largest 4 cities, by population, in the US, Canada, Australia where they had not already been covered.

N.B the 10 GM districts were not scoped via this method, as they are of localised significance.

2) Document Search

The next step was to search for available GI plans and strategies published by the cities identified via the scoping process. The search was carried out in Google, using the following search string:

"green infrastructure" **AND** [city / district name] **AND** strategy **OR** plan"

If this search string did not produce any results, additional related search terms were introduced (e.g. "open space plan", "environment strategy"), reflecting the breadth of GI terminologies and planning contexts. These additional search terms were based on the terminology used in other cities (e.g. identifying that GI may be included in "resilience strategies") or the prevalent GI thematic focus for different countries (e.g. "green stormwater infrastructure" within US cities).

3) Document selection

The GI documents retrieved via the process outlined in step 2 were then filtered according to the following criteria to arrive at a sample of GI plans and strategies to review:

- Focus on city scale: this included municipal and city-region level plans and strategies, but excluded documents focused on neighbourhood or regional levels, in order to keep the focus on the city and urban GI. For some locations this meant that documents from different governance levels were included, such as the municipal Open Space Strategy for the City of Glasgow [2] and the Green Network Strategy for the Glasgow City Region [3].
- English language: at least one substantial document needed to be available in English for a city to be included in the document review. Ideally this would be a plan or strategy published by the city authority, although case studies or summaries within relevant documents were included where they presented enough relevant information for the review. Note: The language requirement criteria resulted in the exclusion of Montreal as one of the most populous Canadian cities.
- Documents current until at least 2021: the selected documents were required to cover a period up to at least until 2021(where an explicit time horizon is given). This criterion was set to avoid gaps in GI development, for example where a city had published plans for earlier years with no current follow up. An exception was made for European cities, where English language information was limited and no alternative current documents could be found.
- Focus on strategic documents: as the focus of this task is on informing strategic GI target development, the selected documents were largely strategic in nature, including frameworks, plans and strategies. Where strategic documents were not available, the review covered action plans or case studies. For some cities, supplementary materials such as maps and technical reports were added where they contributed further relevant detail.
- Focus on multiple benefits and connectivity: our approach encompassed documents using a range of terms related to 'green infrastructure'. Some made specific reference to 'GI' whereas others focused on related themes such as 'open space', 'green space' or 'resilience'. Terms such as these were included if they made reference to both multiple benefits and connectivity, which are described as the broad overarching features of GI (European

Commission 2013). Where a city used multiple relevant interpretations of GI, a maximum of 2 of these were included (e.g. for some US cities, documents on stormwater infrastructure and urban forest were included but not open space strategies).

A detailed analysis of the GM and its 10 districts followed the same process.

Table 2 shows the final list of selected cities. A full list of documents included in the review is provided in Appendix B (which is available as a separate excel document on request).

Table 2: Final Cities List

UK		**USA**	**Canada**	**Australia**	**EU**
Aberdeen	Leicester	Chicago	Calgary	Brisbane	Amsterdam (NL)
Belfast	Liverpool	Houston	Toronto	Melbourne	Bari (IT)
Birmingham	London	Los Angeles	Vancouver	Perth	Bergen (NO)
Bradford	Greater Manchester	Milwaukee		Sydney	Dublin (IR)
Bristol	Newcastle	New Orleans			Leipzig (DE)
Cardiff	Nottingham	New York City			Milan (IT)
Edinburgh	Portsmouth	Philadelphia			Stockholm (SWE)
Glasgow	Sheffield	Portland			Stuttgart (DE)
Leeds	Southampton	Seattle			Utrecht (NL)
	18	**9**	**3**	**4**	**9**
					43

Limitations

This review process has not resulted in an exhaustive assessment of GI targets in the selected cities. Instead, it presents an overview of the target setting landscape, and identifies target types and explores issues linked to their application in practice.

One of the major limitations concerns the Document Search (Step 2). The Google search algorithm restricts the range of our results, and in some cases GI policy documents may have been missed due to alternative terminology being used. Additionally, GI documents are not always easily retrievable from council or city web pages, or have not been updated over recent years. Any exclusions from this review should therefore not be taken as a judgement on a city's lack of engagement with GI target setting, baselines and monitoring, and may be due to a lack of access to documents. However, the goal of this study is not to critique approaches taken in individual cities, but to use examples of

GI targets from practice to understand more about this theme and to use examples of targets to develop a typology of GI targets.

The focus on English-language documents clearly prioritises cities in English-speaking countries. The analysis of non-English speaking cities included in the review tends to be based on case studies or English language summary documents. These are generally less detailed than the plans or strategies, and further research was generally not possible as related documents were only available in the local language. Consequently, there is a gap in the review from this perspective. A case study review similar to the one conducted by the Urban Gaia Project, which engaged local partners to review GI planning documentation across Europe or other global regions, would be a useful next step.

4) GI Target Typology

Typology Development

A key goal of this task was to produce a typology of GI targets to inform GI planning and decision making. The GI target typology outlined below was developed through an iterative review process focused on identifying statements around targets outlined within GI frameworks, plans and strategies and related documentation within case study reports. The understanding of the term 'target' in this context is rather loose. It refers to the ambitions around GI development and implementation set out by different cities, and it includes visions, goals and priorities as well as measurable indicators. The term 'target' can be therefore descriptive or quantitative, and occur at varying levels of specificity. While this usage departs from the more common distinction between goals as value statements and targets as measurable objectives leading towards these goals (Berke and Godschalk 2009), it allowed us take a wider view on how GI ambitions are framed and presented. An initial categorisation of GI targets was undertaken, which established the three higher level categories: quantitative, thematic and spatial. In the final step, we developed sub-categories for each higher level category which distinguish abstract and specific targets (for the thematic and spatial target categories) and different ways of quantifying GI (for the quantitative categories).

The final typology is presented in Table 3, with a list of targets for each city outlined in Table 4. The subsequent sections take a closer look at the targets, drawing out emerging themes regarding common target types, single and multiple targets, the target setting process and targets relating to existing GI. This is followed by an analysis of baseline and monitoring approaches and their relationship to the targets. Chapter 7 then outlines six case studies, one for each target sub-category, which provide further details on the different targets and their framing.

Table 3: Target Typology Overview

Quantitative		Thematic		Spatial	
Quantified targets for the implementation of GI interventions. Provides a specific figure for how much GI should be present or created. Often associated with a specific time frame for achieving target.		Targets focused on the benefits of GI, rather than the GI interventions themselves.		Targets identifying areas for GI interventions or achieving GI benefits. Explicit reference made to specific locations or the wider geography of the city, usually via maps.	
Target Sub-Categories					
Quantitative: Coverage (QC)		**Thematic: Aspirational (TA)**		**Spatial: Vision (SV)**	
% of area or absolute area to be covered by a specific type of GI. Most frequently applied to tree cover and green space.		Descriptive goals related to expected benefits of GI interventions. Sometimes framed as guiding principles for wider green city planning. Most common themes are enhancing well-being, biodiversity, ecosystem services.		High level schematic of GI networks, usually indicating corridors to be protected or developed. No explicit reference to specific locations.	
No. of cities : 16	**Example: Melbourne**	**No. of cities : 21**	**Example: Glasgow**	**No. of cities : 11**	**Example: Belfast**
Quantitative: Units (QU)		**Thematic: Outcome-orientated (TO)**		**Spatial: Needs & Opportunities (SNO)**	
Number of GI units or features created, annually or over duration of strategy. Most commonly applied to trees or individual GI projects (e.g. stormwater capture interventions). Also includes target related to money to be invested in GI projects over a specified time period.		Quantified target related to achieving GI benefits. Most commonly applied to access to green space and stormwater drainage (in US cities).		Spatial prioritisation of locations for future GI interventions based on analysis of needs and opportunities. In some cases, specific project locations are identified (e.g. sites of future parks).	
No. of cities : 9	**Example: Southampton**	**No. of cities : 12**	**Example: Seattle**	**No. of cities : 12**	**Example: Birmingham**

Table 4: Cities and their GI target types

Region	City/town	QC	QU	TA	TO	SV	SNO
UK	Aberdeen			X			X
	Belfast			X		X	
	Birmingham						X
	Bradford						X
	Bristol			X	X		
	Cardiff			X			
	Edinburgh	X	X		X		X
	Glasgow	X		X	X	X	
	Leeds			X			
	Leicester			X		X	X
	Liverpool			X			X
	London	X					
	Manchester (GM & City of Manchester)		X	X		X	X
	Newcastle			X		X	X
	Nottingham					X	X
	Portsmouth					X	
	Sheffield			X			
	Southampton		X				
Australia	Brisbane			X			
	Melbourne	X		X			X
	Perth	X					
	Sydney	X	X	X			
USA	Chicago	X	X		X	X	
	Houston		X	X			
	Los Angeles		X		X		
	Milwaukee	X			X		X
	New Orleans				X		
	New York City				X		
	Philadelphia	X	X	X	X		X
	Portland				X		
	Seattle	X			X		
Canada	Calgary	X		X			
	Toronto	X		X			
	Vancouver	X	X		X		
Europe	Amsterdam (NL)	X		X			
	Bari (IT)	X					
	Bergen (NO)						
	Dublin (IR)					X	
	Leipzig (DE)						
	Milan (IT)	X				X	
	Stockholm (SWE)			X			
	Stuttgart (DE)						
	Utrecht (NL)			X		X	

5) GI Targets – Emerging Themes

The most common target types

Table 5 shows the number of times each target sub-category type appears across the city sample. With 21 occurrences, the most frequently represented target type is **Thematic: Aspirational** (TA), which comprises descriptive goals related to the benefits it is hoped will be achieved through GI interventions. These most commonly concern enhancing well-being, biodiversity and ecosystem services. The spectrum of targets included here is quite broad. At one end, there are statements linking GI to expected benefits in a very general way (e.g. in Glasgow's Open Space Strategy ([2], p.10), open spaces and GI are expected to "contribute positively" to the city's liveability and resilience, as well as the health and well-being of its population, flora and fauna). On the other, TA-type targets can describe clear thematic goals without quantification, as is the case for Melbourne's Nature in the City Strategy [4], which aims for a "net increase in biodiversity, habitats, and ecosystem health" and a" more ecologically connected city" (p.47) by 2027. This is followed, with 16 occurrences, by the **Quantitative: Coverage** target type (QC), which sets a target figure for GI coverage in the city, most commonly for tree canopy and green space. Australian and Canadian cities feature prominently here. Looking at the higher level categories, thematic targets are most common (see

Table 5), suggesting that GI outcomes and benefits are an important reference point for strategic GI planning.

Table 5: Target types and their frequency

High Level Target Type	Quantitative	Thematic	Spatial
Number of Occurrences	24	33	23

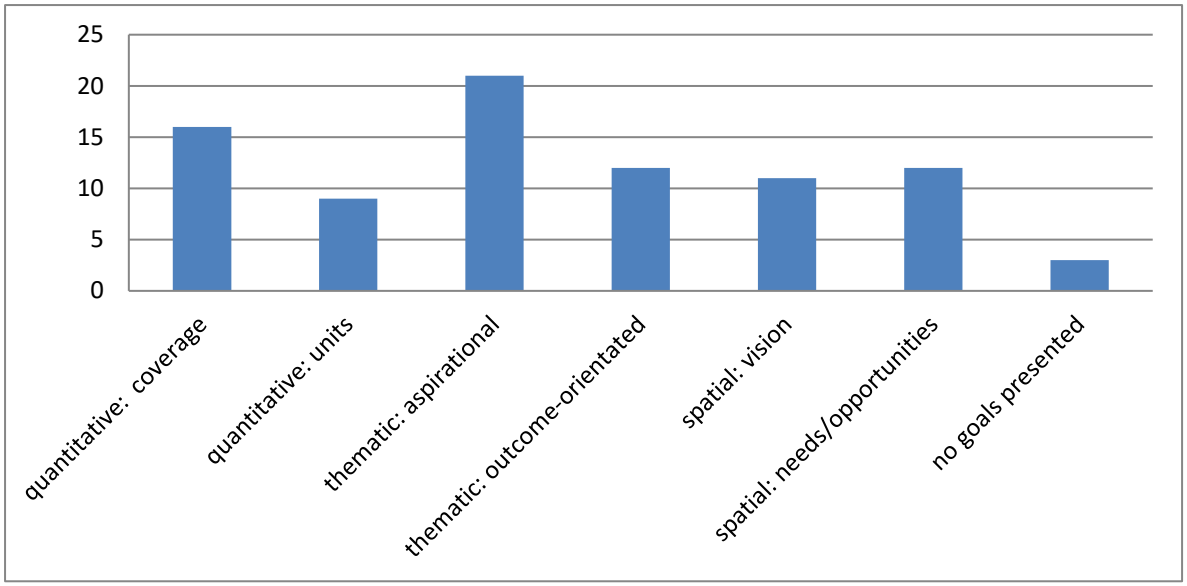


Figure 1: Target types across all cities

*Across all cities, the **most common target type is thematic**, with **Thematic: Aspirational** targets the largest single group. This suggests that **targets are often set in relation to the desired benefits of GI.***

Single and multiple targets

Around one third of cities reviewed (14 out of 43) include a single type of target in their GI documentation. The majority of cities present a mix of targets either within the same document or across different documents and linked to different types of GI. The highest numbers of target types identified for a city was 5 (Philadelphia – see Table 6: Multiple targets for Philadelphia) with several cities presenting 4 targets (Glasgow, Edinburgh, Chicago and Manchester). This suggest that GI target setting is not a 'one size fits all' approach, with different target types used depending on the type of GI in question, the spatial scale (municipal / metropolitan) and the planning context (e.g. strategy / implementation plan). For three of the European cities (Bergen, Leipzig and Stuttgart) no targets could be established from the available English-language documents, although they may be present in local language sources.

*Almost **two thirds** of cities have **more than one type of GI target**. Targets are **not a 'one size fits all' approach,** and differ according to needs and context.*

Table 6: Multiple targets for Philadelphia

Target	GI Focus	Details	Reference
Quantitative: Coverage	Urban Forest	Increase overall canopy cover to 30%, a total of 7,200 acres	[5] p.17
Quantitative: Units	Green stormwater infrastructure	Commitment to have invested $2.4 billion by the end of the 25 year implementation period	[6] p.4
Thematic: Aspirational	Green stormwater infrastructure	Improved recreational space and habitat enhancement, improved water quality standards	[6] p.3
Thematic: Outcome-orientated	Green Space	Access to neighbourhood parks or recreation space within 10min walk for all Philadelphians	[5] p.16
Spatial: Needs & Opportunities	Green stormwater infrastructure	Prioritisation map including drainage area, proximity to low point and community relationships	[7] p.10

Case Study: A single target approach - London

Unlike the example from Philadelphia, London's GI approach is notable for its focus on one consistent, quantitative headline aim: to become "the world's first National Park City, where more than half of its area is green and tree canopy cover will increase by 10 per cent" ([8], p.13). Documents at various levels, from the London Environment Strategy to the Implementation Plan and Tree Cover Map, support this target. Some sources do spell out thematic benefits of London's GI, such as the promotion of healthier living and the reduction of climate change impacts (see [8], p.135). However, these goals are presented in relation to the main target (related to green area and canopy cover) and have therefore not been classified separately. The clear advantage of a single-focus target is its clarity in communication, as it presents a strong and easily recognisable vision.

*A single clear headline target has **advantages in communicating a consistent vision** that is joint-up and easily recognisable.*

Target setting process

While the majority of cities present their targets, goals and aspirations without demonstrating how they were selected or agreed upon, some examples give an insight into the underlying processes. In its 2019 Rain City Strategy [10], Vancouver devotes an entire chapter to its target setting process for green rainwater infrastructure (GRI). It follows the steps shown in Figure 2 (A) to set a performance target for individual sites to be classed as 'managed by GRI' (the target for this standard is for over 90% of average annual rainfall to be managed by GRI practices). This in turn feeds into a citywide implementation target across all sites (which is to manage rainwater of 40% impervious surfaces using GRI as defined by the performance target above). The implementation target was identified through a process of scenario development (shown in Figure 2 (B)). The discussion further outlines the implications these targets have for infrastructure renewal and retrofit on public land, for project financing and for asset management, including maintenance protocols. This level of transparency can be useful for stakeholders during the implementation process.

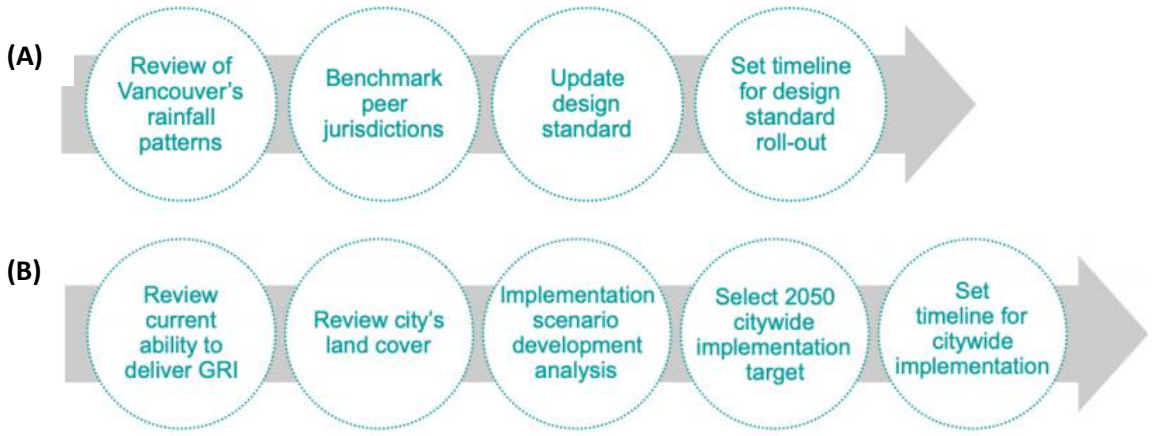


Figure 2: Target setting processes for green rainwater infrastructure (GRI) performance (A) and implementation targets (B) in Vancouver

There is the potential for cities to learn from each other where GI target setting work is documented and communicated. Indeed, several cities present aspirations to develop focused GI plans and targets where these are not yet present. Sheffield's Great Outdoors Green & Open Spaces Strategy [11], for example, cites the development of a GI plan and the definition of targets for the quality of open spaces and local nature sites as one element of its aspirational target linked to the strategic theme of environment and sustainability (p.9). Bradford's Core Strategy Development Plan Document [12] sets out a system that links outcomes, indicators and targets but does not provide any targets for its section on GI and the environment.

*Demonstrating the **target setting process** creates **transparency** and **opportunities for knowledge exchange** and learning.*

Enhancing and improving the quality of existing GI

Targets included in GI plans and strategies are not limited to the provision of new or more expansive GI. The protection and improvement of existing GI features is also an important consideration. A scan of the documents related to the 18 UK cities included in this review reveals that 15 of these cities include reference to “enhancing”, “improving” or “protecting” GI features or their functions. Such references are most commonly found in the associated explanatory framing of GI targets, rather than the targets themselves. Examples include:

- General improvement of overall GI networks: "a network of Green Infrastructure which will be protected, enhanced, developed and managed to ensure that its integrity and connectivity is sustained” (Cardiff [13], p.5).
- Enhancing specific GI features, elements of GI networks or their benefits: “Conserve and enhance London’s wildlife and natural habitats” (London [8], p.12).
- Protecting existing GI features: “Losses in green open space in particular should be […] scrutinised due to its added value for the functions of the green infrastructure network” (Portsmouth [14], p.33).
- Emphasising the need for maintenance as part of a GI strategy: “Existing green infrastructure in the city will continue to require maintenance in order to ensure that it can continue to perform the vital functions it performs. Enhancement work can also help to improve the quality of the GI and potentially increase its functionality.” (Portsmouth [14] p.34).
- Recognising challenges surrounding securing new GI provision: see Liverpool case study below which highlights the need to protect and enhance existing GI given the limited opportunities for creating new GI in the urban core.

In some cases, the targets themselves are explicitly framed around the quality of GI provision. An example here is Perth (Australia). Although the city presents a quantitative coverage target for its urban forest, this sits within a list of goals that acknowledge the importance of canopy quality, species diversity and other factors for its optimum functioning (see case study below).

*Considerations of **GI quality**, and the need to **improve GI structures**, are **important elements** in many cities’ GI strategies. They do not commonly feature within the main targets but **contribute to their wider framing**.*

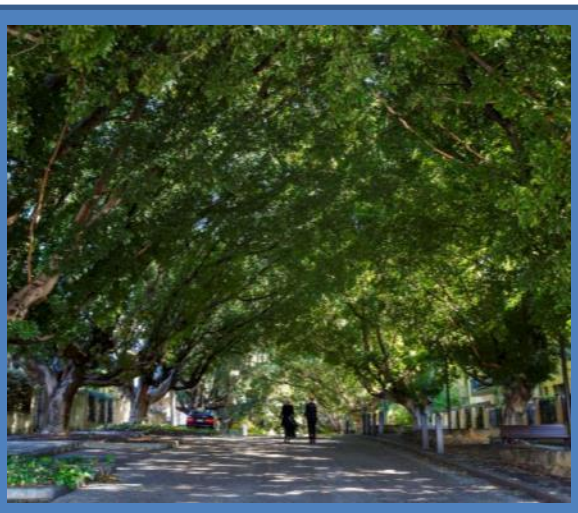
Case Study: Enhancement over expansion - Liverpool

In its Green Infrastructure Strategy, Liverpool recognises the "extremely limited opportunities for creating new areas of traditional greenspace within the urban core" ([15], p.42), a challenge faced by many cities. Often it is these densely built up central urban areas that also have the greatest deficiency in GI, as Liverpool's multifunctionality map ([15], p.41) demonstrates. Recommended actions for the city therefore include:

- Protection and enhancement of GI already in place
- Incorporating GI into new development including green roofs and green walls
- Increasing private garden space in housing developments
- Targeting major access routes for GI improvements

The emphasis here is on protecting and enhancing the quality of existing GI and integrating GI into other land uses, particularly in dense urban areas. This highlights the possibility of a multidimensional GI target approach that considers qualitative aspects alongside quantitative measures such as coverage.

Case Study: Quality targets for an urban forest – Perth (Australia)



The City of Perth's GI focus is on its urban forest, with a comprehensive Urban Forest Plan (2016) that sets out nine complimentary goals ([16], p.58-63). Its quantitative target to increase canopy cover from 19% to 30% is only mentioned in Goal 4. The primary objectives focus on the protection of trees, their replacement where needed, and a sustainable water management system (Goal 1 - 3). The list also includes the promotion of resilience in species composition (Goal 6) and maintaining tree health (Goal 7). Here, the **Quantitative: Coverage** target must be understood as part of a more holistic approach towards urban forest management. The city's vision statement refers to a management approach that "optimises canopy cover and protects and promotes its sustainable growth, health and resilience in the face of continued urbanisation and climate change challenges" ([16], p.6), therefore prioritising the quality of tree coverage alongside its extent.

6) Baselines and Monitoring

Understanding the relationship between GI targets, baselines and monitoring

Alongside the development of the GI target typology and the analysis of how these goals are framed by different cities, the review of the city GI frameworks, plans and strategies that underpins this report also sought to develop an understanding of the status and role of baselines and monitoring in setting and implementing GI targets. Monitoring frameworks allow progress towards GI targets to be tracked, although this requires relevant baseline data, a suitable set of indicators and the capacity to monitor these indicators over time. The requirements for these will vary between GI target types, and in some circumstances, it will not be appropriate or feasible to secure a connection between targets, baselines and monitoring.

The analysis was based on the following questions:

- Do the city GI documents contain any reference to existing GI (e.g. amount, extent or distribution) or an assessment of current GI benefits (e.g. in achieving desired outcomes, or monetary valuation)?
- If so, what data do they include, how was it collected and how is it presented?
- Do the city GI documents include any reference to how progress on GI targets will be tracked and monitored?
- If so, do they make any comments on the monitoring time scales, resources requirements or methodologies employed here?

As before, this is not an exhaustive analysis of GI baselines and monitoring. The review presents a snapshot of the relationships between the three core elements of a target setting approach. The insights outlined below help inform the evaluation of different GI target options from the perspective of establishing baselines and monitoring targets (see Chapter 8). The main observations are detailed below.

Findings from the City Review: Baselines

Almost three quarters of the cities covered by the review (31 of 43) give some level of commentary on or assessment of their existing GI. Table 7 shows the breakdown for different regions. The level of detail provided by these baselines, and the format in which they are presented, varies considerably. At one end of the spectrum, simple summary figures are provided, quoting the amount of green space or tree coverage in a city. At the other end of this spectrum, some cities have conducted detailed spatial analyses, in-depth itemising of GI features or have commissioned technical reports to assess GI benefits and services. Table 8 gives an overview of different types, with example cities.

Table 7: GI baselines across cities

Region	UK	USA	Australia	Canada	Europe
Cities with baseline	14	7	3	2	5
Percentage	78%	78%	75%	67%	56%

One notable observation here is that cities with **Quantitative: Coverage** targets are more likely to also present a GI baseline. Of the 16 cities in this category, based on the documents included in the review, only 4 do not give any details on the existing extent of their GI, 2 of which are European cities where there was limited English language information available to inform the review. Amongst the other 12 cities, several include comprehensive GI audits, inventories or maps. These give robust assessments of the extent of existing GI coverage. In some cases, they provide additional information on the quality, ownership and other characteristics of GI (e.g. Toronto urban forest [17]), the impacts of GI (e.g. thermal imaging baseline study for Perth urban forest [16]) or its spatial distribution (e.g. Edinburgh Open Space Audit [18]).

A strong relationship also exists between **Thematic: Outcome-orientated** targets, such as those around stormwater management or green space access, and associated baselines. 10 out of 12 cities in this target category share details on existing provision. Looking towards aspirational and spatial targets, the links to baselines are less clear. This may relate to the extent to which it is feasible to gather relevant baseline data. For broad aspirational categories such as increased biodiversity, which are complex and influenced by a number of factors, it may not be possible to single out the contribution made by GI as a specific theme. For some of the spatial needs and opportunities assessments (e.g. Birmingham [19]), the targets themselves may implicitly include a baseline as they represent existing demand for GI interventions.

Table 8: GI baseline types

	Types of GI baseline	Example cities
Illustrative ↕ **Comprehensive**	Simple headline figure (e.g. area of green space, number of parks)	Belfast, Stuttgart
	Land use maps (not always related to GI target)	Nottingham
	Number of existing GI projects (including recent trends and annual increases)	Portland, Los Angeles
	Detailed breakdown and extent of existing GI types	Leicester
	Qualitative and descriptive assessments of green landscape and cityscape assets	Newcastle
	Spatial GI baselines using satellite and aerial imagery, LIDAR data[1] or i-trees tools[2]	London, Vancouver
	Databases and interactive maps of specific GI features, such as canopy cover or individual trees and their characteristics	Chicago, Melbourne
	Multi-dimensional baseline audits incorporating existing studies. For a detailed example, see Edinburgh case study below	Edinburgh, Perth

Some cities commit to the creation of baselines where these are not yet available or insufficient in scope, and also comment on their limitations. Leipzig in Germany for example has developed projects through its City Lab [20] to map existing green and grey infrastructure in city in order to identify major pressures and respond to these in its GI planning. Similarly, Los Angeles [21] pledged to complete a tree inventory by the end of 2021 to support GI planning. In the case of Portsmouth, a critical review of its existing baseline maps highlighted important shortcomings. A comparison of Ordnance Survey maps of residential streets against Google maps satellite images ([14], p.19-20) indicates that private gardens provide much less GI than the maps would suggest, as many have been paved over with artificial materials. This discrepancy indicates the importance of cross-

[1] LiDAR stands for Light Detection and Ranging, a remote sensing method which measures distances to points on Earth. It allows for the creation of detailed 3D models of the landscape surveyed, including tree canopy and land cover (Holt 2020)

[2] I-trees is a suite of tools developed by the USDA Forest Service which support the assessment and management of forests globally. The tools included tree population surveys, canopy cover estimation and methods to capture current and future benefits. More information at: https://www.itreetools.org/

checking baselines and indicators, and maintaining these over time, to address limitations in the data.

While this review cannot give a full evaluation of baseline provision, it suggests that baselines are important tools within GI target setting, particularly where quantitative coverage-based or thematic outcome-orientated targets are established. In some cases, baselines are lacking and this can hamper goals to monitor GI over time.

***Baselines** are commonly **provided for both QC and TO targets**, but their **depth and extent varies** for other target types.*

Case Study: Open Space Audit Baseline – Edinburgh

Public Parks and Gardens — **Total Area 2009 Audit: 589.74 ha** — **Total Area 2016 Audit: 591.38 ha**

REFERENCE	NAME	OWNERSHIP (Council / Other)	ACCESSIBLE (Yes/No)	PARK CLASSIFICATION	COMMENTS	AREA (ha)	PARK QUALITY ASSESSMENT GRADE 2009	PARK QUALITY ASSESSMENT GRADE 2016	TREND
City Centre NP									
PG 1	East Princes Street Gardens	C	Y	Premier Park	PQA score combined with Princes St Gardens West.	3.22	Good	Good+	↑
PG 2	West Princes Street Gardens	C	Y	Premier Park	PQA score combined with Princes St Gardens East.	11.04	Good	Good+	↑
PG 3	St Andrew Square	O	Y		Managed by Essential Edinburgh	1.03		No quality score, though included in the large and local space mapping	●
PG 4	Calton Hill	C	Y	Premier Park	PQA score applies to part of site. PQA assessment boundary varies from open space classification	9.60	Good	Fair	↓

Edinburgh's Open Space Strategy [22] sets out a plan for the care, improvement and development of the city's open and green spaces. It includes a range of target types: the provision of 50-60ha new public open space, as well as increase targets for areas covered by wildflower meadows and woodland (all QC), an increase of 1,500 street trees over a decade (QU) and access targets with all homes within 800m/400m of a large/smaller greenspace (TO). It also presents an opportunity map for building links across the green network (SNO).

Underpinning these targets is a detailed Open Space Audit [18] and corresponding Open Space Map [23] , which form "an important step in preparing an open space strategy for the Council area" and "[make] it possible to set appropriate standards for quantity, quality and accessibility of open space, and to identify where these standards are being met and where they are not" ([18], p.1). First conducted in 2009 and updated in 2016, the audit classifies and evaluates all significant open space. It therefore provides a full picture of the extent of open spaces across the Council Area, their quality as well as city-wide trends and patterns. The comparison to 2009 is particularly useful here. It indicates an improvement in the condition of the green network with little change in the overall extent.

Monitoring

References to monitoring and progress tracking for GI targets are relatively limited in the documents reviewed in this study. References to monitoring activities were identified in the documents for 15 of the 43 cities (see Table 9 for a breakdown across regions). This does not include commitments to review GI strategies or plans, or evaluations of related governance procedures and partnerships. These were excluded here as this review focuses on the role and framing of GI targets. The depth, detail and state of development of proposed monitoring activities varies considerably, even more so than for GI baselines. Details of different monitoring approaches are shown in Table 10.

Table 9: References to monitoring activities within city GI documents

Region	UK	USA	Australia	Canada	Europe
Cities referring to monitoring	5	4	1	2	3
Percentage	28%	44%	24%	66%	33%

It appears that frameworks for monitoring the achievement of GI targets are not well developed in practice and are not often referred to in GI documents. Like GI baselines, it may not always be appropriate or feasible to monitor certain GI targets, for example where these are more qualitative or aspirational in nature. Where cities do reference monitoring, it is rare that this constitutes a workable framework which establishes indicators, monitoring techniques and resource requirements. A notable exception is Toronto, whose approach is outlined in the case study below. With monitoring established as a core element of evidence-based planning, the reasons for this lack of development should be explored further with the aim to inform this aspect of GI planning.

Table 10: Types of monitoring reference within city GI documents

	Types of monitoring reference	Example cities
General monitoring commitments	Identification of key areas where monitoring information is needed (e.g. forest area, composition, values), without further details	Melbourne, Southampton
	Commitment to tracking specific indicators, such as access to greenspace per household, without further details	Utrecht
Tracking GI interventions	Tracking number of GI projects in city	Portland
	Work-in-progress maps, showing project locations, their status (planned / in-progress / complete) and/or other available information (such as project type, installation year, amount of water managed)	New York City, Seattle (stormwater)
	Progress reports showing actions, headline figures, spending and/or case studies	Houston, Seattle (stormwater)
Indicator development and measurement approaches	Monitoring at selected sites, such as tracking run-off for neighbourhood demonstration areas	New York City
	GI indicator identification (e.g. canopy coverage) with relevant metrics and measurement actions	Seattle (urban forest), London
	Combined measurements and modelling approach, outlining performance metrics for partial GI implementation and a modelled run-off estimate for full target GI implementation	New York City (Green Infrastructure Performance Metrics Report)
	Full framework – details see case study below	Toronto

***Monitoring** is **not a well-developed part** of target setting. Although it is **recognised as important**, most GI strategies do not set out a workable monitoring framework.*

Case Study: Developing a monitoring framework - Toronto

Toronto [17] identifies monitoring as a key element of good urban forest management and dedicates a full chapter of its Strategic Forest Management Plan to outlining its approach. The indicators and measurement methods selected are based on the following considerations:

- **Simplicity**: criteria and indicators to be understood by non-forestry experts
- **Cost-effectiveness**: information must be available under existing reporting systems
- **Reliability:** Indicators must provide useful information on progress
- **Objectivity:** Indicators must not be affected by interpretative bias.

The framework assigns several indicators for each success criterion and tactical objective. In addition, it supplies existing baseline information (where available), data sources or monitoring methodologies, and measurement frequencies. For the 40% canopy cover target, it suggests tracking overall tree canopy cover, area of additional canopy cover and number of trees planted annually on public land, and using high resolution leaf-on aerial and satellite imagery and the Urban Forestry Database. The suggested monitoring frequency is every 10 years, with an annual review of new planting areas.

7) Target Typology Case Studies

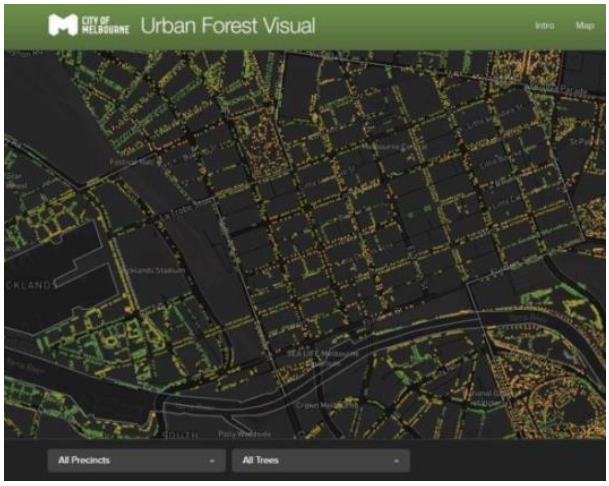
Quantitative: Coverage (QC)

Melbourne

Urban Forest Strategy (2011)
City of Melbourne [24] Link to Document

Duration:
2012 – 2032

Type of GI:
Urban Forest (incl. green roofs and walls)



Source:
http://melbourneurbanforestvisual.com.au/#mapexplore

Key points:

- Target specifies city-wide canopy cover increase with a clear time scale
- Ecological health and quality of forest considered alongside spatial coverage
- Based on existing baseline
- Recognition of extensive information needs for monitoring and review

Melbourne's Urban Forest Strategy [24] outlines the targets, principles and implementation framework for moving towards a "resilient, healthy and diverse urban forest" (p.3), set against three major challenges of climate change, population growth and urban heating in the city.

The primary target aims to increase the overall canopy cover in the public realm, the area for which the city it directly responsible, from 22% in 2011 to 40% by 2040. The focus on canopy coverage is based on work showing greater benefits provided by a single, large tree than several smaller ones. Other targets focus on the wider urban forest ecosystem, including increasing species diversity and improving overall tree and soil health.

The strategy presents a detailed snapshot of existing tree numbers (70,000), canopy coverage (11% across the municipality, 22% in public areas) and forest composition (e.g. species and age diversity) in different areas of the city. Melbourne maintains a tree database and interactive map that records each tree and information about its location, age and diameter. It acknowledges the need for data to support monitoring, and presents a list of areas for information development needs, including: total area of urban forest, forest composition, climate and environmental benefits and their spatial distribution. It does not provide further detail on how these data requirements can be met.

Quantitative: Units (QU)

Southampton

Green City Plan 2020/2030 (2020)
Southampton City Council [25]
Link to Document

Duration:
2020-2030

Type of GI:
Green Space, Urban Forest

Source: Southampton City Council

Key points:

- Quantitative target presented in form of individual GI units: wildflower meadows and trees
- Figures serve as "highlights" alongside a more general commitments to increasing GI
- Success measures not tied to targets and indicate a broader perspective of GI

Southampton's GI targets are embedded in the natural environment section of its Green City Plan [25], where it commits to "increase the extent and quality" (p.16) of blue and green infrastructure. It defines quantitative targets of creating 25 new urban wildflower meadows by 2025 (5 per year) and the planting of 5000 trees on public land by 2030 as strategy "highlights". These targets are singled out amongst more general and thematic commitments to reduce fragmentation, delivery of net gains in biodiversity and balancing these with the benefits of access.

These quantitative targets are underpinned by a series of proposed actions. Some of these directly feed into the targets, such as the development of a Grassland Management Plan to introduce new meadows, and the launch of an urban canopy project to promote planting. Other steps more generally refer to the creation of a 'Green Grid' and the adoption of nature-focused principles in decision making.

The plan provides a detailed list of success measures to guide monitoring and evaluation (p.17), including:

- A net improvement in biodiversity index across the city (no further details given)
- An increase in the extent and quality of managed habitats
- An increase in the tree canopy coverage
- An increase in the area of greenspace

These indicators are not tied to the quantitative targets but outline more general desired achievements that can enhance GI extent and quality. This suggests that the quantitative targets here are spotlight features within a wider set of considerations around GI.

Thematic: Aspirational (TA)

Glasgow

Glasgow's Open Space Strategy (2020). Glasgow City Council [2] Link to Document

Duration:
2020 - 2050

Type of GI:
Open Space (with recognition of other GI elements)

Source: Glasgow City Council

Key points:

- Aspirational open space outcomes set out in 3 thematic areas (liveability, health, resilience)
- Based on open space audit and map
- Attempts to keep this open space map updated
- Interaction with regional GI strategy

The aims for Glasgow's Green Network are outlined in its Open Space Strategy [2]. Open space here comprises blue, green and civic grey space (such as market places or squares). The role of other GI features such as street trees and rain gardens are highlighted. The strategy vision identifies three aspirational targets regarding the implementation of high-quality open space in the city:

1. Liveability: increased attractiveness of the city as a place to live, work and invest
2. Health and well-being: improved human health and biodiversity
3. Resilience: the ability to manage threats from climate change and other external factors

For each of these objectives, the strategy discusses current and future needs, highlights links to relevant plans and legislation, and identifies relevant actions. It does not set any specific targets but presents broader, aspirational commitments. For the resilience theme, for instance, these commitments link to themes including (p.17-18):

- "aiming to address issues associated with increased flood events"
- "helping identify opportunities for expanding habitats and … enhancing physical and functional connections between them"
- "mitigating and adapting to climate change"

The Strategy is based on an open space audit conducted between 2007 and 2010, the results of which are accessible in an Open Space Map. There are efforts to keep this map updated as a tool for open space planning, although the document does not cite further details of how this will be done.

The Open Space Strategy seeks to help deliver the aims of the Glasgow and Clyde Valley Green Network Strategy [3], which sets out quantitative high-level targets for a green network in the region (such as the creation of 30 km2 urban green infrastructure). While the themes are similar, different types of GI targets are contained within strategies operating at municipal and city-regional scales.

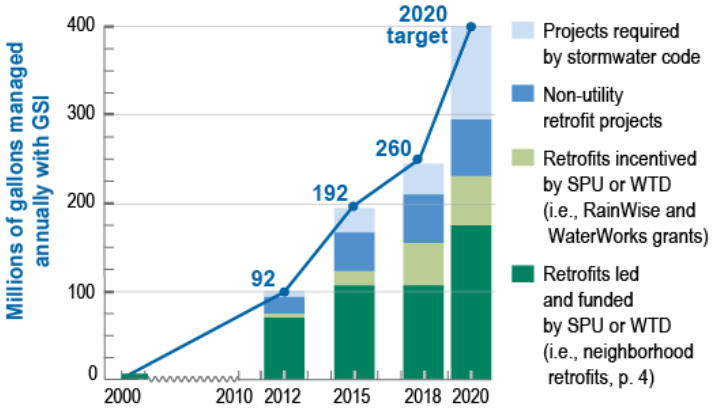
Thematic: Outcome-orientated (TO)

Seattle

700 Million Gallons (2021, Website) [26]
Seattle Public Utilities and King County Water Treatment Division
Link

Duration:
2025

Type of GI:
Green stormwater infrastructure



Key points:

- Target focused on management of stormwater runoff using GI
- Strong link to progress tracking using detailed data for each GI project
- Website based on the target brings together related projects for easy access

Seattle has created a comprehensive GI project programme under the title of "700 Million Gallons", which reflects its core target: "to use GSI [green stormwater infrastructure] to manage 700 million gallons of polluted water each year by 2025" [26]. This target is based on the need to manage wastewater system overflows and to prevent polluted water from reaching waterways during storm events in the city. The target it set and measured against the amount of water that is captured and treated by GI, making stormwater management its central theme. In this respect, Seattle resembles the majority of US cities reviewed here, which link GI primarily to stormwater drainage and treatment (see also Chicago, Houston, Milwaukee, Philadelphia, Portland).

The 700 Million Gallons website as well as a recent progress report [27] both present a tracker to mark progress towards this goal (see image above). The current figure sits at 410 million gallons (2020). Monitoring is supported by a data layer on Seattle's Geo Data Portal which maps all GSI projects in the city. It contains detailed information including the type of GSI, installation year, the project under which it was created and the amount of runoff managed annually.

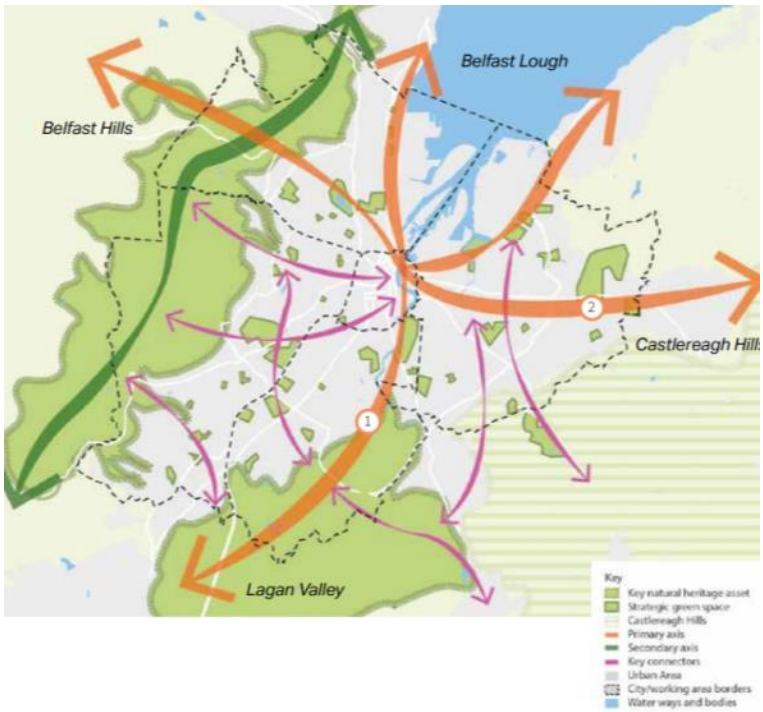
Spatial: Vision (SV)

Belfast

Belfast Green and Blue Infrastructure Plan (2020)
Belfast City Council [28]
Link to Document

Duration:
Vision for 2035

Type of GI:
Comprehensive



Source: Belfast City Council

Key points:

- GI vision presented in spatial form
- Map highlights major axes and connectors without any precise spatial reference
- Underpinned by principles focused on good GI planning and management

In its Green and Blue Infrastructure Plan [28], Belfast sets out a vision where, by 2035, GI will be ”strategically planned to enhance ecosystem services that benefit all living, working in and visiting Belfast” (p.16-17). Alongside, it presents a “spatial vision for the future of green and blue infrastructure” (p.27) as the main framework for guiding future planning.

The map highlights primary and secondary axes and key connectors alongside key natural assets and strategic greenspace without giving specific locations. It was created by layering the existing green space and blue space networks with strategic connections (such as green paths). This gives rise to the main axes and opportunities for further integration. The strategy also shows maps relating to existing environmental designations and summarises existing green and blue amenities.

The visual framework is underpinned by five strategic principles (p.6), stating that GI should be:

- Biodiverse
- Formed of well-planned, interconnected networks
- Integrated into the urban environment
- Well designed and managed
- Appropriately funded

With the exception of the thematic focus on biodiversity, these principles relate to the planning and management of GI, but their discussion largely remains on a conceptual level. Thus, the strategy provides a guiding framework but no direct path to implementation for its spatial vision.

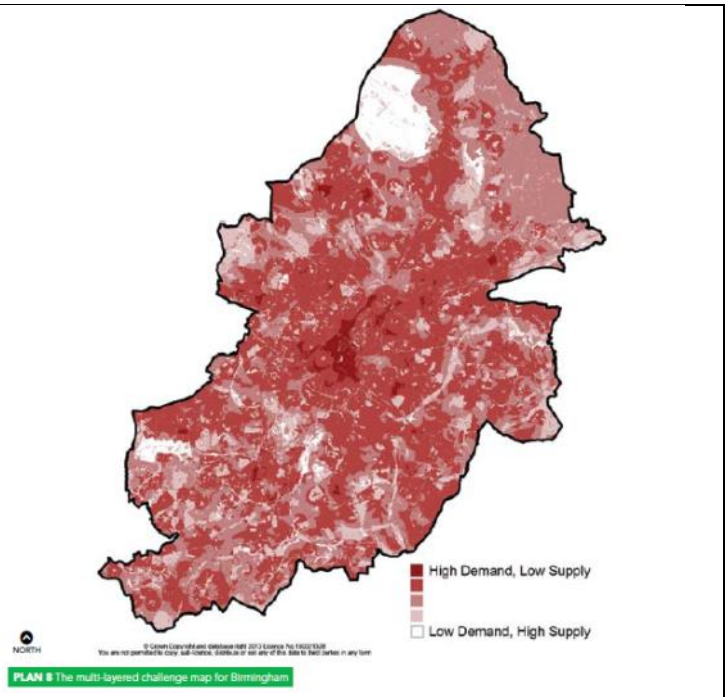
Spatial: Needs & Opportunities (SNO)

Birmingham

Green Living Spaces Plan (2013)
Birmingham City Council [28]
Link to Document

Duration:
Not specified

Type of GI:
Green Space



Source: Birmingham City Council

Key points:

- GI planning grounded in a city-wide analysis of ecosystem service (ESS) provision
- Results are presented in a multi-challenge map
- Focus is on 'hotspots' where demand for ESS cannot be currently met sufficiently
- Maps provide framing for baselines and future updates

Birmingham's Green Living Spaces Plan [29] establishes a vision of Birmingham as an attractive, clean city by "linking the issues of climate change, public health and spatial planning" (p.6). It discusses seven green living spaces principles, grounded in a spatial analysis of existing supply and demand of ecosystem services (p.26 onwards). The services evaluated here include biodiversity, recreation, local climate regulation and flood risk regulation among others. As well as presenting a supply/demand map for each service, the plan also contains the first city-wide multi-challenge map which aggregates the different ESS. The assessment and analysis was conducted by CEEP Consultancy in partnership with Birmingham City Council and Birmingham City University.

The multi-challenge map provides spatial targets for future GI planning as it serves to "prioritise areas where the demand for ESS can't be sufficiently satisfied" ([29], p.6). It is in these hotspots where "the future creation and/or improvement of green and blue infrastructure will be most effective to satisfy human needs" (ibid). While it does not set a quantifiable target or a specific thematic goal, this spatial approach guides and spatially prioritises GI planning and implementation activity. It also notes its limitations, stating that the maps cannot be used as the sole basis for decision-making as they indicate areas for action but not which action to take in each context. (ibid, p.8)

As the maps show the current provision of ESS, they can serve as a baseline against which future improvements may be measured. The methodology allows for the inclusion of future scenarios to assess likely changes in ESS demand. It is recommended that the ESS assessment should be updated in future to track changes and incorporate new available evidence and data ([29], p.13)

8) Evaluation of GI target types

The previous section presented 6 case studies which illustrate the types of GI targets identified in the international city review, with details on their baseline and monitoring provision where relevant. These short snapshots indicate how differently GI targets are conceptualised, developed and presented. To allow further insight into what it means to adopt any of these approaches, and requirements that come with it, the following section presents a high-level evaluation of these GI target types. It considers two elements of target setting: the set up or establishment of the target, and its longer-term follow-up, or monitoring, to assess the extent to which it has been achieved. For each aspect, the evaluation shows the kind of data, expertise and resources that will be needed.

This evaluation focuses on broad themes and does not provide an exhaustive picture of related issues, which is not practical given the wide-ranging nuances that shape the process of GI target set-up and follow-up in different urban contexts. The evaluation does, however, make it clear that a decision taken to adopt, for example, a **Quantitative: Coverage** or **Spatial: Vision** GI target will have significantly different consequences for the organisations responsible for establishing, delivering and monitoring the target. As such, the evaluation can support decision making processes linked to GI target setting.

Quantitative: Units (QU)

Here, a broad distinction is made between GI targets that can be understood as being 'baseline-derived' and those that are 'stakeholder-derived'. Where targets are 'baseline-derived', the current understanding of the number of units of interest (e.g. urban street trees, wild flower meadows) can be used as a basis to set a related uplift target. 'Stakeholder-derived' targets can be arrived at via an issue-led consultation process that is designed to set a GI target (e.g. Greater Manchester's 3 million trees target which is linked to the number of people living in the city-region). 'Stakeholder-derived' **Quantitative: Units** GI targets may be set where baseline data does not exist for a particular GI type or resource, or where producing that data is prohibitive in terms of available time and resources.

Target set up:

	Baseline-derived	**Stakeholder-derived**
Data demands	Current data on the unit (e.g. number of urban street trees) forming the basis of the target. Data demands will depend on the type of unit, with a significant difference between establishing a baseline on number of trees versus number of GI projects.	Target set in response to prominent issues and agendas, which may evolve over time. Most likely approach where baseline data is not available or difficult to obtain.
Expertise needed	Expertise to establish and analyse baseline data for target setting (dependent on unit).	Engagement of relevant topic/thematic experts to support target setting process.
Resource requirements	Depends on whether baseline data underpinning target is already available: • If yes: modest resource requirements to interpret existing data and formulate target. • If no: potentially resource-intensive process (depending on the unit) to establish a baseline to set a subsequent target.	Generally lower than for a baseline-derived target. Consultation workshop(s) with relevant stakeholders (related to the unit forming the basis of the target).

Target follow up:

The distinction between 'baseline-derived' and 'stakeholder-derived' targets in terms of follow up is less apparent. Indeed, if a **Quantitative: Units** target is set and the intention is to monitor the achievement of the target (and related unit-focused GI outcomes) over time, both types will have significant follow up requirements.

Data demands	Dependent on unit: significant difference in data demands comparing monitoring tree planting, versus GI project completion or money spent on GI projects. If appropriate systems are in place to capture data on these units these tasks may become less onerous.
Expertise needed	Dependent on unit and the extent of existing related expertise in city. Project management capacity is needed to capture and integrate data sources, within and sometimes between organisations, to count and report on change in number of units over time.
Resource requirements	Duration of commitment dependent on the target time horizon, which will generally be established as part of the target setting process. Where data is being captured (e.g. numbers of trees planted), systems for gathering data and recording progress towards the target are needed.

Quantitative: Coverage (QC)

These GI targets tend to focus on change in GI land cover and / or change in tree canopy cover. Following the distinction made for the **QU** target type above, **Quantitative: Coverage** GI targets can be broadly understood as being 'baseline-derived' or 'stakeholder-derived'. Again, it is concerning target set up that clear differences between these two broad approaches are most apparent, less so concerning target follow up.

Target set up:

	Baseline-derived	**Stakeholder-derived**
Data demands	Data on current GI cover (and data on other land cover types in the city/urban area).	May not require gathering or accessing data, although the target setting process may stimulate baseline data gathering at a later date.
Expertise needed	GIS and spatial analysis expertise. Specialist knowledge may be needed in some cases, e.g. processing and interpretation of satellite imagery and machine learning to establish certain land cover types (e.g. private gardens).	Wide-ranging stakeholder engagement to set appropriate and relevant target.
Resource requirements	Depends on whether appropriate spatial data is available to inform the target setting process: • If yes: moderate resource requirements for additional analysis. In-house GIS and spatial analysis expertise can be utilised where available. • If not: high resource requirements to create baseline data, for example on current tree canopy cover. Extent of these requirements will depend on GI type of interest (all GI or individual element, e.g. woodland) and coverage area (e.g. whole city or particular part of the city or type of land such as publically owned areas).	Minimal, may consist of arranging stakeholder consultation to establish an appropriate target. Process may be informed by reviewing spatial data if available.

Target follow up:

Data demands	Assessment of change in land or canopy cover at periodic intervals. Specifics will depend on GI type and area over which GI is being monitored. Land cover and/or satellite data can be used to assess the achievement of **QC** GI targets. Possible creation of bespoke spatial data layers to capture GI interventions and record their impact on a related GI target.
Expertise needed	GIS and spatial analysis expertise. Specialist knowledge may be needed in some cases, e.g. processing and interpretation of satellite imagery and machine learning to establish a change in land cover.
Resource requirements	Potentially significant. Key determinants are the duration of the commitment, and the frequency at which changes in coverage are evaluated (e.g. annually, every 5 years). Also depends on whether change can be evaluated via publically available data or whether bespoke data is required.

Thematic: Aspirational (TA)

In practice, it is likely that **Thematic: Aspirational** GI targets are driven by multiple interrelated factors. Targets may be focused on achieving benefits or goals linked to location-specific themes of interest or relevance to a particular city or urban area (e.g. reducing flood risk, providing shading and cooling). **TA** targets may also be set in response to, or to contribute towards, national or international policy or strategy agendas where GI can support their achievement or implementation (e.g. improving water quality, enhancing biodiversity).

Target set up:

Data demands	Unlikely that new data sets will need to be created. Existing sources linked to themes including specific urban challenges and pressures and will be sufficient.
Expertise needed	Knowledge and expertise on GI and GI co-benefits, relevant contemporary urban policy and strategy agendas and specific local issues.
Resource requirements	Draw on existing knowledge and datasets to understand key local challenges and pressures. A consultation process may be needed to establish the specific theme(s) that the target will focus on. Some specialist GI knowledge may need to be brought in where this is lacking in order to make the links between aspirational themes and GI.

Target follow up:

The fact that **Thematic: Aspirational** GI targets are, by definition, high level and aspirational indicates that follow-up activity to monitor the achievement of such targets is less likely to be considered. Although it is relatively straightforward to set **TA** targets, there are considerable challenges linked to monitoring their achievement. It is possible to monitor the realisation of GI co-benefits or outcomes resulting from GI schemes (such as reducing rainwater runoff and enhancing biodiversity) at site scales, which requires dedicated monitoring resources, expertise and sometimes equipment. However, **TA** targets will often be set for an entire city, and it is not possible to establish the contribution of individual GI schemes to city-scale outcomes given the range of causal factors that influence GI co-benefits at wider spatial scales. In practice, cities may simply claim that by implementing GI schemes certain benefits will be achieved within the city, especially where existing studies can be highlighted that have shown a positive link.

Another way of monitoring progress towards **TA** targets is to evaluate the extent to which associated policies and strategies are developed and implemented. Rather than an 'outcome-based' approach to monitoring, this can be perceived as a 'process-based' approach to monitoring where activities supporting the achievement of a target (in this case the integration of connected themes within relevant policies and strategies) are the focus of the evaluation.

Thematic: Outcome-Orientated (TO)

Thematic: Outcome-Oriented GI targets are generally quantitative in nature, with common examples including volume of storm water to be captured by GI schemes or targets linked to citizens accessibility to green space (as measured by distance or walking time). They imply, by definition, significant outcome-oriented follow up monitoring requirements.

Target set up:

Data demands	Relevant data may sometimes be available, although it may also be necessary to create and/or analyse data to support target set up.
Expertise needed	Depending on focus, hydrological modelling (for stormwater drainage) and GIS/spatial analysis expertise (for green space access) will be required. Relevant expertise to establish outcome themes for targets.
Resource requirements	Dependent on issues including the type of outcome, availability of data and the degree to which skills and capacity can be accessed in-house. Resource to run consultation workshops to support target set up.

Target follow up:

Data demands	Data on how GI interventions contribute to the achievement of target outcomes. Specific data requirements will depend on the type of outcome that is sought. Complex cause and effect relationships can make it challenging to evaluate the implications of GI interventions on target outcomes.
Expertise needed	Specialist monitoring expertise may be needed to evaluate the extent to which GI interventions are contributing to the achievement of target outcomes, e.g. hydrological modelling. Capacity to aggregate the contribution of multiple GI interventions to achievement of targets.
Resource requirements	Technical equipment may be required (and needs to be installed and maintained) to monitor outcomes, e.g. stormwater captured by GI interventions. Long-term commitment to monitoring, as it may take a number of years for GI interventions to deliver benefits.

Spatial: Vision (SV)

Spatial: Vision targets may be associated with the identification of opportunities for creating integrated GI networks extending across cities and urban areas, or locations where the protection and/or enhancement of certain GI features is to be encouraged. These are termed 'visions' as there is limited spatial refinement of target areas or corridors.

Target set up:

Data demands	Analysis of existing data on land use patterns across the city (and potentially its hinterlands) to identify broad areas for potential GI interventions linked to, for example, the development of GI networks and/or the conservation and enhancement of notable areas of existing GI.
Expertise needed	GIS and spatial analysis skills. Potential need to engage a wide range of partners in this process given the spatial extent of a city-scale GI vision and the wide range of land uses that could be impacted by it.
Resource requirements	Moderate resource requirements as no new data required. Possible need to bring in spatial analysis and cartography skills if not available in-house. Possible need for consultation process /stakeholder workshops to establish the target.

Target follow up:

Data demands	Tracking whether locations of GI interventions help to achieve the vision (e.g. in the creation of a GI network), or equally whether GI is removed or degraded in these areas. Evaluate city plans and policies (particularly those with a spatial dimension linked to land use change) to establish whether these embed and support the vision.
Expertise needed	If location of new GI projects or land use change are being evaluated, GIS and spatial analysis skills will be needed. Otherwise, no specialist expertise required and existing capacity is likely to be sufficient.
Resource requirements	Resources may need to be allocated to recording the location of new GI schemes and assessing land use change in areas key to the spatial vision, possibly over the long term to suit the duration of the commitment. A review of plans and policies to determine alignment with a spatial vision would not be resource intensive.

Spatial: Needs & Opportunities (SNO)

This target type differs from the **Spatial: Vision** GI target type in its focus on specific needs and opportunities (e.g. improving ecosystem services) that GI provision and enhancement can support. It also entails a more refined spatial focus on particular areas where the need for GI interventions is identified.

Target set up:

Data demands	Access to, and analysis of, data to develop a spatial understanding of prominent needs and opportunities in the city/urban area that could be supported by GI provision. Needs and opportunities may be informed by consultation, possibly with new spatial data required to develop further insight. Potential requirement to process and analyse new data (e.g. to create an ecosystem services needs and opportunity map).
Expertise needed	GIS and spatial data skills to analyse and process data, alongside broad understanding of prominent local needs and opportunities. Knowledge of GI benefits to identify needs and opportunities that GI can support. Given the breadth of GI co-benefits, a wide range of perspectives may need required.
Resource requirements	Potentially resource intensive and time consuming, especially if skills are not available in-house. Resource requirements will depend on the specific needs and opportunities considered, the level of spatial and thematic detail sought, the availability of relevant data and the extent to which additional spatial data creation and analysis is required. Stakeholder consultation process to identify priority needs and opportunities.

Target follow up:

Data demands	Establishing whether GI interventions are happening in areas of identified need and opportunity, with potential further monitoring of outcomes of GI interventions in target locations. Evaluation of plans and policies, particularly those with spatial implications such as land use plans, to determine the extent to which they are supporting (or hindering) the achievement of the GI target.
Expertise needed	GIS and spatial analysis skills to evaluate change in locations targeted for GI interventions on the basis of analysis of local needs and opportunities.
Resource requirements	Low resource requirements for evaluation of plans and policies. Need to establish systems to record interventions taking place in target areas. Spatially focused analysis of change in GI in areas of identified need and opportunity would demand significant investment of resources.

9) GI target setting in Greater Manchester

This section provides an overview of Greater Manchester's (GM's) current position concerning GI target setting. Six documents and one web portal containing spatial mapping outputs that support GI policy and strategy making (the Greater Manchester Open Data Infrastructure Map) were reviewed, as listed in Table 11. It is possible that further documents exist that expand on GM's GI target setting approach that are not covered within this review, which does not claim to be fully comprehensive. Nevertheless, key GM documents have been included. This review therefore provides a useful platform for considering GM's current GI target approach and, recognising that GI targets continue to change and evolve over time, the potential for evolving this approach in the future.

Table 11: Greater Manchester GI target types. (This table also identifies whether associated baselines (BL) and monitoring approaches (MA) are included in the documents reviewed)

Author	Year	Title	BL	QC	QU	TA	TO	SV	SNO	MA
GMCA	2017	Greater Manchester Infrastructure Framework 2040	No			Y				No
GMCA	2021	Places for Everyone	Yes		Y	Y		Y		Yes
GMCA	2018	The Greater Manchester Spatial Framework: The Natural Environment (n.b. this is an evidence base, not a strategy)	Yes	Y	Y	Y				No
GMCA	2019	5 Year environmental plan	Yes		Y	Y				Yes
Natural Course / GMCA	2018	Greater Manchester Capital Investment Plan - baseline review	Yes						Y	No
Mapping GM	2019	Greater Manchester Open Date Infrastructure Map (GMODIN)	Yes							No
GMCA	2021	Report of the Greater Manchester Local Nature Recovery Strategy Pilot	Yes						Y	No

GM's current GI targets

Adopted in 2019, Greater Manchester's *5-year Environment Plan* sets out aspirations for the natural environment of the city region. Its overarching vision is to create a clean and resilient Greater Manchester with goals including, "…access to green space in every community, [and] more trees including in urban areas" (GMCA 2019: p.16). It goes on to specify 6 key areas for action, which should be addressed by a coherent and interlinked "mission-oriented approach" (GMCA 2019: p.21). GI forms one of the core elements of this approach, recognising that GI can address climate goals,

promote active travel and enhance the natural environment amongst other benefits. The overarching targets are therefore **Thematic: Aspirational** in nature. These aspirations are developed further into individual priorities. The section on the Natural Environment states a **Quantitative: Units** target of planting 1 million trees by 2025, and 3 million by 2035 (GMCA 2019: p.61), based on targets set by City of Trees[3]. There is also reference to GI as a vehicle for nature-based climate adaptation in the section on Climate Change Resilience. Here, the plan references the provisional target of the IGNITION project of increasing Greater Manchester's GI coverage by 10% by 2038, but notes that this remains subject to approval.

Places for Everyone (GMCA 2021), the overarching spatial development framework for GM, gives an indication of how the natural environment, and the development of GI in the city-region, is to be considered from a spatial perspective. With regards to GI targets, it presents a **Thematic: Aspirational** approach reflecting the priorities laid out in the 5-year Environment Plan (GMCA 2019). The aim is for the GI network to deliver benefits including (GMCA 2021: p.144):

- Offering recreation opportunities
- Enhancing biodiversity
- Reducing carbon emissions
- Managing flood risk
- Enhancing air quality

Places for Everyone encompasses the key elements of the GI network: river valleys and waterways, lowland wetlands, uplands, urban green spaces and woodland / trees. For each of these GI elements, the plan presents an overview of existing assets and offers a more detailed set of targets, which are almost all **Thematic: Aspirational** in nature. Examples include commitments to improve land management to reduce flood risk, restore lowland bogs for carbon sequestration and protect existing urban green space. An exception is the section on woodland and trees which includes a **Quantitative: Unit** target, referencing the City of Trees ambition to, "…plant a tree for every resident in Greater Manchester over the next 25 years" (GMCA 2021: p.160). *Places for Everyone* also considers possibilities to deliver improvements to the GI network. It outlines a **Spatial: Vision** in the form of 13 GI opportunity areas, presented both as a list and map (See Figure 3), including the South Pennine Moors and Mersey Valley. These are regarded as target locations for GI investment, although no further information is provided regarding specific sites or potential GI interventions linked to these broad opportunity areas. The data available within the *Greater Manchester Open Data Infrastructure Map* has the potential to inform decisions on GI interventions. It covers a range of GI-related land use types and designations, environmental indicators and infrastructure provision. Of particular interest are the ecosystem service, tree planting and LNRS opportunity layers. These show areas where interventions are potentially most beneficial.

Places for Everyone is supported by an evidence base in the form of the *Greater Manchester Spatial Framework: The Natural Environment* report (GMCA 2018), which gives further recommendations on

[3] The City of Trees movement is a not-for-profit organisation dedicated to tree planting and the restoration of woodlands with the aim to deliver a green recovery and tackling the climate emergency in Greater Manchester.

GI target setting. Although this is not an adopted strategy document, the need for specific targets is recognised, "…if the enhancement of Green Infrastructure and the achievement of net gain, both for biodiversity and for green infrastructure in general, is to be meaningful" (GMCA 2018: p.67). The report also acknowledges the challenge of setting targets where impacts of planned development are uncertain, and therefore suggests focusing on developing, "…meaningful and deliverable targets that would address these broad impacts in general terms" (GMCA 2018: p. 67). Examples of potential **Quantitative: Unit** or **Coverage** targets are outlined for the key GI themes (uplands, woodland etc), taking into account existing baselines, current opportunities and likely constraints (see Figure 4 for a suggested target setting approach for the woodland theme). There is no indication of how these targets may be progressed, although they do act as useful signposts for potential future GI targets should these be developed.

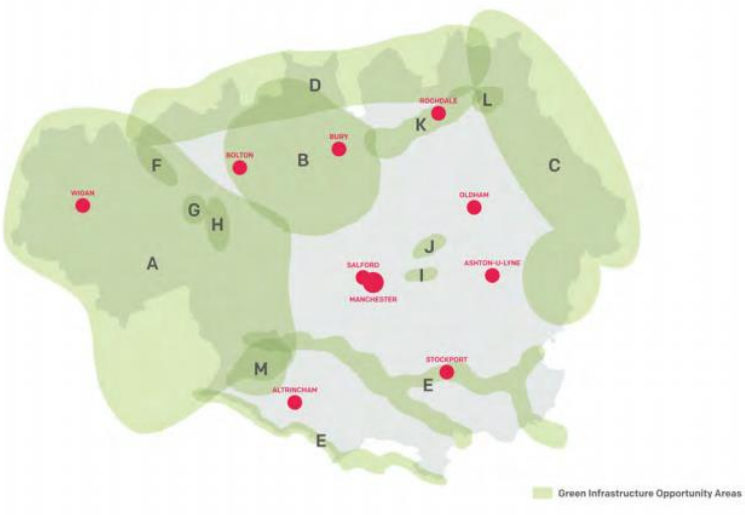


Figure 3: GM's GI opportunity areas. Source: GMCA 2021, p.150

Objective	Target	Extent (ha)
Maintain extent of woodland	Maintain the existing extent of Greater Manchester lowland broadleaved, upland oak and wet woodlands	3,500
Achieve favourable condition	By appropriate management, restore the diversity of structure and species to favourable condition	2,500
Expand Woodland habitat	Through natural regeneration and woodland planting	480
Maintain extent of hedgerow		2,700 km
Plant new hedgerow		20 km
Plant new trees*	By woodland planting and all other tree planting (e.g. street tree planting)	1 million trees

Figure 4: Proposed targets for the woodlands GI theme. Source: GMCA 2018, p.72

Other documents that will shape environment and land use of GM over the coming decades include the *Greater Manchester Infrastructure Framework 2040* (GMCA 2017). This also includes **Thematic: Aspirational** GI statements including, "Increasing the coverage of green infrastructure through the Regional Centre will help to mitigate peak rainfall reaching the areas surface water networks and reduce the risk of flooding (GMCA 2017: p. 59). GI targets are also included in the *Report of the Greater Manchester Local Nature Recovery Strategy Pilot* (GMCA 2021), which considers the city-region's natural environment primarily from a biodiversity perspective. A Local Nature Recovery Strategy opportunity map (available via GMODIN) identifies existing habitats (e.g. grassland, woodland, wetland) across GM and also sites where there are opportunities for the creation, restoration and enhancement of such sites. This mapping is at a fine spatial scale and can supplement the large-scale spatial vision of GI opportunities presented in *Places for Everyone* (GMCA 2021), and provides a **Spatial: Needs & Opportunities** target for specific interventions.

Overall for GM, the *5-year Environment Plan* adopted in 2019 presents a set of broad **Thematic: Aspirational** targets for GI in the city-region. It brings in more specific **Quantitative** targets focused on units (for trees) and coverage (proposal, not yet adopted, for 10% increase in GI coverage) building on the work of partner organisations and ongoing projects. This suggests an ongoing commitment to trial and refine targets, as well as recognition that different target approaches may be needed for different aspects of GI. *Places for Everyone* (GMCA 2021) takes a similar framing, moving from thematic aspirations to more specific attention to different elements of the GI network. Of particular interest here is the *Greater Manchester Spatial Framework: The Natural Environment* evidence report (GMCA 2018), which provides a detailed outline of potential targets that could provide a template to inform future GI target activity. There is potential for *Places for Everyone* to drive the development of more focused GI targets. It could do so in conjunction with emerging Local Nature Recovery Strategies, which provides an opportunity for developing **Spatial: Needs & Opportunities** targets based on a biodiversity-led thematic approach to utilising green spaces.

GI Baselines and Monitoring in GM

Documents and strategies supporting the development of GM's GI are informed by *Greater Manchester Spatial Framework: The Natural Environment* evidence report (GMCA 2018) and an online map resource that incorporates a wide range of spatial data on GI-related themes (GM ODIN). The evidence report (GMCA 2018) provides a map of GM's priority GI network (see Figure 5) that is included in *Places for Everyone* (GMCA 2021). Although this provides a visual baseline, as does the Greater Manchester Open Data Infrastructure Map (GMODIN) (Mapping GM 2019), the GI resource is not quantified. Further, GMODIN does not enable a quantification of GM's GI baseline. However, the evidence report (GMCA 2018) does include baselines for individual GI features (such as woodland or hedgerows) (see Figure 4). The *Natural Capital Investment Plan Baseline Review* (GMCA 2018) was created to support GM's Natural Capital Investment Plan. It identifies the stock of natural capital assets and the value of their services, alongside a review of investment opportunities and needs. Although natural capital provides a different framing to that of GI, there are clear overlaps. Once developed, baselines can inform the production of further documents. *Guidance for Greater Manchester – Embedding Green Infrastructure* (WSP 2019) identifies existing baselines and highlights how these could be utilised and improved.

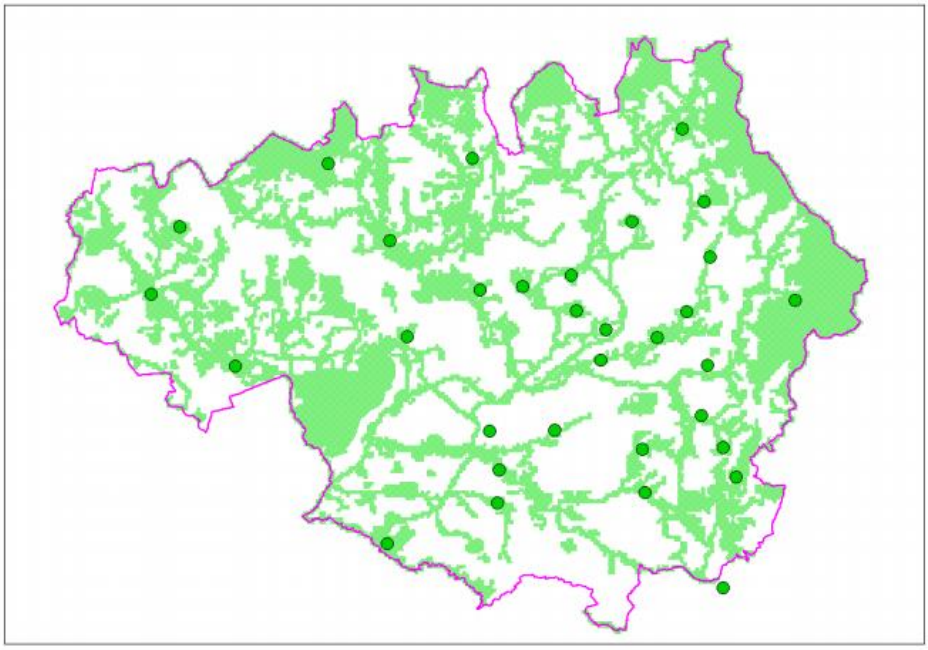


Figure 5: Summary Priority GI network. The green dots represent major parks and public greenspaces. Source: Places for Everyone, GMCA 2021.

Concerning monitoring of GI targets, the need to track progress towards their achievement is addressed in the *5-year Environment Plan* (GMCA 2019). Here, broad measures for reporting are assigned to some (but not all) of the priorities identified within this plan. For the natural environment objective of sustainable land management, these include tracking the number of trees planted and the amount of canopy cover (as noted in section 8 of this report, it is likely that tracking canopy cover will require significant capacity and resources to be directed towards this task). It further identifies "GI uplift" (GMCA 2019: p.80) as a measure of working towards nature-based climate adaptation action, noting that the meaning of this measure is to be developed. *Places for Everyone* also lists indicators to track specific targets, for example "Number of trees planted annually" (GMCA 2021: p. 392), demonstrating further commitment to track the achievement of GI targets.

In summary, GM's GI targets are embedded across a set of strategy documents and technical reports, without the existence of a centralised GI strategy. This has the potential advantage of building on the cross-cutting character of GI and linking it to other activities and programmes (such as around biodiversity or hard infrastructure provision). Like many other cities, a mix of GI target types is used across GM, with **Thematic: Aspirational** goals set alongside a **Quantitative: Unit** target for tree planting. Further, there is evidence of **Spatial: Vision** and emerging **Spatial Needs & Opportunity** targets. Chapter 11 considers how the work of IGNITION, and in particular the GI baseline and GM GI Explorer produced within the project, can support the evolution of these targets, and their subsequent implementation, tracking and evaluation.

10) GI targets in the 10 Districts of Greater Manchester

This chapter presents the results of an analysis of GI target approaches in each of GM's 10 districts, with details provided for each individual district in Appendix 1. The extent to which GI targets are underpinned by baseline data, and whether associated monitoring approaches are in place, is also highlighted. Some GM's districts do not currently have dedicated GI plans or strategies. This element of the review therefore also evaluated local planning documents, which often include GI-related content. There is the potential that relevant documents were not accessed where not available online, and this analysis does not therefore claim to be comprehensive. Further, interviews with local authority officers and decision makers may have revealed further insights into GI targets that cannot be gained via a review of documents. Indeed, further research into the context underpinning GI target setting and monitoring across GM's districts (and within GMCA) would be a useful next step. Despite these caveats, this analysis provides a useful overview of GI target setting across GM's 10 districts, offers insights into each district's approach to GI target setting, and identifies good practice examples. Exploring localised variety in GI planning increases understanding of current practice in this field, and raises themes including whether harmonised approaches to setting and monitoring GI targets could be beneficial at the city-region scale.

GM district GI targets

Table 12 provides an overview of GI targets, and any associated baselining and monitoring, across GM's ten districts. For more detailed information on each district see Appendix 1 – Overview of GI Targets in GM.

Table 12: Breakdown of documents for GM districts, and whether they have baselines, targets / types, and presence of a monitoring approach.

Author	Year	Title	BL	QC	QU	TA	TO	SV	SNO	MA
Bolton Council	2011	Local Development Framework	Y			Y			Y	Y
Bury Council	2018	Bury Local Plan - Topic Paper 7 Natural Environment	Y			Y				N
Bury Council	2015	Bury Greenspace Audit and Strategy	Y							N
Manchester City Council	2015	Manchester City Council Report for Resolution: Manchester Green and Blue Infrastructure Strategy and Stakeholder Implementation Plan	N		Y	Y	Y		Y	Y
Manchester City Council	2015	Manchester's Great Outdoors - a Green & Blue Infrastructure Strategy	Y			Y		Y		N
Manchester city council	2018	The Nature of Manchester - Local Action Project	Y							N
Manchester City Council	2021	MCC Environment and Climate Change Scrutiny Committee	Y			Y				Y

Manchester City Council	2012	Manchester's Local Development Framework Core Strategy Development Plan Document	N			Y			Y	Y
Oldham council	2011	Oldham Local Development Framework Development Plan Document - Joint Core Strategy and Development Management Policies - Environment Statement	N			Y				Y
Oldham Council	2009	Core Strategy and Development Management Policies DPD: Preferred Options	Y							Y
Rochdale Council	2013	Rochdale Township Green Infrastructure Action Plan	Y			Y			Y	N
Rochdale Borough Council	2017	Rochdale Adopted Core Strategy	N			Y			Y	Y
Rochdale Council	2012	Pennines Green Infrastructure Action Plan 2012	Y			Y			Y	N
Rochdale Council	2012	Middleton Green Infrastructure Action Plan	Y			Y			Y	N
Salford Council	2019	Local Plan, Chapter 22: Green Infrastructure	Y			Y	Y		Y	Y
Salford Council	2019	Local Plan, Chapter 23: Biodiversity and geodiversity	Y						Y	Y
Stockport Council	2017	Our green places and spaces	Y			Y				N
Stockport Council	2015	Stockport Town Centre Green Infrastructure Enhancement Strategy	Y	Y					Y	N
Stockport Council	2017	One Stockport All Together As One	Y			Y				N
Stockport Council	2019	Open Space Provision and Commuted Payments	N			Y	Y			N
Stockport Council	2020	Central Stockport Infrastructure Delivery Plan Prospectus	N	Y	Y	Y				N
Tameside Metropolitan Borough	2015	Local Development Framework - Core Strategy, Topic Paper 9 - Green Infrastructure, Open Space, Sport, Recreation and Biodiversity	Y					Y		N
GMCA	2021	Appendix 1 Trafford - GMSF	Y			Y		Y		N
Trafford Council	2010	Trafford Green Space Strategy	Y			Y	Y			N
Trafford Council	2021	The Trafford Local Plan - Consultation Draft - January 2021 - 19. Green Trafford	N			Y				N
Wigan Council	2013	Wigan Local Plan	Y	Y		Y				Y

Five GI target types are present across GM's ten districts (**Error! Reference source not found.**). The range of targets present within plans and strategies incorporating GI themes varied between districts, as does the number of documents that link to GI and GI planning. Some targets are quantitative (e.g. Manchester's Local Development Framework), some are thematic (e.g. Wigan's Local Plan), and others are spatial (e.g. Rochdale's Adopted Core Strategy). Of the 29 documents reviewed, only two contain no evidence of GI targets, although these documents do provide some GI baseline information.

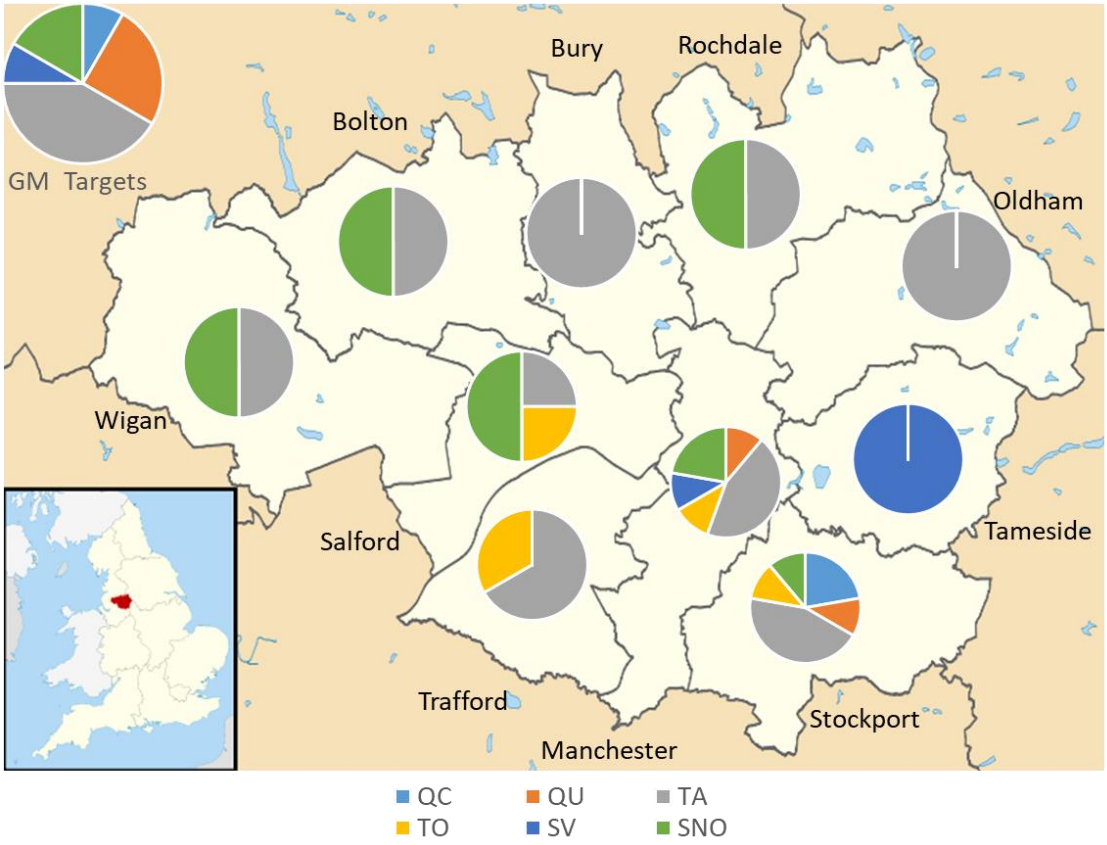


Figure 6: GI targets across GM's 10 districts. (Each district contains a pie chart representing the GI targets included in the reviewed documents. GM targets are also shown. See Table 11 and Table 12 for details of each target type)

The majority of GI targets are **Thematic: Aspirational**, that constitute broad statements around the desire to conserve, enhance and potentially expand GI, and the associated benefits that could potentially be achieved from this activity. For example, within the consultation draft of Trafford's Local Plan, it is stated that, "The Council will seek to protect, enhance and manage Trafford's Green Infrastructure as a network of connected multi-functional green and blue spaces to provide a wide range of services and benefits for people, places, the economy and the local environment. These include supporting nature recovery networks and the movement of wildlife species; providing sustainable and active travel routes; climate change adaptation and mitigation; water management and quality; increasing physical activity; health and wellbeing; quality of place and economic growth" (Trafford Council 2021: p. 1).

The next most common target type is **Spatial: Vision**. Bury Council has a range of GI vision mapping, for example within the "Bury Green Infrastructure Framework" (TEP 2010: p.37) (see Figure 7), and the identification of "Green Infrastructure Action Areas" (TEP 2010: p. 45) (see Figure 8). These maps identify existing GI, GI requiring enhancement and connection and particular areas where GI action is encouraged. Although these are broad scale mapping outputs, they act to identify priority locations for GI intervention and investment which can influence, for example, land use planning policies and decisions.

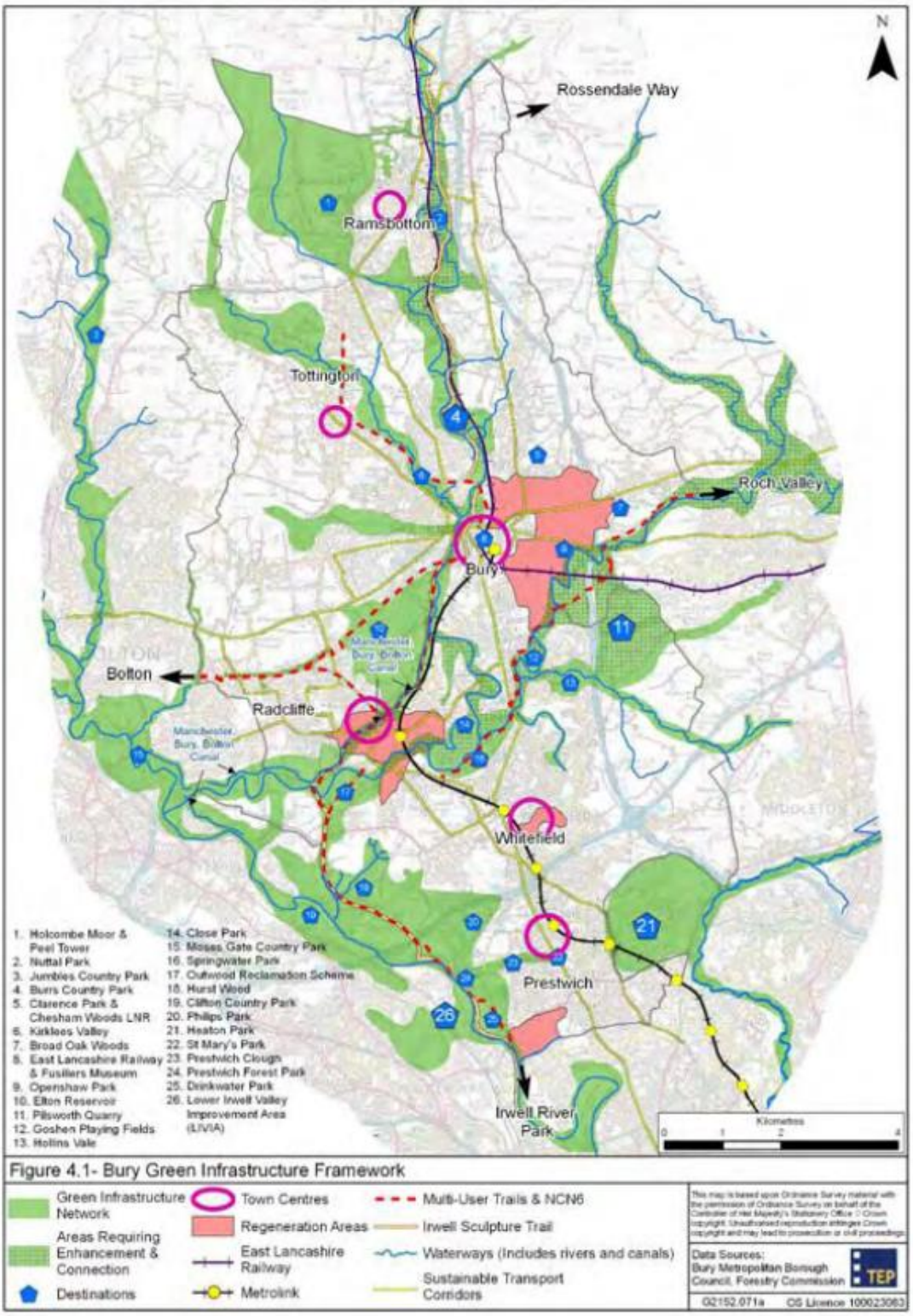


Figure 7:Bury Green Infrastructure Framework (TEP 2010)

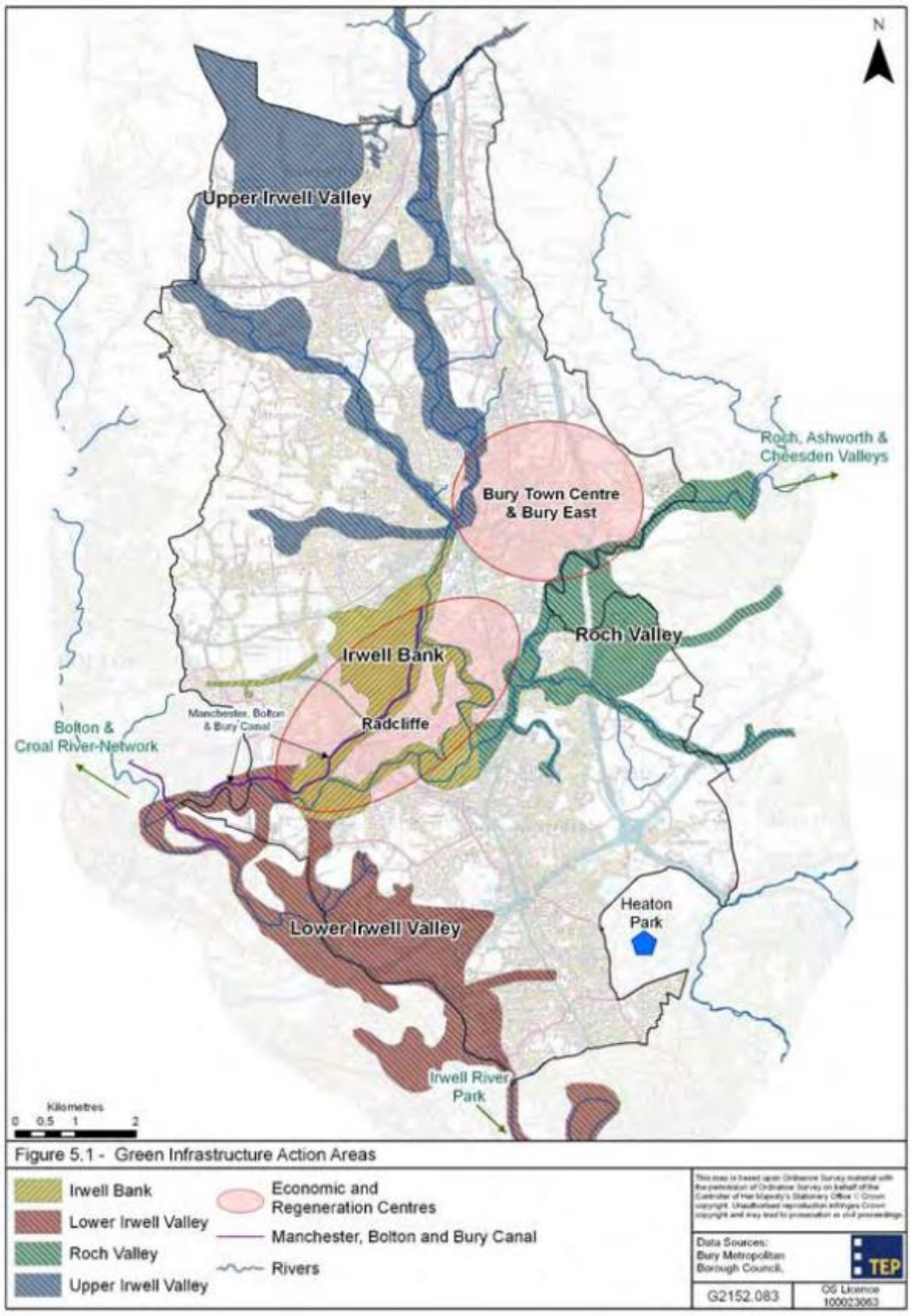


Figure 8: Green Infrastructure Action Areas (TEP 2010)

There are also examples of **Spatial: Needs and Opportunities** targets. Salford provides a good case study of policy led by this approach to GI targeting. Their Local Plan (Chapter 22) covers key green areas of Salford in detail, which include Chat Moss, Irwell Valley, West Salford Greenway. Local areas managed as Green Belt are also spatially defined. The Local Plan states that, "Chat Moss, as shown on the Policies Map (GI2/1), will be protected and enhanced as a key component of Greater Manchester's strategic green infrastructure network, forming part of a wider lowland wetland area extending into Wigan and Warrington." (Salford Council 2019: Policy GI2) (see Figure 9). Here, Chat Moss is being conserved and enhanced as a specific area of GI due to its particular value as a wetland habitat (which is relatively rare across GM), and to enhance the functions this habitat can provide including carbon sequestration and biodiversity conservation.

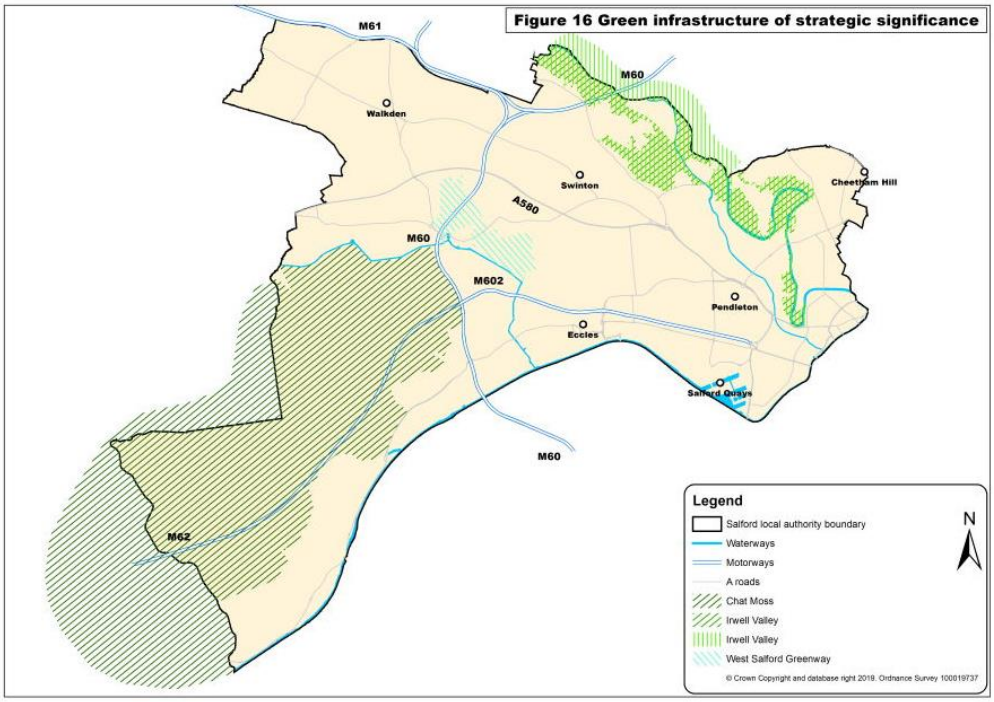


Figure 9: Green Infrastructure of strategic significance. (Salford Council 2019)

One example of a **Quantitative: Coverage** based target was found within GI-related documents produced by GM's 10 districts. This relates to tree canopy cover, and is included in Stockport Council's Stockport Town Centre Green Infrastructure Enhancement Strategy, which states that, **"**The recommended strategic aim is to increase canopy cover to at least 16% (2x the current level) by 2050 and 24% (3x the current level) by 2100." – 7.10:i. **Quantitative: Units** targets were uncommon. However, a good example is included in Manchester's Green and Blue Space Strategy which includes a target of planting at least 4,000 new trees per year across the district.

Thematic: Outcome Orientated targets are also rarely covered in the documents reviewed within this study. One good example linked to increasing access to GI is included within Trafford's Green Space Strategy, which sets a Trafford Open Space Standard (relating to green space managed by the local authority) of 1.35 hectares per 1000 people in the district. This represents the adoption of a measurable GI targets with that is intended to generate specific outcomes, in this case linked to enhancing or expanding GI to support increased green space access.

Baselines underpinning GI targets

All districts include some GI baseline data within documents underpinning their GI approach (see Table 12 and **Error! Reference source not found.**. Some baselines are simple high-level statistics such as percentage GI cover. Others include maps, at varying levels of spatial and thematic detail. Mapped baselines are not always supported by quantified data on GI surface cover and are therefore simply visualising current GI resources spatially, often at large spatial scales.

Tameside has a spatial baseline that is also quantified. The Tameside Local Development Framework notes, "Within Tameside UK BAP Priority Habitat types cover 13.68% of the Borough (shown in Figure

10) and for completeness include: Blanket Bog 210.3 ha, Lowland Beech and Yew Woodland 13.2 ha, Lowland Dry Acid Grassland 24.5 ha, Lowland Heathland 60.6 ha, Lowland Meadows 2.3 ha, Lowland Mixed Deciduous Woodland 9.1 ha, Purple Moor Grass and Rush Pasture 81.6 ha, Upland Heathland 902 ha, Wet Woodland 107.5 ha". This baseline data provides a record of the area covered by specific GI habitats that could in turn be used as a baseline to monitor their change over time. Local authorities including Trafford (Trafford Council 2010), Bury (Bury Council 2018) and Manchester (Figure 11) include map-focused GI baselines.

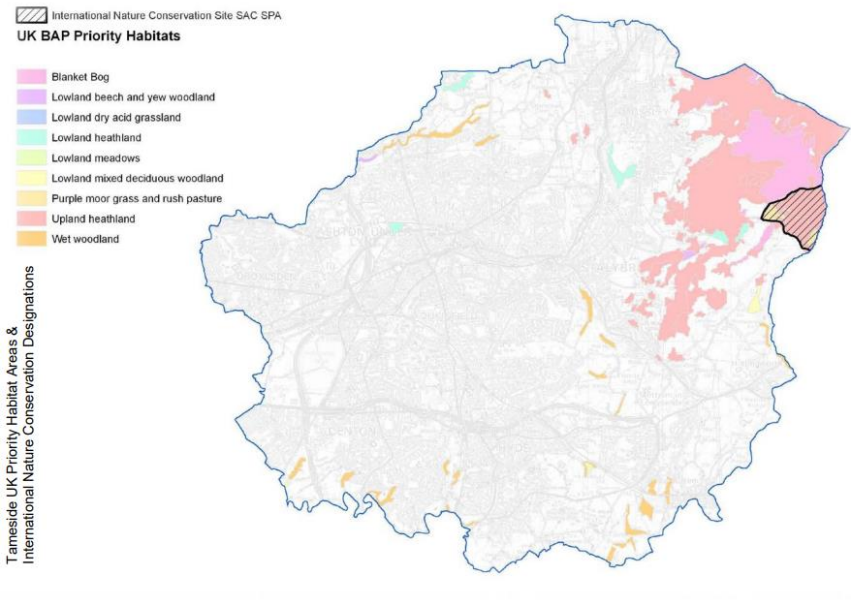


Figure 10: Tameside Priority Habitat Areas (Tameside Metropolitan Borough 2015: p. 4)

Stockport Council has a descriptive baseline focused on highlighting GI elements in its area: "Our greenspaces and parks are important and include: over 1,800 hectares of greenspace made up of over 30 parks, 317 hectares of countryside sites including woodlands, 142 play areas, over 50 sporting facilities as well as 14 formal gardens and memorial gardens" (Stockport Council 2017: p. 40).

Reference to GI baselines across GM's ten local authorities highlights the use of a variety of approaches. A GM-wide spatial and quantified GI baseline that is harmonised for all districts will enable a greater unification of GI planning and management approaches across local authorities. The IGNITION GI baseline, accessible via the GM GI Explorer, will support this goal (as discussed in the following chapter).

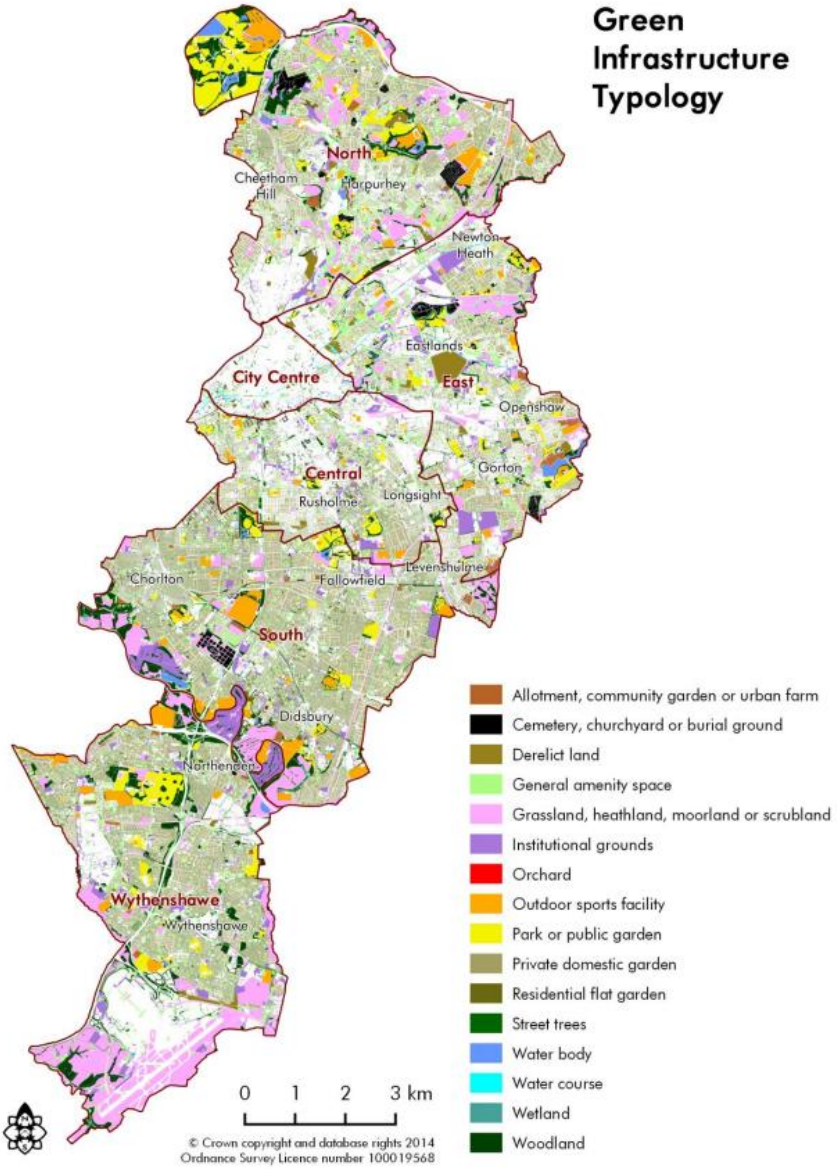


Figure 11: Green Infrastructure Topology (Countryscape 2015: p. 38)

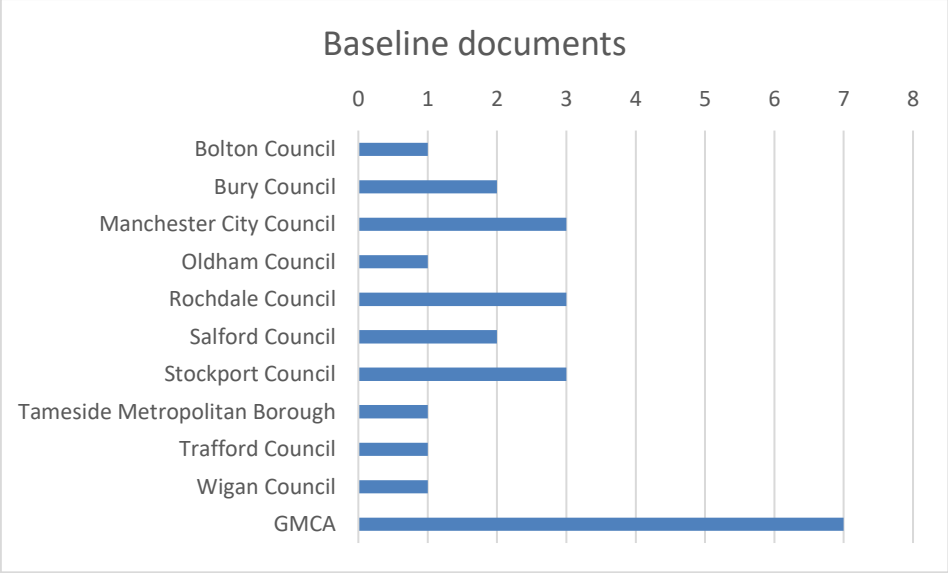


Figure 12: Number of documents per district containing a baseline.

Monitoring GI targets

Monitoring is a key element of effective GI planning. Monitoring of, and accountability for, GI targets improves confidence in an organisations ability to deliver on related objectives and improves strategic and operational GI planning and action. In GM, five districts do not refer to GI monitoring or make related commitments (according to the documents reviewed within this study) (see Table 12 and **Error! Reference source not found.**). Salford and Rochdale make general monitoring commitments, and Manchester and Oldham have measures in place to track GI interventions. Oldham has committed to tracking specific GI-related indicators including; "Net change in the extent of protected open space…Change in areas of biodiversity importance…and Number and extent of Local Nature Reserves and Country Parks" (Oldham Council 2009). These metrics are followed up in Oldham's Local Plan Monitoring Report (Oldham 2021).

GM's 10 districts are similar to cities globally, where monitoring of GI targets is also rare, particularly in the case of more comprehensive monitoring approaches (see section 6). Further, it must be acknowledged that certain types of GI targets, including Thematic: Aspirational which is the dominant target type across GM's districts, are not generally conducive to monitoring. It should therefore not be expected that comprehensive monitoring approaches should be in place in all cases. Despite this, further attention to the monitoring of progress towards achieving GI targets in a harmonised way across GI could support more effective GI planning and management in GM and its districts.

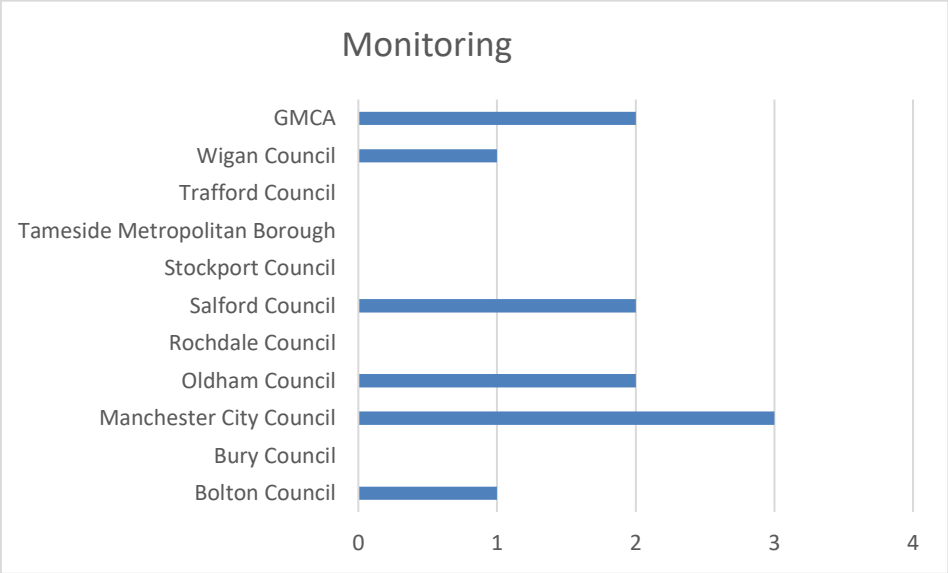


Figure 13: Overview of the number of documents in each district mentioning a monitoring approach.

Looking across the outcomes of this review GM's ten districts, each has a distinct approach to GI target setting, the use of related baseline data and commitments to monitoring of GI approaches and outcomes. Manchester has a relatively evolved approach with multiple related documents in some cases focused specifically on GI, which is potentially linked to their long-term engagement in projects and activities linked to urban GI. Other districts have not proceeded as far with this agenda locally, with references to GI target setting generally found within local planning policies and related documentation. Overall, a patchwork approach to GI target setting in GM's ten districts, and to GI planning more generally, has been identified by this review. This can act as a status check on the situation (as of 2022) and a springboard for further activity and potential harmonisation of approaches at the city-region scale.

11) Evolving GI targets in Greater Manchester – the IGNITION project contribution

This report sets out the results of a review of city GI plans and strategies. This has enabled a typology of GI targets to be developed, and insights into related GI baselines and monitoring of targets have been gained. It is clear that multiple GI targets are used by cities and urban areas as part of GI and environmental planning. These targets have varying resource, expertise and data requirements in terms of their set up and follow up. In addition to the overview of GI target approaches in 43 global cities, the report also outlines the current situation in GM and its districts.

GI targets are in a continual state of evolution, influenced by emerging policies (locally, nationally and internationally), availability of data and connections to relevant project and initiatives. The IGNITION project presents an opportunity to develop new GI target approaches in GM and its districts. To support this process, this concluding chapter explores options for developing new GI targets presented by IGNITION project outputs.

GMs GI Baseline – how does the IGNITION project move this forward?

The majority of cities have some form of GI baseline. Approaches vary considerably from those which are illustrative (i.e. provide simple headline figures on area of greenspace) to more comprehensive baselines that provide interactive data and maps covering different types of GI. GM currently sits in the middle of this spectrum with data on different types of GI available in documents including the GMSF Environmental Evidence Base (GMCA 2018). GI visualisation opportunities are provided by the GM Open Data Infrastructure Map (Mapping GM 2019), which includes data sets such as Ordnance Survey greenspace sites and Natural England's local nature reserves. This map enables point and click spatial data visualisation, but offer no analytical capabilities to users. Although certain GI features can be visualised, limited related data is available to users (for example on the spatial extent of GI features), and the GM Open Data Infrastructure Map does not support GI baseline development from a quantitative perspective.

The IGNITION GI baseline represents a significant advance on the current situation in GM. Firstly, the IGNITION GI baseline result for GM (reported in IGNITION deliverable D 2.4.2) is more accurate than those provided by existing GI datasets as it classifies land parcels that were previously unclassified by Ordnance Survey. It should be noted, however, that no currently available spatial data layer can provide a 100% accurate quantification of current urban GI in GM. Reasons for this include ongoing

changes in urban form and errors with underlying spatial data layers from data providers. The IGNITION urban GI baseline is no exception.

An important feature of the IGNITION GM urban GI baseline is that it is two dimensional. It does not report solely on surface cover but also incorporates tree canopy cover data. The representation and synthesis of surface cover and canopy cover is an important innovation of the IGNITION GI baseline, and enables a more accurate understanding of GM's GI resource to be developed. For example, this approach builds understanding of the extent of tree canopy cover over hard surfaces, which is not be reported as GI under other baseline approaches (e.g. the OS MasterMap Greenspace Layer).

In addition to providing a better representation of GM's urban GI resource, the IGNITION GM GI Explorer enables users to query the GI data sets that it incorporates (including GI surface cover and tree canopy cover data). It allows user-led data analysis at a range of different scales (e.g. wards and districts and also at neighbourhood scales) and concerning different GI 'types' (e.g. woodland, grass etc) to suit user needs. This is a key point of difference between the IGNITION GI baseline and maps and data resources currently available to GM stakeholders. The IGNITION project has therefore moved GM towards the comprehensive end of the GI baseline spectrum when compared against existing approaches in other cities globally (see Chapter 6, Table 8: GI baseline types). The IGNITION GI baseline also has a role to play in supporting GI target development, which is outlined below.

Evolving GM's GI targets – what opportunities do IGNITION project outputs present?

Chapter 9 summarises the GI targets currently in place at the GM level. The 5-year Environment Plan is the key document in this respect, given its status as an adopted strategy, and provides GM with two types of GI target: **Thematic: Aspirational**, related to increasing resilience in GM, and **Quantitative: Units,** linked specifically to tree planting. The draft documents for the GMSF and LNRS include references to spatial GI target approaches. The development of these drafts, including the GMSF's replacement by Places for Everyone, provides opportunities for embedding new and updated GI targets within the GM GI policy landscape, building on outputs and learning from the IGNITION project. Chapter 10 summarises the GI targets present within documents produced by GM's 10 districts (with further detail provided in Appendix 1). Overall, a patchwork approach to GI target setting in GM's ten districts has been identified, with a range of different GI target types present within the documents reviewed during this study.

GI targets are not static. They change over time, driven by factors including shifting political priorities, evolving urban planning goals and changes in data availability. Funded projects can also provide windows of opportunity to shift GI targets. IGNITION project outputs, particularly the IGNITION GI baseline and the GM GI Explorer, can support the process of setting and working towards achieving new GI targets for GM and it's districts. Issues and opportunities connected to developing two target types, **Quantitative: Coverage** and **Spatial: Needs & Opportunities**, are considered below.

The IGNITION GM GI Explorer

The IGN The GM GI Explorer is a software tool that is designed to support stakeholders involved in GI planning and implementation in GM. It is not a generic mapping product (as GIS is). Instead, it has a clearly defined purpose, which is to enable easy access to, and intuitive analysis of, spatial data linked to GI need and opportunity. This can encourage a spatially informed approach to GI conservation, enhancement and expansion in GM.

The GI Explorer incorporates two core functions:

- *Querying spatial data:* The GI Explorer provides end-users with the capability to access and analyse data to support end-user driven GI priorities and objectives (e.g. identifying urban areas that currently have low GI surface and canopy cover). This can support tasks including identifying locations for potential GI investment and building GI investment cases through enhancing GI evidence bases.
- *Analysis at intuitive and useful scales:* The GI Explorer enables end user groups to quantify, visualise and analyse GI baseline data at spatial scales that are meaningful to their work (e.g. wards and lower super output areas). The GI Explorer enables queries to be run, and related outputs to be produced, at these scales. The aggregation layer (introduced below) enables targeted analysis at neighbourhood scales for selected land parcels.

In summary, the GI Explorer enables users to:

- Focus specifically on issues linked to GI in GM.
- Easily quantify GI baseline data at various geographic scales, for surface and canopy cover.
- Produce figures, maps and data tables on the GI characteristics of selected locations.
- Compare between locations (e.g. wards, LSOAs) on the basis of their GI characteristics.
- Export analysis results for further analysis (e.g. within GIS).

Quantitative: Coverage GI target

The original IGNITION project proposal included a **Quantitative: Coverage** target within its headline objective, which was to:

Establish innovative NBS funding and delivery mechanisms to increase GM's urban green infrastructure (GI) coverage by 10% by 2038, from 2018 levels.

As noted in Chapter 2 of this report, work undertaken within the IGNITION project to develop GM's GI baseline highlighted the challenges associated with achieving such a target in practice, and this prompted this study into exploring different GI target types.

Although the original IGNITION GI headline objective included a **Quantitative: Coverage** that it has now been identified cannot be formally adopted at present, there is the potential to develop a different GI target of this type (at GM or GM district scales). Taking a decision to adopt this type of GI target would require further work to set up the target, including determining the specific focus of the target and its underpinning metrics. Questions that would need to be answered include:

- What GI elements (e.g. tree canopy, GI surface cover) would form the basis of the target?
- What is the spatial focus of the target (e.g. all of GM, GM's urban areas, district scale, public spaces etc)?
- What is the quantum of change in GI coverage that is desired?
- What is the duration over which the target should be achieved?

Chapter 8 provides a high-level overview of the implications of setting a **Quantitative: Coverage** target from the perspective of data, expertise and resource requirements. Essentially, this is a resource intensive task requiring specialist expertise and input but it can result in a tangible target that offers a clear direction for GI strategy and action.

If a decision is taken to develop a **Quantitative: Coverage** GI target type, this process could be informed and supported by the IGNITION GM GI baseline and GM GI Explorer. These resources provide the framework for quantifying urban GI, as a whole or regarding different GI types, at a range of different spatial scales across GM. By establishing the baseline situation, and understanding this in the context of other related land use characteristics (e.g. building and transport infrastructure coverage in the area of interest), the development of **Quantitative: Coverage** GI targets that are appropriate for the location being considered could be supported by the GM GI Explorer.

Adopting any form **Quantitative: Coverage** target type implies that this will be monitored in the future to assess progress towards its achievement. Related monitoring demands are significant in terms of issues including the complexity of the task and requisite skills required, and concerning the long duration of the monitoring commitment which brings associated resource implications. Issues related to monitoring **Quantitative: Coverage** targets are explored in greater detail within IGNITION Deliverable 2.4.1. This is not a straightforward process, and relies on a number of spatial data layers which may be produced by different organisations. In the context of monitoring change in GI cover, the type and frequency of updates to spatial data layers produced by data providers (e.g. Ordnance Survey) are key considerations and are outside the control of GM organisations. Another important issue is determining who will be responsible for updating the GI data over the coming years to monitor changes in GI coverage across GM in order to monitor progress towards the achievement of a **Quantitative: Coverage** targets. Although the IGNITION project (via the GI baseline and GM GI Explorer) can support the process of setting a **Quantitative: Coverage** target, the monitoring of such

a target in the future, although achievable, is a challenging task and would require further work to arrive at a workable option for organisations responsible for setting and following up on the target.

Spatial: Needs & Opportunities GI target

There is the potential to adopt and move towards the achievement of a **Spatial: Needs & Opportunities** GI target (at the GM scale or within its districts). This GI target type would align with the GM Natural Capital Investment Plan (NCIP)[4] vision, which is for:

> "A Greater Manchester where investments in natural capital enhance the long term social, environmental, and economic health and wellbeing of its people and businesses".

The NCIP highlights that spatial data can help to target natural capital investments to locations where they are most needed, thereby helping to meet social, environmental and economic objectives. The draft LNRS also makes use of an opportunity-based approach, identifying sites with the potential to expand and connect to provide spaces for nature. Urban GI is an important constituent element linked to achieving this objective, and the draft LNRS document presents an opportunity map identifying locations for possible GI interventions to support nature recovery and biodiversity. Both the draft LNRS and NCIP indicate that a **Spatial: Needs & Opportunities** GI target is an option for GM to consider adopting.

GI interventions have the potential to provide a range of environmental, social, and economic benefits. Within the IGNITION project, the key focus is on increasing GM's urban GI to support climate change adaptation. GM's key climate change risk is flooding, which could therefore provide a particular focus for a **Spatial: Needs & Opportunities** GI target. The IGNITION project has also concentrated on particular types of GI within the process of developing and exploring GI project funding streams. These are SUDS, green roofs and public parks. Tree planting is also important for GM due to the adoption of the 3 million trees target. A GI target building on these themes could therefore look something like (N.B. this is in illustrative draft for discussion):

- Investment in GI, in particular SUDS, green roofs, public parks and tree planting, will be targeted at locations that can reduce flood risk and alleviate heat stress.

The IGNITION GM GI Explorer can inform the development of GI strategies that take a proactive spatial approach to GI investment and intervention. It can support tasks including identifying locations for potential GI intervention and building related GI business cases, helping to achieve a **Spatial: Needs & Opportunities** GI target if this approach was adopted. Chapter 8 provides for further insights into the implications of setting up a **Spatial: Needs & Opportunities** GI target from the perspective of data, expertise and resource requirements. Key issues influencing target set up demands include the specific thematic focus of the target, the extent to which these are broadly agreed upon by stakeholder groups and the availability of existing data on the needs and opportunities of interest.

If a **Spatial: Needs & Opportunities** GI target is considered to be a viable option, monitoring requirements essentially concern establishing whether GI interventions are happening in areas of identified need and opportunity. As this is not a quantitative target, the focus is not on the amount

[4] https://naturegreatermanchester.co.uk/wp-content/uploads/2019/01/GM-Natural-Capital-Investment-Plan-Final180119.pdf

of new GI being developed or existing GI being enhanced, but on where GI interventions are taking place. This implies a move from an opportunistic to a more strategic approach to GI planning, and associated monitoring, which is focused on achieving specific needs in target locations where there is the opportunity to deliver GI. Accordingly, another aspect of monitoring this target type would involve periodic reviews of plans and policies, particularly those with spatial implications such as land use plans, to determine the extent to which they are supporting (or hindering) activity linked to securing GI interventions in target locations.

Appendix 1 – Overview of GI Targets in GM's 10 Districts

A number of GM's districts do not currently have dedicated GI plans or strategies. This element of the review therefore also evaluated local planning documents, which often include GI-related content. There is the potential that relevant documents were not accessed where these are not available online, and this review does not therefore claim to be exhaustive. Nevertheless, it does provide insights into existing GI target setting approaches in GM's ten districts, each of which is now addressed in turn.

Bolton Council

Bolton Council's key document that discusses GI is the Local Development framework, which provides a baseline, a **Thematic: Aspirational** target, and reference to a monitoring approach (see Table 13 and Table 14 for details of Bolton's GI targets). There is also an example of a **Spatial: Needs & Opportunities** target focused on protecting specific areas of the district that represent GI of sub-regional importance. There is a focus on guiding external stakeholders to conserve and enhance GI through development planning in recognition that the council cannot address this issue alone. Bolton's planning timeline currently stretches to 2035, and developing further targets to support and inform GI intervention may help to encourage enhancement of GI over the coming decades.

Table 13: Summary table of Bolton's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Local Development Framework	Y			Y			Y	Y

Table 14: Breakdown of Bolton's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Bolton Council	Local Development Framework	2011	**TA** – "The council and its partners will: Safeguard and enhance the rural areas of the borough from development that would adversely affect its biodiversity including trees, woodland and hedgerows, geodiversity, landscape character, recreational or agricultural value; or its contribution to green infrastructure, reducing flood risk and combating climate change." – Policy CG1 **SNO** - "The council and its partners will: … Protect green infrastructure of sub-regional importance in the West Pennine Moors and the Croal Irwell Valley from adverse development." - Policy LO1, page 93

Bury Council

Bury has two documents that include GI baselines, including reference to mapping of GM's GI network (see Table 15 and Table 16 for details of Bury's GI targets). In particular, data contained in the Greenspace Audit and Strategy presents an opportunity to monitor GI improvements in the coming years. However, monitoring is not mentioned in these documents highlighting that the district does not currently have plans to track GI implementation and outcomes over time. Only one document contains GI targets, the local plan topic paper on the natural environment, and here there is recognition of the benefits of GI (**Thematic: Aspirational**), which is important in driving forward GI development in the area. A consultancy produced guidance document (TEP 2010) includes details of potential GI target approaches, but it does not appear that these have been adopted in practice. The Bury Local Plan will be prepared over the coming years to align with the National Planning Policy Framework (NPPF), and there is the potential to incorporate further GI targets within this document. Indeed, it is noted that a green infrastructure network will be developed for Bury, to inform the local plan (Bury Council 2015).

Table 15: Summary table of Bury's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Bury Local Plan - Topic Paper 7 Natural Environment	Y			Y				N
Bury Greenspace Audit and Strategy	Y							N

Table 16: Breakdown of Bury's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Bury Council	Bury Local Plan - Topic Paper 7 Natural Environment	2015	**TA** – "Green Infrastructure benefits biodiversity (in providing habitats), human health (in providing opportunities for relaxation and exercise away from polluted air) and climate change (in sequestering carbon dioxide)." – p. 19.
Bury Council	Bury Greenspace Audit and Strategy	2015	No targets for GI

Manchester City Council

The district of Manchester provides a good example of how a GM district has developed a GI approach involving baseline development, target setting and monitoring commitments (see Table 17 and Table 18 for details of Manchester's GI targets). Manchester's GI documents cover a wide range of target types, and in some cases multiple target types are present within one document (see Table 18). GI baseline data is included within a number of documents, including a consultancy produced technical report (Countryscape 2015). Monitoring approaches are covered in some of the documents, with

continued scrutiny of GI action via documents such as periodic authority monitoring reports, linked to the implementation of the local plan, which track notable new GI schemes (e.g. Manchester City Council 2020). The City Council has led on the production of these GI strategies and reports, highlighting commitment to this agenda internally in part been fuelled by links to research and engagement in related projects.

Table 17: Summary table of Manchester's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Manchester City Council Report for Resolution: Manchester Green and Blue Infrastructure Strategy and Stakeholder Implementation Plan	N		Y	Y	Y		Y	Y
Manchester's Great Outdoors - a Green & Blue Infrastructure Strategy	Y			Y		Y		N
The Nature of Manchester - Local Action Project	Y							N
MCC Environment and Climate Change Scrutiny Committee	Y			Y				Y
Manchester's Local Development Framework Core Strategy Development Plan Document	N			Y				Y

Table 18: Breakdown of Manchester's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Manchester City Council	Manchester Green and Blue Infrastructure Strategy and Stakeholder Implementation Plan	2015	**TO** – "Identify potential Local Nature Reserves (LNR) or similar opportunities to reach target coverage of 1 hectare LNR per 1,000 residents in line with national guidance, over the 10 year lifetime of the Strategy" – p. 99. **QU** – "Aim for at least 4,000 new trees per year, to be planted in line with the existing Manchester Tree Strategy target, by a range of organisations and the City of Trees initiative." – p. 97. **TA** – "Health and wellbeing: deliver GI projects with a particular focus on improving health and wellbeing" – p. 99. **SNO** – "Irk Valley Project: to improve access to the river valley, water quality, biodiversity and use by local people." – p. 95.

Manchester City Council	Manchester's Great Outdoors - a Green & Blue Infrastructure Strategy	2015	**SV** - A series of maps highlight locations for potential GI intervention and network creation. **TA:** Multiple references are made to the multifunctional benefits that it is hoped that GI will help to deliver, e.g. p. 16.
Manchester City council	The Nature of Manchester - Local Action Project	2018	This document does not include GI targets but does include a wide range of baseline data evidence on GI in the district.
Manchester City Council	Manchester's Local Development Framework Core Strategy Development Plan Document	2012	**TA** – "The development of networks of green infrastructure [...] will promote healthy, low-carbon lifestyles, contribute to a sense of wellbeing, and help to facilitate the sustainable and inclusive growth of the City." – p. 30.

Oldham Council

Oldham has a GI baseline set out in the Core Strategy and Development Management Policies document, covering themes including woodland cover for the district (although this document is from 2009) (see Table 19 and Table 20 for details of Oldham's GI targets). Indicators are set out in the Core Strategy, including the net change in extent of protected open spaces, and these are assessed within the districts Annual Monitoring report. Although these indicators reflect engagement in GI-related themes, there are no dedicated GI targets, beyond those that are **Thematic: Aspirational** in nature. Local plan development presents an opportunity to expand GI target setting and related follow up activities at Oldham Council.

Table 19: Summary table of Oldham's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Oldham Local Development Framework Development Plan Document - Joint Core Strategy and Development Management Policies - Environment Statement	N			Y				Y
Core Strategy and Development Management Policies DPD: Preferred Options	Y							Y

Table 20: Breakdown of Oldham's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Oldham Council	Oldham Local Development Framework Development Plan Document - Joint Core Strategy and Development Management Policies - Environment Statement	2011	**TA –** "The council's preferred way forward is about regeneration, promoting economic prosperity, and creating safe and strong sustainable communities. This will be achieved by: [...] protecting and enhancing existing green infrastructure, and where appropriate providing new quality and accessible open spaces, to promote health and well-being." – p. 19. **TA -** "The protection and enhancement of green infrastructure will also help to mitigate the effects of climate change." - page 27

Rochdale

Rochdale has overarching GI targets within its Core Strategy (see Table 21 and Table 22 for details of Rochdale's GI targets). In addition to **Thematic: Aspirational** targets, specific locations are identified where GI can encourage progress towards strategic sustainable development priorities and help meet local needs. This is an example of a **Spatial: Needs & Opportunity** target. Specific areas within the district (e.g. Middleton) have their own GI strategies. These include **Thematic: Aspirational** targets, and map-based **Spatial: Vision** targets that provide a broad indication of areas where 'green links' could be developed. The spatially oriented nature of Rochdale's GI approach sets it apart from a number of other GM districts. Most of Rochdale's GI-related documents contain some form of GI baseline, which are generally map-based and do not appear to be quantified, although the Core Strategy does reference the need for a green space audit that could enable future evaluation of how GI has changed in the district. The need for GI monitoring is highlighted, for example related to the Local Plan, but no details are provided of specific monitoring approaches.

Table 21: Summary table of Rochdale's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Rochdale Township Green Infrastructure Action Plan	Y			Y			Y	N
Rochdale Adopted Core Strategy	N			Y			Y	Y
Pennines Green Infrastructure Action Plan 2012	Y			Y			Y	N
Middleton Green Infrastructure Action Plan	Y			Y			Y	N

Table 22: Breakdown of Rochdale's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Rochdale Council	Rochdale Township Green Infrastructure Action Plan	2013	**TA** – "High quality green infrastructure will support economic growth, health and wellbeing and other township priorities, enabling the Township to grow in a sustainable way." – p. 52. **SNO** – Maps for specific areas of the district highlight "proposed green links" and "green corridors" to be conserved and focused on as areas for GI enhancement.
Rochdale Borough Council	Rochdale Adopted Core Strategy	2017	**TA** – The strategy notes that the council will focus on, "Promoting green infrastructure in a way that supports growth and regeneration and improves health and wellbeing and the image of the borough." – p. 11. **SNO** – "We will protect, improve and create green infrastructure to help deliver strategic sustainable development priorities and meet local needs in the following locations: 1. The South Pennine uplands 2. The Roch Valley corridor" – p. 95. N.B. further locations are listed
Rochdale Council	Pennines Green Infrastructure Action Plan 2012	2012	**TA** – "A high quality environment will support the Township's aspirations for economic growth, regeneration and health and well-being." – p. 2. **SNO** – Maps for specific areas of the district highlight "proposed green links" and "green corridors" to be conserved and focused on as areas for GI enhancement.
Rochdale Council	Middleton Green Infrastructure Action Plan	2012	**TA** – "Ensure that green infrastructure enables Middleton to tackle the effects of climate change and helps with flood risk management." – p. 1. **SNO** – Maps for specific areas of the district highlight "proposed green links" and "green corridors" to be conserved and focused on as areas for GI enhancement.

Salford City Council

Salford includes GI baseline data within its Local Plan (see Table 23 and Table 24) for details of Salford's GI targets). The Local Plan (Chapters 22 and 23) incorporate multiple target types, with **Spatial: Needs & Opportunity** targets being particularly common. These targets identify specific GI sites (of varying sizes) and emphasise their need to be protected and enhanced to encourage the achievement and defined goals (e.g. biodiversity conservation and climate change adaptation). A **Thematic: Outcome** target provide quantified goals around access to public woodlands. Reference to monitoring approaches is made within both chapters. Salford's Local Plan covers the period up to 2038, and provides a clear strategic approach to GI planning based around spatially-oriented targets. This long-

term approach provides the ability to adapt and improve GI policies, planning and implementation in response to changing external factors related to the economy or climate for example.

Table 23: Summary table of Salford's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Local Plan, Chapter 22: Green Infrastructure	Y			Y	Y		Y	Y
Local Plan, Chapter 23: Biodiversity and geodiversity	Y						Y	Y

Table 24: Breakdown of Salford's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Salford Council	Local Plan, Chapter 22: Green Infrastructure	2019	**TA -** "The overarching aim is to establish a comprehensive, high quality network of green infrastructure throughout Salford, extending into surrounding districts." - Chapter 22.3 **TO – "**Working towards the Woodland Trust standard of all households being within 4,000 metres walking distance of a publicly accessible woodland of at least 20 hectares in size." – Policy GI6:6 **SNO – "**Within the following parts of the city, some of which overlap, the provision and improvement of green infrastructure shall support and enhance the identified priority functions as far as practicable: Within flood zones 2 and 3 as identified by the Environment Agency, the provision of capacity for water storage in the event of a flood" – Policy GI1 **SNO – "**The Irwell Valley, as shown on the Policies Map, will be enhanced as a key landscape and wildlife corridor connecting the urban area to the countryside, forming part of a large expanse of strategic green infrastructure extending into neighbouring districts, and providing multiple environmental, social and economic benefits. [*Other GI locations have also been identified as having specific needs*]" – Policy GI3
Salford Council	Local Plan, Chapter 23: Biodiversity and geodiversity	2019	**SNO – "**The area of Salford within the Great Manchester Wetlands Nature Improvement Area as shown on the Policies Map will be managed so as to: … Optimise the ecosystem services provided by all habitats, particularly the carbon storage function of lowland raised bog" Policy BG1.

			[Other target outcomes are indicated for this particular GI resource]

Stockport Council

Stockport has GI targets at the district scale, and for the town centre as a distinct space (see Table 25 and Table 26 for details of Stockport's GI targets). These are supported by various baseline data, and indeed a number of the targets include an element of quantification, both **Quantitative: Units** and **Quantitative: Coverage**. A **Thematic: Outcome** target linked to access to open space also includes a quantification of desired outcomes. However, monitoring approaches were not mentioned within the documents reviewed, which limits opportunities to understand whether targets and associated objectives are being met in practice. Despite this, the range of target types adopted within several GI-related plans and strategies provide a clear direction for Stockport GI. The fact that some of these include quantification of, for example canopy and tree planting targets, enables related evaluation to take place in the future. Further, Stockport has short-term, and long-term targets, with a priority to enhance central Stockport by 2025 alongside a longer-term plan for GI within the district up to 2040.

Table 25: Summary table of Stockport's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Our green places and spaces	Y			Y				N
Stockport Town Centre Green Infrastructure Enhancement Strategy	Y	Y					Y	N
One Stockport All Together As One	Y			Y				N
Open Space Provision and Commuted Payments	N			Y	Y			N
Central Stockport Infrastructure Delivery Plan Prospectus	N	Y	Y	Y				N

Table 26: Breakdown of Stockport's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Stockport Council	Our green places and spaces	2017	**TA –** "Woodlands and trees provide benefits through recreation, carbon storage and capture and flood mitigation. We could, therefore, look at new tree planting, positive woodland management, including clough woodland" – p. 34.
Stockport council	Stockport Town Centre Green Infrastructure Enhancement Strategy	2015	**QC – "**The recommended strategic aim is to increase canopy cover to at least 16% (2x the current level) by 2050 and 24% (3x the current level) by 2100." – 7.10:i **SNO –** "The project based interventions are for the most part focused on the Central Business and retail areas of the Town Centre and are site specific." 7.15

Stockport Council	One Stockport All Together As One	2017	**TA – "**Improve the biodiversity and accessibility of our spaces and centres and increase the number and range of groups and individuals that benefit from our green spaces." – p. 41.
Stockport Council	Open Space Provision and Commuted Payments	2019	**TO – "**This standard sets out that for each 1000 residents there should be 2.4 hectares comprising of 1.7 hectares for outdoor sport and recreation space (including parks) and 0.7 ha for children 's play with about 0.25 ha of this equipped playgrounds." – p. 11. **TA – "**Providing green infrastructure, civic spaces and public realm that are well designed, safe and accessible, sufficient to satisfy the recreational, leisure, health and amenity requirements of the population, which can adapt to the needs of and which help mitigate the impacts of climate change and which improve health" – p. 8.
Stockport Council	Central Stockport Infrastructure Delivery Plan Prospectus	2020	**TA –** "The importance of green networks and urban spaces is increasingly recognised as an essential benefit to the well-being of people and nature. By 2040 we will have implemented a much larger network of green routes throughout the town centre, which will link to the existing parks and green spaces within the communities in and surrounding the town centre." (p.7) **QU -** "Double the number of trees (1000+) to address climate change" (p. 22) **QC -** "We will at least double the amount of green space in Central Stockport over the next 20 years, including both horizontal and vertical interventions." (p.24)

Tameside Council

Tameside only has one document referring to GI, a Core Strategy topic paper on GI and open space (see Table 27 and Table 28 for details of Tameside's GI targets). However, this document does contain a quantified baseline of priority habitat types, providing a useful basis for future monitoring. A map of a previous GM-scale analysis of priority areas for GI investment is included in the topic paper, providing a **Spatial: Vision** target. Aside from this, there is no evidence of specific targets in this document, and it is therefore understandable that no monitoring approach is presented.

Table 27: Summary table of Tameside's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Local Development Framework - Core Strategy, Topic Paper 9 - Green Infrastructure, Open Space, Sport, Recreation and Biodiversity	Y					Y		N

Table 28: Breakdown of Tameside's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Tameside Metropolitan Borough	Local Development Framework - Core Strategy, Topic Paper 9 - Green Infrastructure, Open Space, Sport, Recreation and Biodiversity	2015	**SV** – Priority Areas for Green Infrastructure Investment map p.12.

Trafford Council

Trafford's GI-related documents include quantified and spatial baseline data (see Table 29 and Table 30 for details of Trafford's GI targets). A clear target is provided linked to achieving a desired amount of greenspace per capita (**Thematic: Outcome**). There is also maps available that detail potential locations for future GI intervention (**Spatial: Vision**). Although there are quantified targets, and a range of baseline data, there are no monitoring approaches presented within available GI-related documents.

Table 29: Summary table of Trafford's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Appendix 1 Trafford – Greater Manchester Spatial Framework (GMSF)	Y			Y		Y		N
Trafford Green Space Strategy	Y			Y	Y			N
The Trafford Local Plan - Consultation Draft - January 2021 - 19. Green Trafford	N			Y				N

Table 30: Breakdown of Trafford's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
GMCA	Appendix 1 Trafford – GMSF	2021	**TA** – "The opportunity exists to enhance existing green infrastructure networks through the creation of new wetland areas to connect with existing SBIs and provide a contiguous habitat network." (p.15) **SV** – Maps identifying potential opportunities to enhance GI are provided (p.22 + 39)
Trafford Council	Trafford Green Space Strategy	2010	**TO – "**Trafford Local Open Space Standard (1.35 Ha/1000 population) (council managed greenspace)." – p. 43.

			TA – "Replenish the tree stock of parks with native species to enhance the aesthetic aspect of parks, provide valuable habitat and increase tree..." – p. 35.
Trafford Council	The Trafford Local Plan - Consultation Draft - January 2021 - 19. Green Trafford	2021	**TA –** "The Council will seek to protect, enhance and manage Trafford's Green Infrastructure as a network of connected multi-functional green and blue spaces to provide a wide range of services and benefits for people, places, the economy and the local environment, These include supporting nature recovery networks and the movement of wildlife species; providing sustainable and active travel routes; climate change adaptation and mitigation; water management and quality; increasing physical activity; health and wellbeing; quality of place and economic growth" – p. 1

Wigan Council

Wigan Local Plan provides a baseline, and **Thematic: Aspirational** targets (see Table 31 and Table 32 for details of Wigan's GI targets). Policies are included that refer to creating, conserving and enhancing GI in certain areas of the district (e.g. the new Northleigh development site has an associated **Quantitative: Coverage** target). It is stated that monitoring of the strategic landscape and GI policy will take place via monitoring of other related policies. These include policies related to Wigan's 'green heart', those linked to wildlife habitats and species, and those linked to open space, sport and recreation. For example, the latter policy includes an indicator stating that there should be no net loss of sport, recreation and informal open space. The Local Plan notes that a GI plan will be published in the future.

Table 31: Summary table of Wigan's GI plans, covering inclusion of baseline data (BL), target types, and reference to monitoring approach (MA).

		Target Types						
Title	**BL**	**QC**	**QU**	**TA**	**TO**	**SV**	**SNO**	**MA**
Wigan Local Plan	Y	Y		Y				Y

Table 32: Breakdown of Wigan's GI documents and target types with examples of each target type.

Author	Title	Date	GI target type(s)
Wigan Council	Wigan Local Plan	2013	**TA –** "We will improve the natural environments and open spaces within and between our towns and other settlements - our strategic landscape and green infrastructure - for the benefit of people and wildlife, and help make the borough a better place to live and visit and for businesses to locate and thrive…" (p.83). **QC** – The Local Plan includes a target to provide new GI in a new development site (Northleigh Park). The target is to create 9 hectares of new GI by 2022, and 18 hectares by 2026.

Appendix 2 - References

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City GI Documents

(see Appendix B, which exists as a separate excel file, for a full list)

[1] GMCA (2021) Places for Everyone. Greater Manchester Combined Authority Greater Manchester's Plan for Homes, Jobs, and the Environment: Greater Manchester Spatial Framework Revised Draft. Greater Manchester Combined Authority.

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GMCA (2017) Greater Manchester Infrastructure Framework 2040

GMCA (2021) Places for Everyone

TEP (2010) Greater Manchester's Green Infrastructure

TEP (2008) Towards a Green Infrastructure Framework for Greater Manchester: Full report

WSP (2019) Guidance for Greater Manchester - Embedding Green Infrastructure Principles

GMCA (2018) The Greater Manchester Spatial Framework: The Natural Environment

GMCA (2019) 5 Year environmental plan

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GMCA (2019) Greater Manchester's Plan for Homes, Jobs, and the Environment: Greater Manchester Spatial Framework Revised Draft

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Greater Manchester district documents

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Bolton Council (2011) Local Development Framework

Bury

Bury Council (2018) Bury Local Plan - Topic Paper 7 Natural Environment

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Manchester

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Stockport Council (2020) Central Stockport Infrastructure Delivery Plan Prospectus

Tameside

Tameside Metropolitan Borough (2015) Local Development Framework - Core Strategy, Topic Paper 9 - Green Infrastructure, Open Space, Sport, Recreation and Biodiversity

Trafford

GMCA (2021) Appendix 1 Trafford - GMSF

Trafford council (2010) Trafford Green Space Strategy

Trafford council (2021) The Trafford Local Plan - Consultation Draft - January 2021 - 19. Green Trafford

Wigan

Wigan Council (2013) Wigan Local Plan

Appendix 3 - European Projects focused on GI and Nature-Based Solutions

Name	Dates	Focus	Link
Urban Gaia	Since 2018	Knowledge and tools for Urban Green Blue Infrastructure	http://urbangaia.eu/ug_wa_gbi.php
GrowGreen	2017-2022	Nature-based solutions for resilient, healthy and liveable cities	http://growgreenproject.eu/category/resources/
Urban Green Up	2017-2022	Developing methodologies for nature-based solutions in cities	https://www.urbangreenup.eu/
Connecting Nature	2017-2022	Nature-based inventions in cities	https://connectingnature.eu/
PERFECT	2017-2021	Benefits and financing of green infrastructure	https://www.interregeurope.eu/perfect/
Naturvation	2017-2021	Knowledge creation and innovation around nature-based solutions	https://www.naturvation.eu/learn
BEGIN	2016-2020	Blue Green Infrastructure and Social Innovation	https://northsearegion.eu/begin/
Green Surge	2013-2017	Green Infrastructure and Urban Biodiversity for Sustainable Urban Development and the Green Economy	https://cordis.europa.eu/project/id/603567/reporting
GRABS	2007-2013	Green and Blue Space Adaptation for Urban Areas and Eco Towns	https://orca.cf.ac.uk/64906/1/Database_Final_no_hyperlinks.pdf
URGE	2001-2004	Development of urban greenspaces to improve the quality of life in cities and urban regions	https://cordis.europa.eu/project/id/EVK4-CT-2000-00022