

# *Lost in transition? Examining green infrastructure evaluation in neighbourhood master planning*

Article

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# lost in transition?

## examining GI evaluation in neighbourhood masterplanning

**Rosalie Callway, Tim Dixon and Dragana Nikolic** discuss the findings of recent research on how green infrastructure was evaluated and what was constructed onsite following the adoption of the BREEAM Communities standard in six sample neighbourhood-scale development projects

The potential benefits of green infrastructure (GI) to new neighbourhood developments are the focus of a growing body of research.<sup>1</sup> Such benefits include supporting wellbeing, raising property values, reducing flood risk, and improving biodiversity. There has been less research, however, examining how GI

is evaluated by practitioners during large-scale masterplan processes, and whether formal GI evaluative practices affect what is ultimately designed and delivered. The Building Research Establishment Environmental Assessment Method for Communities (BREEAM Communities) sustainable neighbourhood

**Table 1**  
Case study site data

	Estate 1*	Estate 2	Infill 1*	Infill 2	Rural-urban extension 1*	Rural-urban extension 2
<b>Masterplan type</b>	Estate regeneration	Estate regeneration	Urban infill development	Urban infill development	Rural urban extension	Rural urban extension
<b>Location</b>	Central London	Outer London	North East England	Inner London	South West England	South West England
<b>Area</b>	28 hectares	25 hectares	12.1 hectares	1.85 hectares	47 hectares	73 hectares
<b>Dwellings</b>	3,575 units	2,517 units	800 units	257 units	1,400 units	4,000 units
<b>Density</b>	125 dwellings per hectare	101 dwellings per hectare	66 dwellings per hectare	138 dwellings per hectare	30 dwellings per hectare	55 dwellings per hectare
<b>Affordable units</b>	50%	50%	25%	35%	30%	35%
<b>Client</b>	Local authority and housing association	Local authority and housing association	Local authority and housing association	Local authority and housing association	Local authority	Homes England, local authority and housing association
<b>Timeframe</b>	2010-2032	2011-2027	2011-2032	2012-2020	2011-2035	2012-2037

\* BREEAM Communities applied on site masterplan

standard assumes that if certain formal evaluative activities, including those relating to GI, occur at the pre-planning design stage, developers will take greater account of these issues in the transition to masterplan delivery. This article presents recent research findings on whether adopting BREEAM Communities (BC) affected how GI was evaluated and what was constructed onsite.

Six English neighbourhood-scale projects were studied between 2015 and 2017, reflecting three broad types of neighbourhood development projects – estate regeneration, urban infill, and rural-urban extension (see Table 1 on the preceding page). For each type of development project, two sites were studied, one which adopted the BC standard and one that did not. At each site, at least one development phase had been completed. Although each site had distinct geographical contexts and scales, they all sat within an English planning context, and the broad masterplan stages and technical evaluative processes were similar at each site. These similarities supported a degree of comparison of the formal evaluations relating to GI, such as Landscape Visual Impact Assessments (LVIAs) and ecology, tree and flood risk surveys. To understand the masterplan processes, 48 practitioners and local actors were interviewed, and public planning documents were reviewed for each site.

To examine the evaluative practice and outcomes relating to particular GI issues, ‘Strategy as Practice’ (SaP)<sup>2</sup> was used as an analytical framework to analyse 13 ‘evaluative episodes’ across all sites. SaP considers the ‘practitioners’ or actor groups, ‘practices’ such as evaluation, design and construction practices involved in a strategic process, and the ‘praxis’ or real-time

enactment of those practices. A visual SaP framework was plotted for each evaluative episode over time (see Fig. 1). In 11 episodes, GI recommendations that were established at the outline design stage were compromised or diluted during the subsequent detailed design and construction stages. Significantly, these compromises occurred *regardless* of the use of the BC standard (see Table 2 on the next page).

Four main findings emerged from the study which point to why GI was compromised in the majority of episodes:

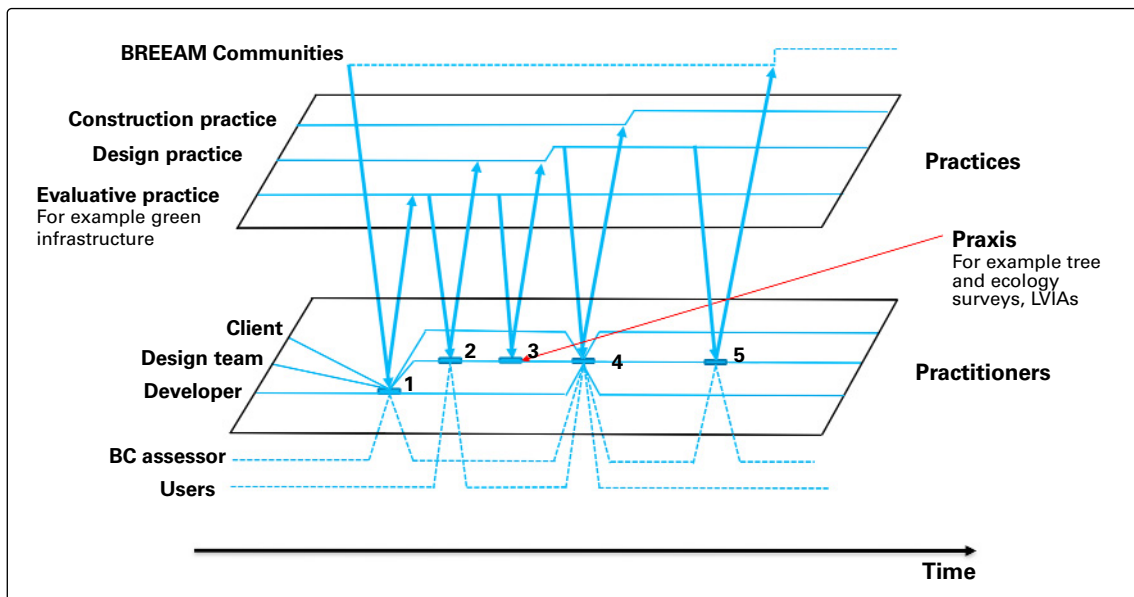
- GI is still not commonly defined and understood by all masterplan practitioners.
- GI is principally treated as an object for anthropocentric intentions.
- There is a weak sense of responsibility for GI among dominant actors.
- There are limited opportunities for local engagement in formal GI evaluation.

These four findings are discussed in turn before considering the role of BC in the process.

**Lack of a shared understanding of GI**

Overall, key GI principles such as long-term ecosystem functioning, inclusive provision, multi-functionality and multi-scalar connectivity<sup>3</sup> did not seem to be commonly understood by practitioners, and few rules or policies clearly promoted this multi-faceted view of GI. Some interviewees were uncertain about the scope of what the term GI included:

*‘When you’re talking about green infrastructure, are you talking about sustainability – for example district heating networks or actual green?’*  
Architect, Estate 2



**Fig. 1** An example masterplan evaluative episode, with numbered praxes (the enactment of practice by practitioners) and arrows indicating praxis influence (or lack of influence) on other practices

**Table 2**  
**Dominant actors and outcomes for GI evaluation and decision-making**

Site	GI evaluative episode	Decision-making stage/s	Dominant actor	GI response
Estate 1*	<b>1 Inclusive view of park for social housing tenants</b>	Outline to detailed plan	Developer (local authority)	Compromised
	<b>2 Neighbours' street view of GI</b>	Outline plan Detailed plan	Design team Design team	Compromised Prioritised
	<b>3 Overshadowing of gardens and public realm</b>	Outline to detailed plan Detailed plan	Developer National regulator	Compromised Prioritised
Estate 2	<b>4 Promotion of courtyard block trees</b>	Outline to post-construction	Design team Developer (local authority)	Compromised
	<b>5 Promotion of trees and allotment external to block</b>	Detailed plan Construction	Design team Developer	Prioritised Compromised
Infill 1*	<b>6 Adoption of soft sustainable drainage systems</b>	Outline to detailed plan Construction	Design team Developer	Prioritised Compromised
	<b>7 Promotion of street trees</b>	Outline to construction	Developer	Compromised
Infill 2	<b>8 Link to local park (and Site of Importance for Nature Conservation – SINC)</b>	Outline plan Detailed plan to construction	Design team Developer	Prioritised Compromised
	<b>9 Installation of biodiverse green roof</b>	Outline to detailed plan Construction	Design team Developer	Prioritised Compromised
Rural-urban extension 1*	<b>10 Link to ancient woodland (and SINC)</b>	Outline to construction	Developer	Compromised
	<b>11 Adoption of soft sustainable drainage systems</b>	Outline to detailed plan Detailed plan	Local authority Developer (phase2)	Prioritised Compromised
Rural-urban extension 2	<b>12 Promotion of street trees</b>	Outline plan Detailed plan	Design team Developer	Prioritised Compromised
	<b>13 Protection of wildlife corridor</b>	Outline to detailed plan Construction	Developer (private) Developer (local authority)	Compromised Compromised

\* BREEAM Communities applied on site masterplan

Several actors, including developers, housing associations, residents and some consultants, referred to just one or two specific GI functions (for example ecological conservation or flood relief). Others who worked more directly with GI (urban designers, landscape architects, and ecologists) presented a broader understanding, as did some local authority officers. Perhaps this variation in understanding is unsurprising, but it raises questions about who drives evaluative practice and how GI could be given greater priority by them. A narrow definition of GI used by developers meant that other masterplan intentions with clearly defined, more immediate benefits often took

priority, such as time management, cost control and hard infrastructure:

*'In truth trees are so insignificant they are often an afterthought... The biggest financial problem is not mitigating [for the loss of] the trees. It's the wrong trees affecting the site footprint. If that means a loss of units, that's going to hit the purse strings.'*  
 Arboriculture assessor, Estate 2

The limited interpretation of GI and its potential functions, as well as norms and standards, by key decision-makers had direct implications for masterplan outcomes. For example, evaluative recommendations supporting ecological connectivity (i.e. biologically



Photo: R Callway

**Fig. 2** Left: Proposed wildlife links for Rural-urban extension 1 at outline design stage. Right: Shrubs and ornamental hedges planted instead of natural hedges that were meant to link to woodland

linked ecological habitats that support humanity as well as other living organisms) were poorly supported by regulations and policies, resulting in compromises on three sites (Infill 2, Rural-urban extension 1 and Rural-urban extension 2). In the outline designs for Rural-urban extension 1, commitments to make ecological connections between a neighbouring ancient woodland and the site by using soft sustainable drainage systems (SuDS), natural hedgerows and tree planting were cut back in the detailed and construction stages. The developer increased car parking provision to meet minimum requirements, reduced tree planting, introduced more hard SuDS, and planted predominantly ornamental miniature hedges (see Fig. 2).

**GI as merely an anthropocentric ‘object’ for people to use**

In the research, a commonly held view is that GI is predominantly used for human-centred reasons, neglecting the living species and natural habitats that are essential for ecological functioning and that humanity ultimately depends upon (for example, woodland areas support climate mitigation and promote soil and air quality and water filtration). Furthermore, GI contains living organisms that have their own agency and functions, which arguably are intrinsically valuable in their own right;<sup>4,5</sup> i.e. all living things, not just humans, can impact and change their surroundings, shaping not just neighbourhoods but also the wider world.<sup>6</sup> As one local ecologist (at Rural-urban extension 2) commented, the GI concept feels framed against ecological agency: *‘Green infrastructure is more for people... You can’t make a wildlife site multi-use... you know the usual parlance – ‘We’ll put a road through the heathland. It won’t matter if the badgers get run over. That’s hard luck, you know.’*

In terms of evaluation, the arboriculture, noise, flood, energy, microclimate, overshadowing and transport surveys undertaken did not formally consider GI as living systems that can have agency – i.e. that GI can affect and be affected by a development. For example, arboriculture surveyors seemed more concerned with ensuring that trees were safe for humans rather than considering wider ecological benefits that trees might provide which are of importance to the long-term survival of both humans and other species.<sup>7</sup> Even where trees were classified as being of good ecological quality (A or B categories under BS 8537), they were often sacrificed to deliver other development priorities of more immediate and obvious functional benefit, such as highways, car parking, and underground utilities (this compromise occurred in evaluative episodes 7, 8, 10 and 12).

Other evaluations, such as energy models, flood surveys, overshadowing and microclimate surveys, also did not recognise that GI might be affected by or help to mitigate negative development impacts. For example, in evaluative episode 2 (Estate 1), trees and vegetation were not considered in a transport survey for their potential buffering role (i.e. protecting against visual, air, soil, water and noise pollution, and providing physical protection for pedestrians). As a result, GI was not proposed until neighbouring residents protested about their loss of visual amenity. This highlights a tension between the anthropocentric views that underpin terminology such as green *infrastructure*, *ecological services* and *natural capital*, and an eco-centric view that sees human needs and intentions as only part of a wider ecological context.<sup>8,9</sup>

**Weak GI responsibility**

Unlike financial and hard infrastructure evaluations, which were conducted regularly throughout the masterplan process, most GI-specific evaluations





**Fig. 3 Pedestrian character area (Rural-urban extension 2) with trees (2014, left) and trees removed when utilities were redesigned (2015, right)**

were heavily 'front-loaded', conducted early during the outline design stage and driven by planning rules and norms. During the later detailed design and construction stages, however, GI-related evaluations were conducted more intermittently. They were also often conducted by consultants peripheral to the core design team, which, in turn, weakened the evaluative accountability of central decision-makers at the latter stages. For example, a landscape architect (at Infill 2) described how the design team seemed unaware of the evaluative recommendations that had arisen from an earlier ecology survey:

*'Sometimes you have information at the beginning of the project and it kind of gets lost and forgotten about... it's just quite surprising how architects aren't always very aware of these issues.'*

This problem was demonstrated by the failures to plant the agreed number of trees (at Estate 2, Infill 1 and Rural-urban extension 2) (see Fig. 3), to construct functional soft SuDS (at Infill 1 and Rural-urban extension 1), or to establish a living green roof (at Infill 2).

It is clear that evaluative responsibility requires a definite *intention* by practitioners to respond to and track evaluative recommendations. This research reveals constrained, risk-averse and pragmatic evaluative behaviour by both developers and local authorities which undermined early intentions to incorporate GI. Local officials referred to conflicting policies and resource constraints (such as housing targets and budget cuts) that limited their sense of

responsibility over GI intentions. For example, unless legal protections were involved, or the GI on site was substantial, desk-based reviews of GI data were more common when awarding planning consent than primary on-site checks. Even housing associations were constrained in terms of GI responsibility. As an urban designer (at Estate 1) put it:

*'[Housing associations] are very heavily capped on costs so it just tends not to get done. They have the right aspiration but then they don't do it because [...] finding the money to do it isn't always their priority.'*

### Exclusive GI evaluation

The research found that local actors (for example residents associations and park groups) were not expected to engage with most technical evaluations relating to GI, including Landscape Visual Impact Assessment, and microclimate, overshadowing, flooding, noise, arboriculture and ecology surveys. Instead, they were engaged through more generic design workshops and public exhibitions. Developers and their contracted consultants talked about wanting to avoid consultation overload and conflict. One arboriculture assessor (Estate 1) highlighted how technical consultants felt fearful when it comes to public engagement:

*'It's very dangerous to talk to local residents. Things get reinterpreted very quickly: 'I spoke to the tree guy and he said...' You know... we tend to be robotic so that things don't get misrepresented.'*

Table 3

**Barriers to embedding GI in neighbourhood masterplans, and recommendations for overcoming them**

Barriers to embedded evaluation	Recommendations
<p><b>1 Differing understanding:</b> GI is not an established evaluative concept, in relation to key principles of long-term multi-functionality, multi-scalar connectivity, and inclusive GI provision.</p>	<ul style="list-style-type: none"> <li>● <b>Clarifying GI intentions:</b> Broad intentions, principles and potential measures for GI evaluation need to be better defined and further integrated into masterplan design, construction and in-use stages.</li> </ul>
<p><b>2 Anthropocentric dominance:</b> The agency of GI is often missing in formal masterplan evaluations – for example, energy and microclimate surveys do not consider the impact of and/or on GI.</p>	<ul style="list-style-type: none"> <li>● <b>Recognising GI agency:</b> Further research is required to improve how different formal GI evaluations (finance, overshadowing, microclimate, noise, flood, transport surveys) account for the impacts of and on GI.</li> </ul>
<p><b>3 Weak responsibility:</b> There is a lack of commitment to deliver and keep track of evaluative recommendations about GI, especially during the construction and in-use masterplan stages.</p>	<ul style="list-style-type: none"> <li>● <b>Assigning responsibility:</b> Masterplans should include a GI strategy that specifies how, when, by whom and with what resources evaluative recommendations will be enacted, monitored and responded to.</li> </ul>
<p><b>4 Exclusion:</b> The weak conceptualisation of ‘inclusive’ GI means that the distributive impact of proposals and the knowledge of local actors are not considered in formal evaluative practice.</p>	<ul style="list-style-type: none"> <li>● <b>Inclusive GI evaluation:</b> The distributional impacts of GI decisions should be evaluated, including through more deliberative processes that engage local actors in formal evaluation (for example ecology, landscape, tree, overshadowing surveys).</li> </ul>

At all six sites, although local actors displayed considerable knowledge and commitment to aspects of GI, they described experiencing limited opportunities to engage with formal surveys. This exclusion of local actors reduced developer commitment to GI, and damaged local trust and general engagement. As one local newspaper quoted:

*‘It’s called a public consultation day... but they do not listen. They have made their plans. We have been ignored from day one.’*

Resident, Rural-urban extension 2

A second aspect of inclusivity relates to the distributional impacts of design proposals.<sup>10,11</sup> The formal GI evaluations studied here did not consider who benefited or was disadvantaged by different design decisions. For example, the LVIA at Estate 1 and Infill 2 did not consider the visual impact for social housing tenants. They were not allocated flats overlooking neighbouring parks, so that those flats with a nice view could be sold at a higher price, privately. External rules and norms did not support a more inclusive or equitable distribution of GI functions, except in evaluative episode 3 (at Estate 1), where legislation relating to Compulsory Purchase Orders (CPOs) enabled the CPO inspector to evaluate the social sustainability impact of loss of light on publicly accessible GI.

There needs to be more opportunities for early deliberative dialogue about masterplan intentions regarding GI, thereby increasing accountability about the distributional impacts of alternative options, with sufficient time and resources for two-way dialogue, learning and response.<sup>11,12</sup>

### Discussion and conclusions

The study reported here suggests that BC played a limited role in shaping how GI was evaluated and responded to in the three sites that applied it. Instead, BC was used to legitimise the quality of the planning applications, but was barely referred to in documents after that point. Existing rules and accepted practice appeared to be more influential in shaping how practitioners addressed GI. To affect greater change, BC needs to be more closely aligned with how masterplans are actually put into practice. All masterplan stages need to be reviewed, but BC currently prioritises the design stage. Evaluative practices at key points where decisions are made – such as cost appraisal, and layout of highways and utilities – also need to be better targeted. BRE (the Building Research Establishment) is currently reviewing BC, which offers a potential opportunity to address some of the issues identified by this and other research.

In some ways it is perhaps understandable that the research showed that GI intentions were



compromised, given the narrow GI conceptualisation and a paucity of tools that evaluate GI in a broader way. More work is therefore needed to operationalise the definition and evaluation of GI intentions within masterplan processes, especially during construction and in-use stages, including clarifying who should take evaluative responsibility at the latter stages, and assessing the resources required to do this. There is also a need to consider how GI might be better reflected in formal evaluative practices, such as LVIAAs, to help strategically plan for multi-functional, interconnected, multi-scalar GI systems, and to ensure that they are supported in the long term and delivered in a more inclusive way.<sup>13-15</sup> Table 3 on the preceding page summarises key barriers and recommendations to further embed GI in masterplan processes.

Although the findings of this research are specific to the six case study sites, other research has raised similar concerns about how GI is understood and incorporated in planning, design and construction.<sup>5,14</sup> Long-term trends of ecological decline in the UK are partly a consequence of habitat loss and disconnection through urbanisation.<sup>7</sup> HM Government's 25 Year Environment Plan calls for the creation of 'more green infrastructure' in our towns and cities.<sup>16</sup> There is a need, however, to be much more specific in planning and development policies about what GI is and what it is for, in order to encourage developers and authorities to take greater responsibility in the delivery of good-quality GI both for people and for a functioning natural environment. As Ellen Bernstein wrote in *The Green Bible*:<sup>17</sup>

'... habitat (air, water, earth) matters. Place matters. Place and habitat are words from two different domains – culture and biology – that refer to the same thing: the physical environment in which a creature (inhabitant) makes its home. Without habitat, without a home providing food, shelter and air, no creature can exist.'

● **Dr Rosalie Callway, Professor Tim Dixon and Dr Dragana Nikolic** are with the School of the Built Environment, University of Reading. The research reported here was kindly sponsored by the Industrial CASE studentships of the Engineering and Physical Sciences Research Council and by BRE. The views expressed are personal.

## Notes

- 1 See, for example, IC Mell: 'Green infrastructure: reflections on past, present and future praxis'. *Landscape Research*, 2017, Vol. 42 (2), 135-45; *Design and Masterplanning*. Guide 3. Practical Guides for Creating Successful New Communities. TCPA, Dec. 2017. [www.tcpa.org.uk/guidance-for-delivering-new-garden-cities](http://www.tcpa.org.uk/guidance-for-delivering-new-garden-cities); and *The Multifunctionality of Green Infrastructure*. Science for Environment In-Depth Report. Environment Directorate-General, European Commission, Mar. 2012. [http://ec.europa.eu/environment/nature/ecosystems/docs/Green\\_Infrastructure.pdf](http://ec.europa.eu/environment/nature/ecosystems/docs/Green_Infrastructure.pdf)
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