NH101/2

Neighbourhood Sustainability Framework: Prototype

Final

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About This Report

Title

Neighbourhood Sustainability Framework: Prototype

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Abstract

Discusses nature and measurement of neighbourhood sustainability and presents the prototype Neighbourhood Sustainability Framework including Neighbourhood Sustainability Outcome Specification, Neighbourhood Sustainability Assessment and Monitoring Tool, and Neighbourhood Sustainability Action Planning Tool. Supported by research that confirms the significant influencing role of neighbourhoods in ensuring the sustainable performance of homes.

Reference

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List of Case Studies

List of Acronyms

NBH1	*Neighbourhoods Research Baseline* research report, part of Beacon's project confirmation phase.
NDC	Neighbourhood Development Conditions
NSF	Neighbourhood Sustainability Framework
N-SAMT	Neighbourhood Sustainability Assessment and Monitoring Tool
N-SAPT	Neighbourhood Sustainability Action Planning Tool
N-SOS	Neighbourhood Sustainability Outcome Specification
SF 1.1	*Sustainability Framework Design* research report, part of Beacon's project confirmation phase.

1 Executive Summary

This report (NH101) addresses the nature and measurement of neighbourhood sustainability and presents the prototype Neighbourhood Sustainability Framework (NSF). The NSF consists of three tools:

- The Neighbourhood Sustainability Outcome Specification (N-SOS)
- The Neighbourhood Sustainability Assessment and Monitoring Tool (N-SAMT)
- The Neighbourhood Sustainability Action Planning Tool (N-SAPT)

The development of the framework and tools is supported by research (presented in four papers, and included as appendices) that confirms the significant influencing role of neighbourhoods in ensuring the sustainable performance of homes. The first three papers review international visions and practices, critical dynamics of neighbourhoods identified in social research, and sustainability indicators. The fourth paper summarises the proceedings of a workshop held with local experts.

The Neighbourhood Sustainability Framework (NSF) – An Overview

The prototype NSF is intended to ensure that the built environments are designed, constructed and managed to generate neighbourhoods that are adaptive and resilient places that allow people to create rich and satisfying lives while respecting the limitations of the natural environment. The prototype NSF is a multi-dimensional model of sustainability that sets out:

a) the outcomes that we would expect from sustainable neighbourhoods, and
b) a set of tools to assist decision-makers to improve the sustainability of neighbourhoods through built environment responses.

Each of the tools performs a particular function in the processes of assessing and developing or redeveloping neighbourhoods towards sustainability. As Figure 1 shows, the prototype NSF sets up a process by which planners and practitioners can address the sustainability of neighbourhood built environments:

1) N-SOS specifies the characteristics of a sustainable neighbourhood.
2) N-SAMT allows practitioners and planners to assess and monitor the extent to which neighbourhoods exhibit the characteristics of sustainable neighbourhoods. The application of N-SAMT allows practitioners to identify the gaps between the actual or (in proposed greenfield developments) planned built environment and the desired sustainable neighbourhood built environment.
3) On that basis, sustainability actions can be identified and prioritised through the application of the N-SAPT.

Figure 2 sets out the elements of the N-SOS. The other tools are detailed in the body of the report.

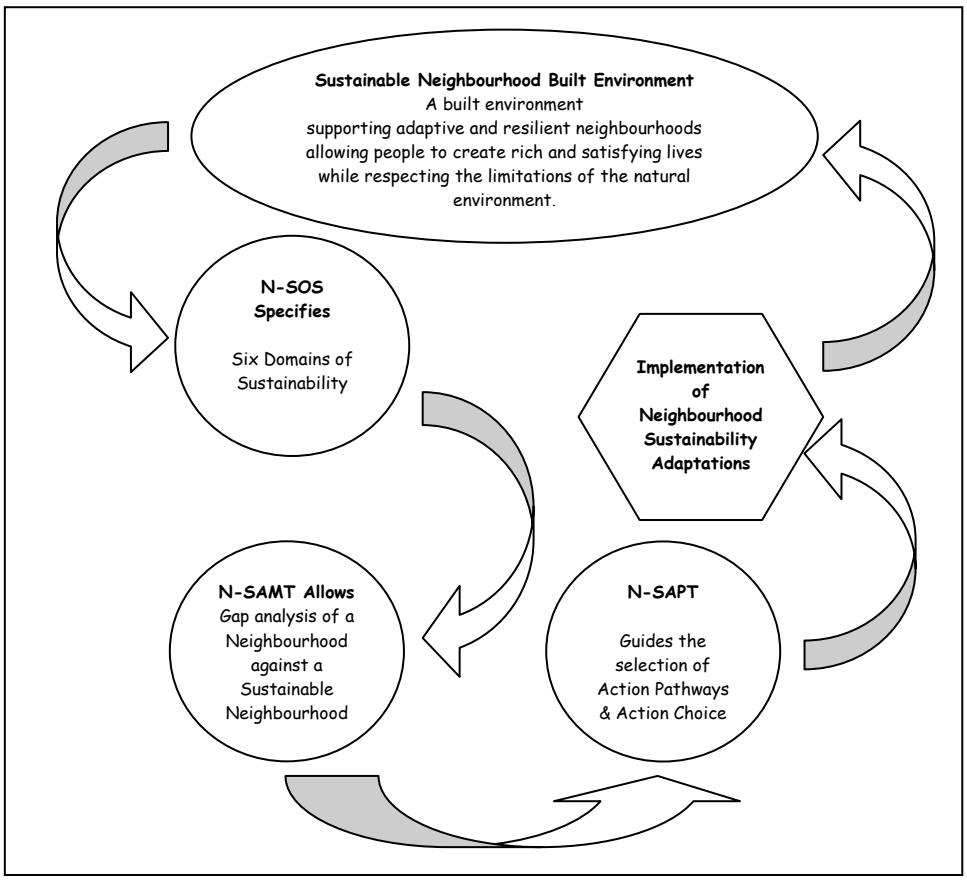
Conclusions and Next Steps

The prototype NSF has drawn from the available evidence and expertise, and is designed to be flexible and adaptable to the unique situations of neighbourhoods. Determining how appropriate and effective the framework is will depend, however, on how it is applied. It is vital that the proposed NSF be well tested and piloted. This prototype NSF therefore requires:

- A thorough testing of the validity and reliability of the tools.
- Development of mechanisms to allow the tools to be applied appropriately in the development and re-development process, particularly through integration into participative and cross-stakeholder engagement at the neighbourhood level.

Both those activities are intended in the next phase of the Neighbourhood Stream research, through the application of the prototype NSF to several case study neighbourhoods. The purpose of the case studies is twofold. Firstly to test the validity, relevance and reliability of the tools as presented here and secondly to gather baseline data on existing neighbourhoods in order to begin to assess the level of sustainability within them.

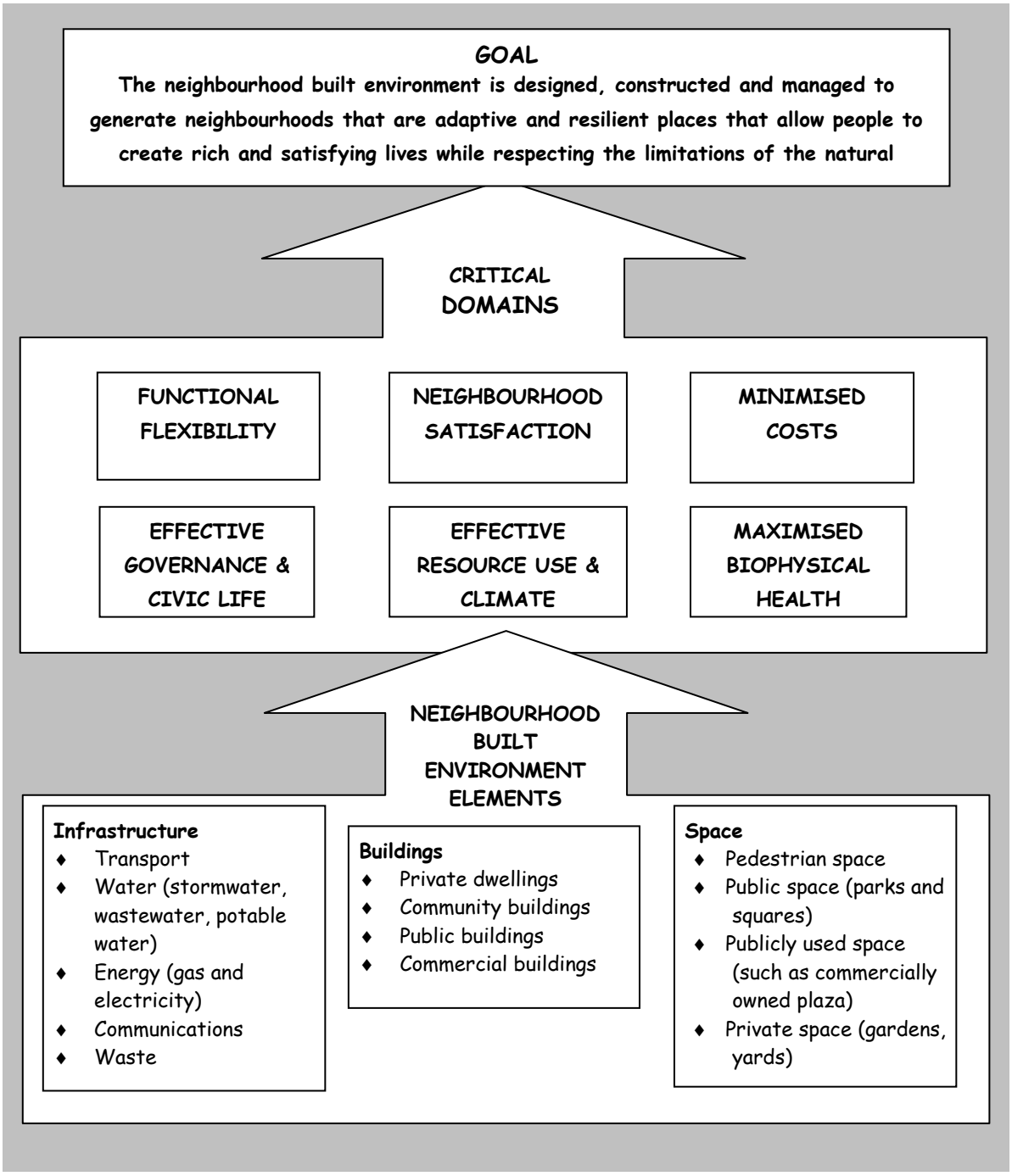
Figure 1: NSF Sequence of Adaptation of Neighbourhoods for Sustainability



One of the key challenges will be in designing solutions for the issues identified, in terms of both the process and content aspects of neighbourhood development. Recognising the interconnections between dwelling and neighbourhood, and the potential to break significant new ground, there would be value for Beacon in ensuring consistency and alignment between research streams in this regard. The research team recommends therefore, that the following steps be taken in the next phase of the research programme in order to further develop and refine the prototype NSF:

- Develop methods for undertaking case studies. This will require the development of criteria for choosing different areas, the methods of research and analysis as well as how and when the tools might be applied and by whom.
- Undertake case studies in different areas throughout New Zealand. At least three case studies are required to accommodate the different Neighbourhood Development Conditions.
- Include and develop secondary data to contextualise and support the empirical data. Analyse the information and refine the proposed NSF in light of the results as well as reporting the analysis of each case study.
- Develop stronger linkages to other streams of the Beacon project as well as within the local 'expert' community.
- Develop and maintain international linkages, particularly with those involved in related projects such as BREEAM (UK), CitiesPLUS (Vancouver, Canada), LEED (USA), METRIX (Sydney, Australia) and PPS (USA).

Figure 2: N-SOS Neighbourhood Sustainability Goal, Domains and Elements



2 Introduction

Beacon Pathway is seeking that 90 per cent of New Zealand's homes will perform sustainably by 2012. That is, New Zealanders will all live in "homes and neighbourhoods that work well into the future and don't cost the earth." The Sustainability in the Residential Built Environment Research Programme 2004-2010 (the Beacon Project) is funded by the Foundation for Research Science and Technology (FRST) and Beacon Pathway Ltd, and is intended to provide the research necessary to achieve this goal. Research is organised into four streams: policy and regulation, market transformation, technology, and neighbourhoods.

As part of its strategic plan, Beacon Pathway Ltd has set out an objective for neighbourhoods, for:

> 'Every new subdivision and any redeveloped subdivision or neighbourhood from 2008 onwards to be developed with reference to a nationally recognised sustainability framework.'

This report (NH101) is concerned with the nature and measurement of sustainable neighbourhoods, with a focus on neighbourhood built environments. It is an initial output of a research programme designed to develop tools to guide the design, building, retrofitting and management of neighbourhoods. The objective is to maximise neighbourhoods' on-going positive environmental, social and economic outcomes and mitigate the inevitable negative impacts that human settlement and human activities have on the environment.

NH101 provides a prototype Neighbourhood Sustainability Framework (NSF) that requires testing in the field. This model is multi-dimensional, including domains, principles, goals, objectives, indicators and measures that can be used together to assist decision-makers in increasing the sustainability of neighbourhoods through the choices they make about elements of the built environment. It is designed to be flexible and adaptable to local neighbourhood situations and conditions and can be applied in greenfield, brownfield and retrofit development contexts.

This report also provides a rationale and supporting evidence for the development of the NSF to its current form. It is structured in three parts with four supporting appendices. Part One provides the context and background for the development of the NSF. Part Two presents and describes the various levels of the prototype NSF, which incorporates tools that range from neighbourhood design and management guidelines to systems for monitoring neighbourhood performance. Part Three recommends the actions required to test and substantiate the model as well as other steps recommended for the robust development of neighbourhood sustainability in New Zealand. The four appendices are the result of the research and engagement processes undertaken as part of the development of the NSF. These include:

a) A review and analysis of international practice directed at developing sustainable residential built environments.

b) A review of the critical dynamics of neighbourhoods and identification of the key characteristics that appear to generate successful neighbourhoods.
c) Identification of the critical neighbourhood sustainability issues, how they may be influenced through the built form and what possible indicators of neighbourhood sustainability may be.
d) A report of the workshop held with key stakeholders with expertise in the built environment, settlements, the environment, and neighbourhoods. The workshop explored the nature of neighbourhood sustainability, its measurement and the potential of a NSF as an applied tool for the design of new and retrofitting of existing neighbourhoods.

2.1 Sustainability and the Built Environment at Dwelling and Neighbourhood Levels

The Beacon Project is a direct response to the profound imperatives to develop an environmentally and socially sustainable housing stock. It recognises that whether or not individuals wish to reduce the environmental impact of their dwellings, they will be increasingly confronted with direct and indirect costs of those environmental impacts (see Hotere, June 19 2005 for example).

The Kyoto Agreement is only one mechanism by which environmental impacts will become valued and transformed into a pricing mechanism. Other mechanisms include development and infrastructure levies to be imposed at the national, regional and local levels, including the neighbourhood level (such as those considered by Rodney and Whakatane District Councils for example; see also Price Waterhouse Coopers, 2004).

The value of the environmental impacts of the construction industry and the industries that generate building components and materials will be progressively made more transparent. Those industries will be more and more required to compensate for the value of their environmental impacts. In turn, the costs of environmental compensation will inevitably be absorbed into building costs and directly impact on housing affordability. This will occur not only in the new house market but in the secondary market as well. At the same time, households are already beginning to face the direct costs for dwellings that have poor energy performance. The risks to the social and economic viability of New Zealand households of poor design, material use and design are beginning to emerge, not only in the context of ‘leaky homes’ but also with the mounting evidence of poor health outcomes associated with a housing stock that tends to be poorly heated and subject to damp. New Zealand’s persistent tendency to under invest in repairs and maintenance also poses a sustainability risk of which we are only now becoming aware.

In response to these emerging issues, it is tempting to focus on dwellings and to attempt to increase the durability and performance of dwellings. This usually involves a focus on the development of new building technologies, the take-up of existing, but marginally used,

environmentally-conscious technologies, and the development of construction techniques, products and materials which reduce environmental impacts and increase dwelling performance. Such an approach has significant limitations, however, in generating an environmentally and socially sustainable housing stock.

The reality is that dwellings are built within settlements. The spatial arrangement of these settlements has significant impacts on the environmental performance of dwellings and incurs direct, as well as indirect, costs to households. These impacts are increasingly being recognised in New Zealand and overseas (du Plessis *et al.*, undated; MacKay, undated; Akundi, 2005; Bright, 2005; Forrest, 2004; Blum, 2003; Charlot-Valdieu and Outrequin, 2003; Eley, 2003 Hall, 2002; Fowler 1992).

Of particular relevance to New Zealand are the problems raised by low density housing tracts which require high levels of private car use, demand significant roading and other infrastructure which is costly to maintain, require costly solutions to the management of water and drainage, and absorb considerable tracts of both economically productive soil and productive ecosystems. These issues are well rehearsed in both the research literature and in the context of settlement management.

For example, the following transport effects are connected with density and urban form:

- Traffic congestion costs business an estimated $1 billion annually in the Auckland region alone due to lost productivity and delays in transporting goods (Auckland Regional Chamber of Commerce, Undated).
- Transport costs are the second largest costs to most households, after the cost of housing.
- It is now estimated that more people in the Auckland region die from vehicle emissions than in vehicle accidents (Fisher et al, 2002).
- Pollution from transport is a significant contributor to air quality and the cause most easily influenced by neighbourhood form.

Density in particular has been shown to have a significant influence on travel behaviour (Bachels, Newman and Kenworthy, 1999, Cervero and Kockelman, 1997; Newman and Kenworthy, 1989). Public transport provision and people's ability to access local facilities easily (this is often interpreted as within a 10 min walk) are often included in the social effects of neighbourhoods (see Calthorpe, 1993 for example) and are both positively impacted upon by increased neighbourhood density. Indeed, several researchers have suggested that particular density thresholds exist, such as somewhere between 20 and 30 people per hectare (Newman, 1994:77), at which travel behaviour changes dramatically. At the same time, service levels are also critical and a combination of mixed use, density and adequate service provision have been shown to be a good predictor of increased public transport use (Cervero *et al*, 2004). Recent Australian research has shown that nearly three quarters of urban motor vehicle use can be predicted on the basis of just two factors: access to full-time public transport, and street layout (Chandra, 2005).

The Beacon neighbourhood stream responds to the issue that, whether or not individuals wish to reduce the environmental impact of their dwellings, their efforts will be more or less successful depending on the opportunities and constraints of their neighbourhood's development form.

Understanding the built environment at neighbourhood level necessarily involves consideration of the non-residential built environment as well as the residential dwelling stock. The neighbourhood built environment consists of individual buildings constructed for various purposes. It also includes public and open space such as streets, walkways and parks. Any analysis needs to include how both buildings and the spaces around them work collectively and also consider what impact the space or place may have on the activities that take place within them. It must consider the state of the infrastructure systems and services available, such as public transport.

Alongside the functional aspects of buildings and spaces, their design, quality and aesthetics all work together to shape the urban built environment and exert a collective influence over the activities and behaviours that take place there. They influence local social and cultural identity.

Finally, it is necessary to consider the processes that unfold around and within the neighbourhood built environment. Understanding the social processes of the local area and involving local people in genuine partnerships is critical in developing a successful urban built environment that contributes to the sustainability of both the local community and the wider urban area. Indeed the process of implementing initiatives to improve sustainability can be as critical to the outcomes as the strategies and products themselves.

2.2 The Neighbourhood Research Stream, Rationale and Definitions

The neighbourhood component of the Beacon Project is tasked with developing tools to guide the design, building, retrofitting and management of neighbourhoods. This is to maximise neighbourhoods' on-going positive environmental, social and economic outcomes and mitigate the inevitable negative impacts that human settlement and human activities have on the environment.

It recognises that sustainable dwellings are closely associated with sustainable neighbourhoods, but, individually, sustainable dwellings do not make sustainable neighbourhoods. Neighbourhoods form an important connection between dwellings and cities. Understanding the nature of sustainable neighbourhoods will better help the building and construction industry to understand and develop the designs, construction techniques, products and materials that are going to be required in the neighbourhoods of the future and to retrofit the neighbourhoods of the past.

The rationale for the neighbourhood research stream was to be guided by international theory and experience but also to be relevant and applicable to the New Zealand context. For practical

reasons, the Auckland Regional Growth Strategy (ARGS) (ARC, 1999) has been utilised as a guiding structure. The ARGS is one example, but by no means the only one in New Zealand, of a response to issues of managing urban growth and development. The ARGS is "locked in" for the Auckland Region and similar models are also being applied in other urban areas around the country, particularly Tauranga, Wellington and Christchurch (see Eley, 2003 for example). In essence, using the ARGS as a guiding structure means accepting that our urban neighbourhoods are likely to become more populous, intensified and dense as well as needing to be better integrated both within themselves and to other neighbourhoods. It also means that development may be more focussed around town centres and related to the provision of public transport in the coming decades. Population growth has served to magnify issues that are also of concern from a sustainability perspective and responses such as those described by the ARGS can also serve to work towards goals of improved sustainability as they work towards accommodating population increases. Although implementation since 1999 has produced very mixed results, improving urban neighbourhood sustainability through the built environment needs to consider how to work with parameters such as those outlined in the ARGS.

2.3 Summary of Key Points from International Experience and Evidence

> "…appreciating the neighbourhood scale as a life space is a strategic move towards developing policies of sustainable urban development."
>
> (Charlot-Valdieu and Outrequin, 2003:10)

Appendix 1 demonstrates the diversity in understandings and applications of the concept of 'sustainability' at neighbourhood level. There is, however, plenty of common ground and the international experience reinforces that a strong community empowerment focus is fundamental to the success of sustainable neighbourhood renewal practice and visioning. Such a focus ideally emphasises:

- Incorporation and integration of local, regional, national, and global perspectives (context)
- Interdependence and interconnectedness of social, cultural, economic and environmental spheres (perspective/worldview)
- Long term visions and shorter term actions (strategy)
- Ongoing engagement, dialogue, participation and partnership between a diverse range of local stakeholders, including both residents and users, and "experts" (process and assessment)
- Adaptability, flexibility, resilience, relevance, durability, diversity, richness, creativity, integration and interconnection (application and outcomes/outputs)

The international evidence also highlights the role of the built environment in sustainability at neighbourhood level, with particular attention paid to:

- Consideration of location – both within and between neighbourhoods, including site orientation, shape, lay out as well as tenure and affordability.
- Density, diversity, and compactness of buildings.
- Design, amenity value, quality and aesthetic appeal of settlements - to create a distinctiveness between neighbourhoods that is reflective of the local area, including heritage, location, activities etc., as well as being flexible and adaptable as current uses change. Design also impacts directly on the daily lives of those who use the spaces as well as on how successive generations might be able to live.
- Integration, connectivity, and efficiency within and between neighbourhoods - a choice of transport options and ways to foster connection (a complete street network that is too narrow for fast driving for example) including integration with surrounding neighbourhoods and design of parking facilities that create inviting places to walk and don't dominate the residential landscape.
- Organisation of space: including buildings, public space and open space as well as the creation of mixed-use zones to provide economic and employment opportunities. Access to appropriate local facilities/amenities, including recreational areas and appealing public and open spaces that encourage local use including spontaneous social interaction whilst linking the various parts of the area. These areas can serve multiple functions.
- Sustainable use of resources at all lifecycle stages of buildings, infrastructure and public/open spaces - environmentally friendly development, maintenance and running costs that include improved energy efficiency, water conservation, local management of stormwater and waste water treatment, less waste and reduced air pollution.
- Protection and enhancement of the natural environment. Green spaces are more than just spaces for recreation: integrating green infrastructure into the urban built environment yields environmental benefits and can save money. Green spaces can reduce the urban heat island effect for example, but they can also provide habitat, space for community gardens and improve air and water quality. According to the US Forest Service, one acre of trees can absorb as much carbon dioxide as a car produces in 26 000 miles and neighbourhood greening has been used in Philadelphia to increase community cohesion. See, for example, http://neighborhoodcoalition.org/smartgrowth/article.asp?art=4
- Minimising direct and indirect costs.

Appendix 2 describes social research that shows how neighbourhoods are at once a unit of the larger settlement system, connected to it by flows of people, resources and the settlement infrastructure, while also being distinct entities, albeit entities with often ambiguous and 'soft' boundaries. However, reducing neighbourhoods to real measures and proximities or definitions that require a specific and unchanging range of functions or activities to be carried out within them has proved a largely futile task. Neighbourhoods are highly dynamic. The functions of and activities carried out in neighbourhoods vary from one neighbourhood to another, from city to city, from time to time, and according to the different social and economic roles of the diversity of people living in neighbourhoods.

Neighbourhoods are important entities within city systems that both reflect and impact on the way in which people lead their everyday lives. Planning and research literature a set of key characteristics of neighbourhoods are discernable. Neighbourhoods:

- are spatial nodes in which households and dwellings are clustered;
- provide for residential functions;
- facilitate residential functions through a built environment that allows for the interconnection and mutual use of infrastructure and services among neighbours and neighbouring dwellings;
- are connecting spaces between individual dwellings and the city system;
- consist of the neighbours of a cluster of dwellings;
- consist of boundaries that are loosely defined although those boundaries will typically go beyond a household's directly adjacent neighbours;
- are a domain of casual social interaction; and
- are a key site of the routines of everyday life.

The research suggests that neighbourhoods work when there is:

- housing satisfaction – notably housing satisfaction also determined by neighbourhood satisfaction
- an acceptable physical appearance of the neighbourhood including low levels of dilapidation
- safety in the street both from traffic and other people
- low noise disturbance
- access to facilities and services
- access to other sites in the settlement system
- manageable cost of both residence in the neighbourhood and in connecting to other parts of the city system
- ability to have pleasant, friendly and non-threatening casual social relations
- ability to provide opportunities for neighbourhood action on local issues, and
- low tenure mix.

The following key findings emerge from looking at the main sustainability issues affecting neighbourhoods in relation to built form (Appendix 3):

- The motor vehicle plays an important role in environmental, social and economic neighbourhood sustainability. A large proportion of greenhouse gas emissions, stormwater pollution and air pollution are caused by vehicle emissions; the time spent travelling in motor vehicles has a significant social and economic cost; transport presents the second highest cost to households after housing; and those parts of society unable or unwilling to drive are at risk of being severely disadvantaged in current neighbourhood design. Walking on the other hand is associated with greater interaction between neighbours and increased informal surveillance and therefore safety. Motor vehicle use and neighbourhood walking can be influenced by neighbourhood form through action pathways such as improving

neighbourhood walkability, local facilities, availability of public transport and increasing density.

- The quality and nature of public space plays a key role in neighbourhood sustainability. Good public space can cause people to interact, provide local habitat, double as stormwater treatment mechanisms, increase walking and be the stage for creative activities. Design quality of public space is key to achieving these and other desirable outcomes.
- Flexibility and adaptability are necessary to create robust neighbourhoods that will stand the test of time, therefore avoiding neighbourhood decline and the associated social and economic costs. Key action pathways to ensure flexibility and adaptability include a mixture in building typology and dwelling size, mixed use, local facilities and the availability of public transport.
- Increasing density in urban areas can protect valuable ecological areas by reducing sprawl, reducing the amount of land that is developed, improving the viability of town centres and public transport and directly affecting travel behaviour.

Interestingly, the conclusions each paper came to were surprisingly similar, although each research paper was worked on independently. This provides a firm footing on which to develop a prototype NSF with indicators and measures. Thus, guided by international research, six domains of characteristics emerge for the built environment of the environmentally, socially and economically sustainable neighbourhood. Those domains are:

1) Functional Flexibility,
2) Neighbourhood Satisfaction,
3) Minimised Costs,
4) Effective Governance and Civic Life,
5) Effective Resource Use and Climate Protection and
6) Maximised Biophysical Health.

These six domains form the basis for the development of the NSF, which is described in detail in Section 3.

3 The Neighbourhood Sustainability Framework

This section presents a prototype Neighbourhood Sustainability Framework [NSF]. The prototype NSF consists of three main tools:

- Neighbourhood Sustainability Outcome Specification – N-SOS
- Neighbourhood Sustainability Assessment and Monitoring Tool – N-SAMT
- Neighbourhood Sustainability Action Planning Tool – N-SAPT.

The N-SOS specifies the goal for, and scale of, sustainable neighbourhood built environments. It identifies six domains of critical outcomes, and three elements of neighbourhoods where sustainable choices may be made. These components shape the N-SAMT and N-SAPT. The N-SAMT is designed to assist in identifying neighbourhood sustainability considerations. It consists of a series of matrices that set out objectives and indicators that focus on the most fundamental elements of a sustainable built environment at neighbourhood level. The N-SAPT provides application guidance for specific neighbourhood typologies. It sets out the priority considerations for greenfield, brownfield and retrofit situations.

All neighbourhoods are dynamic and all neighbourhoods are unique in relation to their developmental histories, their built environments, their populations, and their geographical and socio-economic positioning within the broader settlement. Underpinning NSF is a conception of the neighbourhood built environment as being generated out of complex interactions in a mix of social and environmental domains.

Figure 3: Six Critical Outcome Domains for Sustainable Neighbourhoods

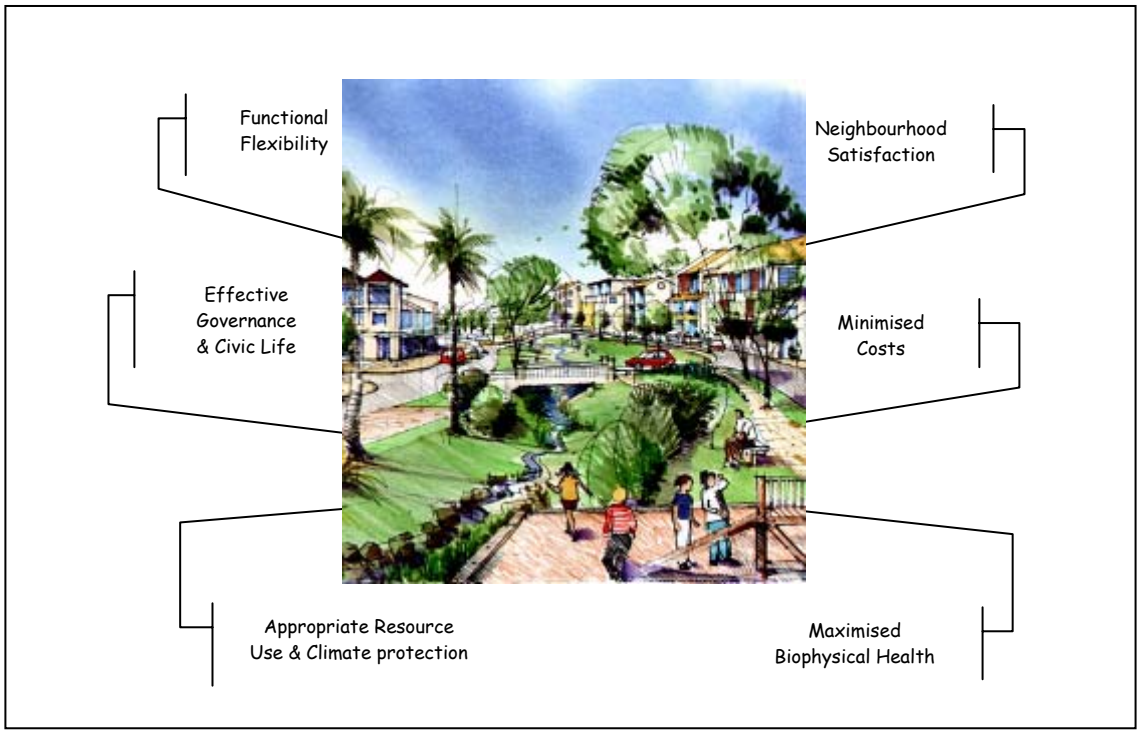


Image courtesy of IMF Westland.

The NSF focuses on those aspects of neighbourhoods that are influenced by the neighbourhood's physical form and structure, and can be controlled through acting on the current or future built environment. In developing the NSF the research team has been concerned to have a significant impact on sustainability by developing indicators that are measurable and practical. The NSF constitutes a set of tools to assist in goal and priority development and decision-making in those neighbourhoods. The effectiveness of the NSF in determining appropriate sustainability pathways and actions will, however, depend on active engagement with, and participation of, the various stakeholders in each neighbourhood, including the families and households that live there. Mechanisms for the integration of sustainability tools such as the NSF into participative and cross-stakeholder engagement at the neighbourhood level will be part of the focus of Neighbourhood Stream in Year 2.

3.1 The Evolution and Limits of the NSF and its Application

The NSF is in the early phase of development. It will be subject to revision and refinement as the Beacon Neighbourhoods research stream progresses. It will be tested in relation to case studies of neighbourhoods (both existing and yet to be built).

The NSF builds on the previous work undertaken as part of the neighbourhood stream of the Beacon Project (*NBH1: Neighbourhoods Research Baseline*, September 2004). It will be noted that the NSF presented here moves beyond the model for evaluating neighbourhood sustainability as described in NBH1[1] and explores potential indicators and guiding principles for the process of making decisions that can contribute to more sustainable neighbourhoods. These reflect critical neighbourhood-scale sustainability impacts and form the basis of the development of the prototype NSF presented here. It is recommended that this framework and identified measures then form the basis for studying the sustainability of several New Zealand case study neighbourhoods. Such case studies need to assess the different options and issues for green- and brown-field developments as well as for neighbourhood retrofitting. The case studies will assist in developing a code of practice to support implementation of sustainability measures at the neighbourhood level.

It is important to recognise that while the NSF provides a way of assessing and guiding sustainable development, the assessment criteria (metrics and indicators) are only one, albeit important, aspect of the model. The individual nature of each neighbourhood as well as the level of engagement, participation and partnership achievable within each neighbourhood will largely determine the process of implementation and application. The neighbourhood component of the Beacon Project recognises this complexity of neighbourhood dynamics and does not expect to arrive at a 'one-size fits all' response. It also recognises the challenge of separating the built environment from other aspects of neighbourhood development (such as socio-economic mix for example) but believes that there are a range of sustainability issues that are common to the

[1] NBH1, pp.77-79.

built environments of all neighbourhoods, even if the particularities of different neighbourhoods lend themselves to different mixes of priorities and solutions. These commonalities are described as six critical outcome domains. They have been developed on the basis of the research activities set out in Part I and reported in the Appendices 1-4.

Further developmental work on the NSF will be directed to:

- determining if and how the incorporated indicators can be measured,
- ensuring the reliability and validity of the indicators and measures,
- testing the Framework's applicability and functionality under different neighbourhood and settlement conditions,
- integrating it with effective process to ensure participative engagement and decision-making with neighbourhood households and stakeholders, and
- refining the NSF tools to ensure easy take-up and application by practitioners.

3.2 N-SOS – Neighbourhood Sustainability Outcome Specification

The N-SOS consists of specification of the:

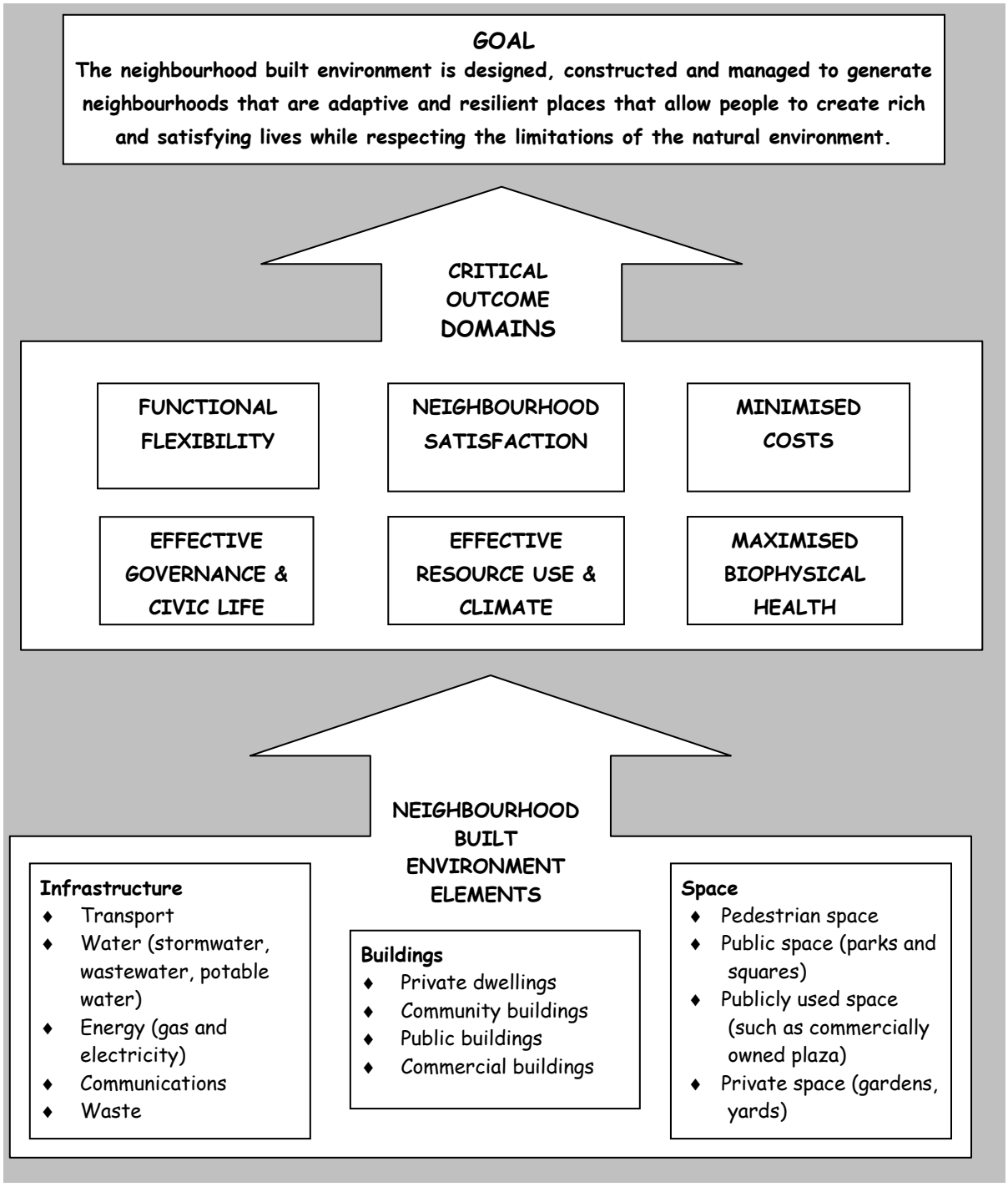
- ***goal*** for neighbourhood built environments
- ***scale*** in which the NSF is intended to operate
- ***critical outcome domains*** that are critical to achieving sustainable neighbourhoods through the built environment, and
- ***elements of the built environment*** in which built environment actions and applications will be undertaken.

Table 1 below provides an explanation of each of the four levels in the N-SOS. The macro-specification of and connections between the N-SOS are presented in Figure 4. Table 2 provides a detailed specification of the outcomes sought from the built environment in relation to the six critical domains.

N-SOS Level	Explanation & Rationale for Incorporation in N-SOS
Goal	The goal is designed to specify the characteristics of the neighbourhoods that stakeholders are attempting to achieve through built environment design and management. It reflects the dynamic nature of both the concept of sustainability and of neighbourhoods. By referencing the goal specifically to the built environment, N-SOS is limited in focus to that part of generating sustainable neighbourhoods that can be achieved through the management, design, construction and maintenance of neighbourhood built environments.
Scale	The scale is designed to ensure that N-SOS is used in relation to neighbourhood units by providing a definition of neighbourhood.
Critical outcome domains	There are six critical outcome domains. Those domains represent success statements for components which *together* are likely to represent the active and on-going achievement of sustainable neighbourhood built environments. Those domains are associated with indicators and measures in the N-SAMT.
Elements of the built environment	Three elements (buildings, infrastructure and space) have been identified which together constitute the built environment in and between neighbourhoods. Actions to achieve desirable outcomes in each of the six critical outcome domains will be specific to each element.

Table 1: The Components of N-SOS

Figure 4: N-SOS Neighbourhood Sustainability Goal, Domains and Elements



Note: The delineation between the three Built Environment Elements is not rigid. A stream for example can be employed as part of the stormwater infrastructure while at the same time being part of a neighbourhood park.

Table 2: Definitions and Descriptions of Terms used in N-SOS

Application Scale	Neighbourhood	Spatial nodes in which households and dwellings are clustered. Provide for residential functions and may facilitate non-residential functions through a built environment that allows for the interconnection and mutual use of infrastructure and services among neighbours and neighbouring dwellings. Connecting spaces between individual dwellings and the city system. Consist of the neighbours of a cluster of dwellings. Consist of boundaries that are loosely defined although those boundaries will typically go beyond a household's directly adjacent neighbours. Arenas of casual interaction. Key site of the routines of everyday life.
Critical Outcome Domains for Neighbourhood Built Environment	Functional Flexibility	The built environment can be continuously adapted to the needs of diverse and changing populations, social, economic and environment conditions: adaptability to changes in household structure, adaptability to changes in transport costs and choices, adaptability to changing ethnic and socio-economic mix of the population, adaptability to the effects of climate change.
	Neighbourhood Satisfaction	The built environment maximises the key determinants of neighbourhood satisfaction: housing quality, durability and low levels of dilapidation, street safety, low noise disturbance, opportunities for casual social interaction, opportunities for enclave living.
	Minimised Costs	The built environment minimises the direct and indirect costs and cost uncertainty for households and cities associated with: travel, dwelling and section provision, maintenance and repair, infrastructure provision, maintenance and repair, facility provision, maintenance and repair.
	Effective Governance and Civic Life	The built environment encourages: casual social interaction at street level, access to neighbourhood and city wide facilities and amenities, equitable access to basic services and amenities for children and adults with diverse levels of mobility within the neighbourhoods, formal interaction and spaces for formal interactions for neighbourhood governance, civic participation and government.
	Appropriate Resource Use and Climate Protection	The neighbourhood built environment encourages resource efficiency, resource conservation and the use of more sustainable resources in relation to: maximisation of dwelling performance, land consumption, transport energy consumption, energy and other resource sources, sustainable and renewable sources of energy, potable water and materials, lifecycle impacts.

	Maximised Bio-physical Health	The neighbourhood built environment is designed to protect and enhance the biosphere, with particular focus on: reducing negative impacts on air quality, ensuring aquatic health, protecting/enhancing biodiversity and soil quality.
Neighbourhood Built Environment Elements	Infrastructure	The fixed physical elements associated with shared services, including water infrastructure (wastewater, stormwater and potable water), transport infrastructure (roads, footpaths, cycleways, public transport), energy infrastructure (gas and electricity), communications infrastructure (phone, cable TV, etc) and waste infrastructure (e.g. recycling depot).
	Buildings	Neighbourhood buildings include private dwellings, community buildings (such as schools or a community house), public buildings (such as libraries or a town hall) and commercial buildings. Some private buildings have a public use, such as cafes, bars or the foyer of an office building or apartment complex.
	Space	Space is the area not covered by buildings or infrastructure. It includes private space (such as gardens), public space (such as parks and squares) and publicly used private space (such as a privately owned square in a shopping complex).

3.3 N-SAMT – Neighbourhood Sustainability Assessment & Monitoring Tool

N-SAMT is designed to facilitate more sustainable neighbourhood development by focussing on the fundamental elements of a sustainable built environment at neighbourhood level. N-SAMT connects the six critical outcome domains with indicators and measures that can be tailored into the practical design process. It is intended to guide and focus the development of neighbourhoods, whether at conceptual or retrofit stage, on those aspects that are essential to sustainability.

The N-SAMT involves separate matrices for each element of the built environment, that is, for infrastructure, buildings and space. They are set out in Tables 3, 4 and 5 respectively. It should be noted that most indicators and measures can be used to measure more than one domain and are often relevant to more than one element. A summary matrix, set out in Table 6 identifies the multiple outcomes and benefits of each action pathway.

3.3.1 Important sustainability issues not included in the proposed framework:

It is acknowledged that there are several significant neighbourhood sustainability issues that are not addressed by the proposed NSF, even though they have some relation to built form. This is because they were not thought to be significantly influenced by neighbourhood built form within the current systems. That is, influencing these things through the built form under the current situation or with reasonable changes to the current system was not thought practical or likely. These issues include:

Toxicity, which was referred to in *NBH1: Neighbourhood Research Baseline* in relation to the second system condition of the Natural Step framework proposed. While it is acknowledged that toxicity is an important issue, neighbourhood built form it is not thought to significantly influence toxicity.

The Nutrient Cycle, which includes food production and organic and human waste disposal. Significant gains could be made by more local food production and disposal of organic materials to those food growing areas, however this would require changes to systems far beyond the boundaries of the neighbourhood, and beyond significant built environment influence.

Solid Waste, which is perhaps the most visible symptom of our non-sustainable lifestyle. While there are solutions that could be implemented via neighbourhood built form, such as local re-use and recycling centres, they will only function if changes are made to city-wide systems. On the other hand there are solutions that can be implemented at the household or building level, such as recycling collection points or composting facilities. It can therefore be said that within the current systems neighbourhood built form does not significantly influence the generation, collection and disposal of solid waste.

Health, which has been linked to neighbourhood walkability via improved fitness and activity levels. It is clear that increased walking has health benefits, however there are so many other factors contributing to health that it was considered inappropriate to explicitly include health in the proposed NSF.

Table 3: N-SAMT – Infrastructure

Critical Outcome Domains								
Functional Flexibility	**Neighbourhood Satisfaction**	**Minimised Costs**	**Effective Governance and Civic Life**	**Appropriate Resource Use and Climate Protection**	**Maximised Bio-physical Health**	**Contributory Actions**	**Target**	**Indicators**
✓	✓	✓	✓	✓	✓	The neighbourhood infrastructure meets people's needs and is attractive.	Neighbourhood walkability supported by functional attractive footpaths, appropriate pedestrian crossings and roading layout.	Quality of pedestrian space satisfies independent urban designer. % of dwellings within 400/800m walk of neighbourhood shops, PT stop, neighbourhood park, primary school, food outlet.
✓	✓	✓	✓	✓	✓	People have quality transport choices.	Availability of public transport.	Public transport stops have seating and shelter
							Provisions for cyclists.	Adequate lane width on distributors. Cycle lanes marked at intersections. Shared walking/cycling tracks through open spaces.
✓	✓	✓	✓	✓		The neighbourhood infrastructure is able to provide for a wide variety of needs and scenarios.	Availability of high speed telecommunications.	% of properties with access to high speed telecommunications
							Infrastructure has sufficient capacity for future scenarios.	Sufficient water, energy and transport infrastructure capacity to accommodate future development.
✓	✓		✓			Pedestrian space that allows for people to gather and interact.	Sufficiently sized footpaths.	Quality of pedestrian space satisfies independent urban designer.
✓	✓				✓	Infrastructure mimics natural systems as much as possible.	Natural waterways are maintained/ reinstated in preference to piped solutions.	% of total stream length maintained in natural condition. % of riparian margins planted.

	✓	✓				Roads and pedestrian space reduces opportunities for crime	Road and pedestrian space design follows crime prevention through design guidelines.	Design satisfies independent assessor.
		✓		✓		Infrastructure that requires minimal maintenance.	Good design and use of low maintenance materials and systems.	Design satisfies independent assessor.
				✓	✓	Town supply water use is minimised.	Communal rain water collection system.	% of households served by communal rainwater collection system.
		✓		✓		Roading layout allows for sections to be orientated for good solar access.	Streets are aligned within 30 degrees of east-west.	% of streets aligned within 30 degrees of east-west.
				✓	✓		Imperviousness is minimised.	m^2 imperviousness per resident. % imperviousness in catchment.
					✓		Mitigation for imperviousness.	% of impervious area treated by stormwater management devices.

Table 4: N-SAMT – Building

Critical Outcome Domains								
Functional Flexibility	**Neighbourhood Satisfaction**	**Minimised Costs**	**Effective Governance and Civic Life**	**Appropriate Resource Use and Climate Protection**	**Maximised Bio-physical Health**	**Contributory Actions**	**Target**	**Indicators**
✓	✓	✓	✓	✓		Neighbourhood buildings that are able to accommodate the sort of facilities people will want to access locally.	Local facilities	Number of premises suitable for retail, professional services, cafes/restaurants. Number and type of educational and community facilities.
✓	✓	✓				Neighbourhood buildings provide a variety of housing choices.	Availability of rental properties	% of residential units that are rental units.
							Mixed Use	% dwellings suitable for home occupation. % of buildings that accommodate residential and commercial activities.
							Variety in housing typology and dwelling size	% of one, two, three and four bedroom units. % of detached homes, medium density units, apartments and homes with gardens.
✓	✓			✓		Neighbourhood buildings that are likely to create employment	Local jobs	Number of local jobs likely to be created.
✓	✓	✓				Neighbourhood buildings are attractive and will stay attractive over time.	Quality design and durable materials	Design and material choices satisfies independent assessor. *Note that this links to the house level efforts of Beacon*

				✓	✓	Neighbourhood form contributes to the viability of public transport. Increased density in one area protects sensitive natural areas from development.	Increased Density	Residents per hectare. Number of units per hectare (and/or FTEs) within 800 m of a rail station, ferry terminal or bus interchange. Number of units per hectare (and/or FTEs) within 400 m of a bus stop. Highest density housing is near public transport stops.
		✓				The neighbourhood includes housing that is affordable	Availability of low cost housing.	% of Housing New Zealand dwellings
	✓					The neighbourhood attracts and retains creative and skilled people.	Availability of suitable space for creative use.	% of commercial space #% under average commercial rent.
				✓		Buildings are resource efficient in their construction and ongoing use	Party Walls	Average number of shared walls/ceilings/floors per dwelling.
							Dwellings are not excessively large.	Average size of one, two, three and four bedroom homes.

Table 5: N-SAMT – Space

Critical Outcome Domains								
Functional Flexibility	**Neighbourhood Satisfaction**	**Minimised Costs**	**Effective Governance and Civic Life**	**Appropriate Resource Use and Climate Protection**	**Maximised Bio-physical Health**	**Contributory Actions**	**Target**	**Indicators**
✓	✓	✓	✓	✓		Neighbourhood buildings that are able to accommodate the sort of facilities people will want to access locally.	Local facilities	Number of premises suitable for retail, professional services, cafes/restaurants. Number and type of educational and community facilities.
✓	✓	✓				Neighbourhood buildings provide a variety of housing choices.	Availability of rental properties	% of residential units that are rental units.
							Mixed Use	% dwellings suitable for home occupation. % of buildings that accommodate residential and commercial activities.
							Variety in housing typology and dwelling size	% of one, two, three and four bedroom units. % of detached homes, medium density units, apartments and homes with gardens.
✓	✓			✓		Neighbourhood buildings that are likely to create employment	Local jobs	Number of local jobs likely to be created.
✓	✓	✓				Neighbourhood buildings are attractive and will stay attractive over time.	Quality design and durable materials	Design and material choices satisfies independent assessor. *Note that this links to the house level efforts of Beacon.*

				✓	✓	Neighbourhood form contributes to the viability of public transport. Increased density in one area protects sensitive natural areas from development.	Increased Density	Residents per hectare. Number of units per hectare (and/or FTEs) within 800 m of a rail station, ferry terminal or bus interchange. Number of units per hectare (and/or FTEs) within 400 m of a bus stop. Highest density housing is near public transport stops.
		✓				The neighbourhood includes housing that is affordable	Availability of low cost housing.	% of Housing New Zealand dwellings.
	✓					The neighbourhood attracts and retains creative and skilled people.	Availability of suitable space for creative use.	% of commercial space #% under average commercial rent.
				✓		Buildings are resource efficient in their construction and ongoing use	Party Walls	Average number of shared walls/ceilings/floors per dwelling.
							Dwellings are not excessively large.	Average size of one, two, three and four bedroom homes.

Table 6: N-SAPT Actions for Critical Outcome Domains

	Critical Domain Outcomes					
Action Pathways to Neighbourhood Sustainability	**Functional Flexibility**	**Neighbourhood Satisfaction**	**Minimised Costs**	**Effective Governance Civic Life**	**Appropriate Resource Use & Climate Protection**	**Maximised bio-physical health**
Neighbourhood walkability	✓	✓	✓	✓	✓	✓
Availability of public transport	✓	✓	✓	✓	✓	✓
Increased Density	✓	✓	✓	✓	✓	✓
Design quality of public space	✓	✓	✓	✓	✓	✓
Local facilities	✓	✓	✓	✓	✓	
Mixed Use	✓	✓	✓	✓	✓	
Availability of high speed telecommunications	✓	✓	✓	✓	✓	
Local jobs	✓	✓	✓		✓	
Provisions for cyclists		✓	✓		✓	✓
Stormwater management devices		✓	✓		✓	✓
Suitability of public space for a variety of uses	✓	✓	✓	✓		

Variety in building typology & dwelling size	✓	✓	✓			
Protection of valuable soils	✓				✓	✓
Availability of free facilities		✓	✓	✓		
Planted riparian margins		✓			✓	✓
Sufficient infrastructure capacity	✓		✓			✓
Appropriate dwelling size			✓		✓	✓
Section orientation			✓		✓	
Low Imperviousness					✓	✓
No green space irrigation with town supply			✓		✓	
Communal water collection					✓	✓
Party walls			✓		✓	
Completeness of the green network (ecological linkages)		✓				✓
Availability of low cost rental properties	✓		✓			
Availability of rental properties	✓		✓			
Cost of land and buildings suitable for creative use		✓	✓			

3.4 N-SAPT – Neighbourhood Sustainability Action Planning Tool

N-SAPT has two components:

1) A preliminary method of action prioritisation (Infobox 6). This method is currently restricted to one prioritisation parameter – the extent to which an action contributes to multiple domains. Contribution to multiple domain outcomes provides a stronger case for action.
2) Guidance matrices setting out likely sustainability opportunities under various Neighbourhood Development Conditions.

The actions that will contribute to the critical domain outcomes will vary according to the nature and site of a neighbourhood. Neighbourhood Development Conditions (NDCs) govern the potentialities, limitations and return of changes to, or design, of the neighbourhood built environment. (NDCs). Table 7 provides brief description of five different NDCs. The 'retrofit urban' and 'retrofit suburban' development conditions are intended to cover those kinds of neighbourhoods where little alteration to the physical fabric is likely. Greenfield and brownfield developments offer significantly more scope for change. For each NDC, NSAPT identifies indicative sustainability pathways (Tables 8-12).

Table 7: Neighbourhood Development Conditions (NDCs)

NDC	Infrastructure	Buildings	Space
Greenfield/Brownfield - Suburban	Infrastructure is generally planned and built from scratch, but needs to be integrated with the wider settlement system. Opportunities for public transport infrastructure may be limited.	Traditionally stand alone dwellings, however an increasing trend to also include some medium density housing and limited suburban centre development. Opportunities to include some mixed.	Generally consists of neighbourhood parks, rather than urban spaces. Opportunities to create quality spaces as part of the road network.
Greenfield Urban	Infrastructure is planned and built from scratch. Capacity in receiving systems may be an issue. Generally better opportunities for public transport infrastructure than in suburban developments.	Higher density housing, often including a new town centre. Generally includes commercial and mixed-use buildings. Opportunities for communal services and facilities.	Generally more urban public spaces, such as public squares. Footpaths play an important role as public space.

Brownfield Urban	Similar to Greenfield Urban, however some infrastructure may exist (likely to require extensive work).	Similar to Greenfield Urban, however some existing buildings may be able to be retained/reused.	Similar to Greenfield Urban, however contamination may be present and providing quality greenspace may be a challenge.
Retrofit Urban	Infrastructure is existing but will often require upgrading. Demand management is an opportunity to reduce costs.	Additional housing is generally of high density. Many urban retrofit projects include some brownfield development.	Generally good opportunities to improve/create pedestrian spaces and urban open space.
Retrofit Suburban	Infrastructure is generally in place with limited opportunities for change. Improving walkability is a priority.	Existing housing tends to be stand-alone low density. Provision of community facilities is often a priority.	Local parks generally exist, but there may be opportunities for improvements.

Table 8: N-SAPT Indicative Objectives & Actions

for Greenfields/Brownfield Suburban NDC

Critical Domain Outcome	Built Environment Elements	Priority Objectives	Key Actions
Functional Flexibility	Infrastructure	Neighbourhood walkability	Short blocks/grid layout.
	Buildings	Mixed use buildings, variety of building typology and dwelling size	Provide some higher density units and some smaller dwellings suitable for one or two person households.
	Space	Suitability of public space for a variety of uses	Provide spaces suitable for people of all ages for a range of activities.
Neighbourhood satisfaction	Infrastructure	Public Transport	Cluster higher density units near public transport stops. Provide shelter at public transport stops.
	Buildings	Mixed Use	Include buildings that can accommodate home occupation and basic local facility, such as dairy or café. Create a neighbourhood centre. Ensure a primary school is in walking distance for most houses (this may be outside the neighbourhood).
	Space	Basic local facilities	Provide playground, and space to sit and talk.

Minimised Costs	Infrastructure	Infrastructure capacity	Allow for increased future densities.
	Buildings	Availability of low cost housing	Consider including some Housing New Zealand units. Include some smaller lower cost units.
	Space	Robust public spaces	Use of durable, low maintenance materials and systems.
Effective Governance and Civic Life	Infrastructure	Pedestrian space that allows for people to gather and interact.	Sufficiently wide footpaths.
	Buildings	Local facilities	Provide some local facilities, such as community house/centre.
	Space	Robust public space	Provide opportunities for casual interaction and community events.
Appropriate Resource Use & Climate Protection	Infrastructure	Solar access	Consider solar access for dwellings in street layout.
	Buildings	Smaller dwellings	Consider reducing the size of dwellings.
	Space	No green space irrigation	Design green spaces not to require irrigation.
Maximised bio-physical health	Infrastructure	Reduced imperviousness/ hydrological neutrality	Aim for low levels of imperviousness and include stormwater treatment devices
	Buildings	NA – see SF 1.1	
	Space	Completeness of the green network	Maintain/re-establish important ecological linkages. Provide wildlife habitat.

Table 9: N-SAPT Indicative Objectives & Actions

for Greenfield Urban NDC

Critical Domain Outcome	Built Environment Elements	Priority Objectives	Key Actions
Functional Flexibility	Infrastructure	Neighbourhood walkability	Short blocks/grid layout; High density; Pleasant and safe footpaths and crossings.
	Buildings	Mixed use buildings, variety of building typology and dwelling size	Provide a mixture of apartments and terraced housing and a mixture of one, two, three and four bedroom homes. Mixed use dwellings, with opportunities for buildings to be used for residential, employment and commercial purposes.
	Space	Suitability of public space for a variety of uses	Provide urban spaces suitable for events, markets, performances, etc. Ensure young people and children are catered for.
Neighbourhood satisfaction	Infrastructure	Public Transport	Cluster higher density units near public transport stops. Liaise with PT operators to ensure the new neighbourhood is well serviced.
	Buildings	Mixed Use	Include buildings that can accommodate home occupations such as live above work situations. Create a neighbourhood centre with shops, cafes and professional services.
	Space	High quality open spaces	Ensure design is of high quality and contributes to neighbourhood character. Design spaces to minimise crime.
Minimised Costs	Infrastructure	Infrastructure capacity	Demand management if insufficient capacity in receiving systems (includes sewage, stormwater, transport).
	Buildings	Availability of low cost housing	Consider including some Housing New Zealand units. Include some smaller lower cost units.
	Space	Provision of recreational facilities.	Provide children's playground and areas for play, exercise and interaction.
Effective Governance and Civic Life	Infrastructure	Pedestrian space that allows for people to gather and interact.	Sufficiently wide footpaths.
	Buildings	Local facilities	Provide some local facilities, such as community house/centre.
	Space	Robust public space that is available for public use.	Provide opportunities for casual interaction and community events. Ensure that most open space is in public ownership.

Appropriate Resource Use and Climate Protection	Infrastructure	Communal rainwater collection	Consider communal rainwater collection tanks.
	Buildings	Residential energy efficiency	Ensure good thermal performance by maximising the use of party walls. Consider building orientation to reduce the need for electrical heating and cooling.
	Space	Allow people to grow their own food.	Provide public community gardens or shared private gardens as part of private developments.
Maximised bio-physical health	Infrastructure	Use Stormwater Management Devices to treat, retain and detain run-off.	Swales in carparks, raingardens, sandfilters. Create a 'treatment train' of devices.
	Buildings	NA – see SF 1.1	
	Space	Completeness of the green network	Maintain/re-establish important ecological linkages. Leave streams unpiped and consider reinstating piped streams.

Table 10: N-SAPT Indicative Objectives & Actions

for Brownfield Urban NDC

Critical Domain Outcome	Built Environment Elements	Major Objectives	Key Actions
Functional Flexibility	Infrastructure	Neighbourhood walkability	Short blocks/grid layout High density Pleasant and safe footpaths and crossings
	Buildings	Mixed use buildings, variety of building typology and dwelling size	Provide a mixture of apartments and terraced housing and a mixture of one, two, three and four bedroom homes.
	Space	Suitability of public space for a variety of uses	Provide urban spaces suitable for events, markets, performances, etc. Ensure young people and children are catered for.
Neighbourhood satisfaction	Infrastructure	Public Transport	Cluster higher density units near public transport stops. Liaise with PT operators to ensure the new neighbourhood is well serviced.
	Buildings	Mixed Use	Consider retaining some commercial industrial buildings for creative uses (such as artists' workshops). Include buildings that can accommodate home occupations such as live above work situations. Create a neighbourhood centre with shops, cafes and professional services.

	Space	High quality open spaces	Ensure design is of high quality and references historic use (consider retaining some existing elements). Design spaces to minimise crime. Ensure that there are no remaining contamination issues, especially around playgrounds.
Minimised Costs	Infrastructure	Infrastructure capacity	Demand management if insufficient capacity in receiving systems (includes sewage, stormwater, transport).
	Buildings	Availability of low cost commercial space.	Consider maintaining some existing commercial/ industrial buildings for cheap commercial space.
	Space	Provision of recreational facilities.	Provide children's playground and areas for play, exercise and interaction.
Effective Governance and Civic Life	Infrastructure	Pedestrian space that allows for people to gather and interact.	Sufficiently wide footpaths.
	Buildings	Local facilities	Consider re-using an existing building as a community centre.
	Space	Robust public space that is available for public use.	Provide opportunities for casual interaction and community events. Ensure that most open space is in public ownership.
Appropriate Resource Use and Climate Protection	Infrastructure	Communal rainwater collection	Consider communal rainwater collection tanks.
	Buildings	Residential energy efficiency	Ensure good thermal performance by maximising the use of party walls. Consider building orientation to reduce the need for electrical heating and cooling.
	Space	Reuse existing spaces and/or materials.	Utilise demolition materials for landscaping (such as bricks).
Maximised bio-physical health	Infrastructure	Use Stormwater Management Devices to treat, retain and detain run-off.	Consider communal rainwater collection tanks.
	Buildings	NA – see SF 1.1	Swales in carparks, raingardens, sandfilters. Create a 'treatment train' of devices.
	Space	Completeness of the green network.	Maintain/re-establish important ecological linkages. Leave streams unpiped and consider reinstating piped streams.

Table 11: N-SAPT Indicative Objectives & Actions

For Retrofit Urban NDC

Critical Domain Outcome	Built Environment Elements	Major Objectives	Key Actions
Functional Flexibility	Infrastructure	Neighbourhood walkability	Connect streets when brownfield sites are redeveloped. Improve footpaths and crossings.
	Buildings	Mixed use buildings, variety of building typology and dwelling size	Ensure any new development contributes to an appropriate mix.
	Space	Suitability of public space for a variety of uses	Retrofit spaces to cater for a wider variety of uses.
Neighbourhood satisfaction	Infrastructure	Public Transport	Liaise with PT operators to improve services. Improve public transport stops to be more pleasant waiting spaces.
	Buildings	Mixed Use	Encourage uses that are currently absent from the neighbourhood (such as café, etc).
	Space	High quality open spaces	Upgrade spaces to be more functional and better reflect neighbourhood character. Upgrade spaces to minimise crime.
Minimised Costs	Infrastructure	Infrastructure capacity	Demand management if insufficient capacity in receiving systems (includes sewage, stormwater, transport).
	Buildings	Availability of low cost housing	Consider including some Housing New Zealand units, and/or some smaller lower cost units when sites are redeveloped.
	Space	Provision of recreational facilities.	Provide children's playground and improve areas for play, exercise and interaction.
Effective Governance and Civic Life	Infrastructure	Pedestrian space that allows for people to gather and interact.	Improve footpaths by creating spaces where people can gather.
	Buildings	Local facilities	Provide/upgrade some local facilities, such as community house/centre.
	Space	Robust public space that is available for public use.	Improve opportunities for casual interaction and community events. Ensure that most open space remains in public ownership.
Appropriate Resource Use and Climate Protection	Infrastructure	Demand Management	Undertake demand management for water, energy and car use.
	Buildings	Reuse buildings	Reuse existing buildings as much as possible.
	Space	Allow people to grow their own food.	Create public community gardens.

Maximised bio-physical health	Infrastructure	Use Stormwater Management Devices to treat, retain and detain run-off.	Retrofit swales in carparks, raingardens, sandfilters, etc. Create a 'treatment train' of devices.
	Buildings	NA – see SF 1.1	
	Space	Completeness of the green network	Maintain/re-establish important ecological linkages. Leave streams unpiped and consider reinstating piped streams.

Table 12: N-SAPT Indicative Objectives & Actions

for Retrofit Suburban NDC

Critical Domain Outcome	Built Environment Elements	Major Objectives	Key Actions
Functional Flexibility	Infrastructure	Neighbourhood walkability	Improve footpaths and crossings.
	Buildings	Mixed use buildings, variety of building typology and dwelling size	Consider including some higher density, smaller units when sites are redeveloped.
	Space	Suitability of public space for a variety of uses	Upgrade public spaces as opportunities arise.
Neighbour-hood satisfaction	Infrastructure	Neighbourhood Walkability	Consider traffic calming local roads.
	Buildings	Attractive buildings	Encourage residents to maintain/enhance the appearance of their dwellings.
	Space	Basic local facilities	Provide/enhance playground, and space to sit and talk.
Minimised Costs	Infrastructure	Infrastructure capacity	Undertake demand management to delay upgrades.
	Buildings	Availability of low cost housing	Consider including some Housing New Zealand unit and/or some smaller lower cost units when sites are redeveloped. Retain some existing low cost housing.
	Space	Robust public spaces	Use of durable, low maintenance materials and systems when spaces are upgraded.
Effective Governance and Civic Life	Infrastructure	Pedestrian space that allows for people to gather and interact.	Improve footpaths.
	Buildings	Local facilities	Provide/upgrade some local facilities, such as community house/centre.
	Space	Robust public space	Provide/upgrade opportunities for casual interaction and community events.

Appropriate Resource Use and Climate Protection	Infrastructure	Demand Management	Undertake demand management for water, energy and car use.
	Buildings	Reuse buildings	Reuse existing buildings as much as possible.
	Space	Allow people to grow their own food.	Create public community gardens.
Maximised bio-physical health	Infrastructure	Reduced imperviousness/ hydrological neutrality	Aim for low levels of imperviousness and include stormwater treatment devices.
	Buildings	NA – see SF 1.1	
	Space	Completeness of the green network	Maintain/re-establish important ecological linkages. Provide wildlife habitat.

4 Summary, Conclusions and Next Steps

This NH101 project has involved the development of a prototype Neighbourhood Sustainability Framework, supported by three separate research papers and an interactive local workshop. Both the international evidence and local expertise has confirmed the validity of developing sustainability models for the built environment at the neighbourhood level (Blum, 2003; Charlot-Valdieu and Outrequin, 2003; Eley, 2003).

International experience shows that neighbourhoods are extremely diverse, and that there is also much diversity in understandings and applications of the concept of 'sustainability' at neighbourhood level. The importance of the neighbourhood built environment in improving sustainability is recognised internationally. Analysis highlighted several aspects of neighbourhood sustainability that are common across different projects and models.

Local expertise highlights issues specific to New Zealand including the need for acceptance of change in our urban built environments (especially in terms of density and population growth), the lack of a design tradition to accommodate population increases and concentrations as well as the strong link between sustainable dwellings and sustainable neighbourhoods (ARC, 1999; Mackay, undated).

The neighbourhood research team has developed a proposed NSF from this international evidence and local expertise. The prototype NSF constitutes a set of tools to assist in goal and priority development and decision-making for more sustainable neighbourhoods. It has been developed out of a rational process, drawing from the evidence and expertise, and is designed to be flexible and adaptable to the unique situations of neighbourhoods. It is, however, without a clear audience of users; its appropriateness and effectiveness will depend on how it is applied. This prototype NSF therefore requires:

- A thorough testing of the validity and reliability of the tools.
- Active engagement with, and participation of, the various stakeholders in each neighbourhood, including the families and households that live there. Mechanisms for the integration of sustainability tools such as the NSF into participative and cross-stakeholder engagement at the neighbourhood level are needed to allow the tools to be applied appropriately.

Both those activities are intended in the Neighbourhood Stream in Year 2, through the application of the prototype NSF to several case study neighbourhoods. The purpose is twofold:

1) To test the validity, relevance and reliability of the tools as presented here.
2) To gather baseline data on existing neighbourhoods in order to begin to assess the level of sustainability within them.

These two purposes are interlinked and offer the opportunity for feedback and critical reflection on the tools with regard to their practical application and usefulness as well as their content and structure.

4.1 Conclusions

Neighbourhoods are diverse in their design, but they all contain common elements and activities, centred on a residential built environment which includes infrastructure and space as well as other buildings that allow residents to meet many of their daily needs locally.

Most neighbourhood development projects can be broadly defined as fitting one of five common scenarios (Neighbourhood Development Conditions – NDCs): Greenfield/Brownfield Suburban, Greenfield Urban, Brownfield Urban, Retrofit Urban and Retrofit Suburban.

Affecting the sustainability of New Zealand's neighbourhoods demands a considerable focus on existing neighbourhoods. This is a major challenge, given that many were designed using fundamentally different assumptions about the sustainability of car-based lifestyles. Research suggests that an initial priority for neighbourhood change should be in those areas where it is likely to make most difference. These areas are going to be closer to town centres, and/or near more frequent public transport services.

The application and understandings of sustainability are also diverse but there are some common themes that recur across international efforts at improving neighbourhood sustainability. These can broadly be grouped into six Critical Outcome Domains:

1) Functional Flexibility
2) Neighbourhood Satisfaction
3) Minimised Costs
4) Effective Governance and Civic Life
5) Appropriate Resource Use and Climate Protection
6) Maximised Biophysical Health

The international experience highlights the role of the built environment as well as the need to be flexible and adaptable. For the purpose of the proposed NSF the neighbourhood built environment has been split into three elements:

1) Infrastructure
2) Buildings
3) Space

Key considerations for the built environment include:

- Location, lay-out, diversity and density as well as tenure and affordability of buildings
- Accessibility and connection, including walkability, efficient transport options
- Organisation and provision of public and open spaces, including mixed use zones and green spaces
- Design, amenity value, quality and aesthetic appeal of settlements.
- Sustainable use of resources at all lifecycle stages of buildings, infrastructure and public/open spaces
- Minimising direct and indirect costs
- Protection and enhancement of the natural environment.

Successful sustainability outcomes are, however, as much about the process of developing and applying concepts and methods of improved sustainability as they are about developing indicators, measures and tools. Outcomes will be significantly different between individual neighbourhoods. The neighbourhood level is a scale whereby individuals and groups of individuals, both professional and otherwise, can be successfully involved and engaged and both ground-up and top-down approaches can be modified so as to be more relevant to the local situation. It is vital for successful sustainability outcomes that this degree of flexibility is maintained in any framework model.

The three tools embodied by the proposed NSF are designed to be flexible and adaptable whilst also providing a structure that allows well-defined goal-setting (Neighbourhood Sustainability Goal and Outcome Specification – N-SOS), assessment and monitoring (Neighbourhood Sustainability Assessment and Monitoring Tool – N-SAMT) and, following the gap analysis undertaken with the N- SAMT, provides pathways for action (Neighbourhood Sustainability Action Planning Tool – N-SAPT) within the five different NDCs (as described above).

Attention also needs to be given to the less measurable aspects of neighbourhood sustainability. This includes the richness and creativity evident as well as the cultural and historical heritage felt and expressed. These can be embodied and expressed through the built environment and the activities that go on within the built environment.

What this means for the Beacon Project is that neighbourhoods are a vital link between dwellings and the greater urban form. They are linkages and intermediary spaces/places that offer much scope for influencing sustainability both at the local and wider scale. Ignoring such a link places the viability of efforts at the dwelling level in jeopardy and renders city-wide efforts less than effective, because higher level policies are inevitably enacted or have impact at the neighbourhood level.

4.2 Next Steps

As discussed before, it is vital that the proposed NSF be well piloted and tested. Fundamentally this needs to involve local case studies but also to foster both local and international linkages between projects and the people involved with those projects. The research team recommends therefore, that the following steps be taken over Year 2 in order to further develop and refine the prototype NSF. These steps will not necessarily flow in a structured linear fashion and there may be some too-ing and fro-ing between them.

Step One: Develop methods for undertaking case studies. This will require the development of criteria for choosing different areas, the methods of research and analysis as well as how and when the tools might be applied and by whom.

Step Two: Undertake case studies in different areas throughout New Zealand.

Step Three: Include and develop secondary data to contextualise and support the empirical data. Analyse the information and refine the proposed NSF in light of the results as well as reporting the analysis of each case study.

Step Four: Develop stronger linkages to other streams of the Beacon project as well as within the local 'expert' community. It is important to sustain and involve the workshop attendees as, perhaps, some sort of a 'reference group'.

Step Five: Develop and maintain international linkages, particularly with those involved in projects such as:

- BREEAM (UK)
- CitiesPLUS (Vancouver, Canada)
- LEED (USA)
- METRIX (Sydney, Australia)
- PPS (USA)

This may involve electronic information sharing, conference attendance and study tours. This work is cutting edge and it is necessary to stay informed as well as to foster relationships amongst those who are also working in a similar area. This is important for future peer review as well as for developing contemporaneous relationships and to follow international case studies and examples of model development and testing.

5 Appendix One: International Vision and Practice for Sustainable Neighbourhoods: Research Review

By Denise Bijoux

This paper is one of three generated by the neighbourhood research stream of the Beacon Project as background and supporting evidence for the development of a Neighbourhood Sustainability Framework (NSF).

This paper documents international interpretations of sustainability at the neighbourhood level with an emphasis on those projects and policies that have a focus on the urban built environment. It is divided into four parts:

- The first part briefly describes the context of the term 'sustainability' as it has been applied to and evolved from out of urban areas.
- The second part considers the international experience of working towards improving sustainability at the neighbourhood level. This research review considers various visions of sustainability for specific neighbourhoods as well as models and projects that advocate and apply particular strategies aimed at achieving sustainability on a variety of levels, including for the urban built environment.
- The third part of the paper focuses on the importance of the process of improving sustainability outcomes within neighbourhoods.
- Finally, the paper reflects on the implications for the development of a Neighbourhood Sustainability Framework for New Zealand.

5.1 Sustainability

Sustainability is a term that can be interpreted in many ways, largely dependent on the context in which it is used. Many interpretations are derived from the definition of sustainable development first published in "Our Common Future", the report of the World Commission on the Environment and Development:

> "Development that responds to the needs of the present without compromising the capacity of future generations to respond to their own needs."
> (Brundtland, 1987)

This definition is essentially about people living within the limits of the biophysical environment and managing resources in ways that can meet the aspirations of society over time

(Chiu, 2003). It is, however, highly interpretable and with application can become increasingly complex. By 1997, Satterwaite observed that:

> "…Such a diverse range of environmental, economic, social, political, demographic, institutional and cultural goals have been said to be part of 'sustainable development' that most governments or international agencies can characterise some of what they do as contributing to sustainable development."
> (as cited in Fooks, 2000:1)

Sustainable development, and sustainability, can thus be seen as evolving terms and, many models have been developed to express the various emphases and perspectives. Broadly, however, the challenge appears to be in balancing the needs of the community for social, cultural and economic well being with protection of the environment. It is important that these aspects be considered "all together at once" (Charlot-Valdieu and Outrequin, 2003:6) because essential to the concept of sustainability are the concepts of interconnectedness and integration:

> "Sustainability, based on a long-term view that the needs of humanity and the environment are interconnected is rightly high on the agenda…To respond to change and challenges, a city needs to be diverse, healthy, dynamic and resilient. Sustainable cities are vibrant, harmonious and lasting…Close-knit and well-connected cities assist the efficient flow of materials, energy, information and people. This relies on diverse neighbourhoods, dense and attractive, with good connections…."
> (www.sustainable-cities.org.uk/institute/policy.html, accessed 20.03.05)

Sustainability is not only complex, it is complex on multiple levels, at the same time. A recognised key feature, alongside the importance of integration and interconnectedness of the various elements of sustainability, is the implication for sustainable development from the scale and location of where the bulk of the population live. In an increasingly urbanised world, the United Nations Environmental Programme (UNEP) has declared that the battle for sustainable development will be won or lost in the world's cities and this highlights the potential role of the urban built environment for improving sustainability both locally and more widely.

Urban sustainability is particularly pertinent for New Zealand as the 2001 census shows that nearly 86% of the national population reside in urban centres and these areas cover less than three percent of the total land area. Urban living can create noise, traffic congestion, air pollution, loss of privacy and overloaded water supply and sewerage infrastructures whilst threatening the bio-physical health of the area through such things as runoff from paved areas and loss of habitat. These things impact on quality of life for residents and can be expensive to fix as well as being unsustainable in the medium to long term. According to Eley (2003:9), New Zealanders are more inclined than not to agree there is a need for a sustainable urban form. However, the general public has also been described as complacent about sustainability,

possibly because the effects of non-sustainable development are not often felt immediately whereas the benefits can be (Freeman and Thompson-Fawcett, 2003: 13-19).

Another arena where concern for sustainability has emerged is from within the urban environment. Unlike the broader sustainability movement and the sustainability and cities movement, which have both been largely driven out of environmentalism, by way of contrast, the concern with community development, and neighbourhood renewal and neighbourhood regeneration have been driven out of social and economic concerns (see http://www.jrt.org for examples). In particular, the decline of neighbourhoods in the face of economic restructuring, the disinvestment in repairs and maintenance in declining neighbourhoods, and the problems of crime, poor life chances, deprivation and ill-health associated with declining neighbourhoods have been a major stimulus in seeking sustainable neighbourhoods. Concern for improvement in neighbourhood sustainability from this perspective can be seen to have a direct link to the urban built environment as the quality of the built environment reflects neighbourhood decline and can exacerbate further decline. Addressing deficiencies in the built environment has, therefore become a significant pathway to regenerating neighbourhoods, preventing their decline through adaptation, and sustaining the liveability of those neighbourhoods.

The problem of reconciling environmental, social and economic outcomes which is so apparent in the broader sustainability debate becomes even more apparent when sustainability is applied to urban systems. The search for sustainability is increasingly recognised as an ongoing, always dynamic act of balancing system inputs and impacts. Haughton and Hunter, for example, state that: “sustainable urban development is a process which is ceaselessly dynamic responding to changing economic, environmental and social processes (1995:263). Sustainability is integral to the conception, planning and design stages as well as to action, application and end-use. Assessment of sustainability thus requires a life-cycle analysis of inputs and impacts as well as of costs and benefits (see www.sustainable-cities.org.uk/institute/policy.html, for example). Sustainability can be understood as a process as much as any outcome or output, and assessment can only be done at significant points along the way.

For that reason improving sustainability within and through the built environment at neighbourhood level can be better understood as a critical part of the decision making process guided by ongoing pursuit of outcomes rather than final achievement. Such an approach accommodates the diverse nature of neighbourhoods and allows for flexibility and adaptation so that actions towards improved sustainability remain relevant, useful and effective. However, while the physical environment, including the built environment, is almost always a key factor in plans for encouraging and improving sustainability at the neighbourhood level, neighbourhood renewal and regeneration also focuses on providing governance and managerial mechanisms to revitalise and sustain neighbourhoods. Case Study Ai1 provides an example.

Case Study 1: Kamloops (British Columbia)

In Kamloops (British Columbia), the aim was to revitalise the McDonald Park Neighbourhood and enhance community pride whilst also serving as a model for future, more sustainable planning for other neighbourhoods. Work began in the neighbourhood in October 2003 with extensive consultation and collaboration with the community, culminating in this vision:

> "Liveability enhances the social and natural environment by creating a walkable, safe, and green neighbourhood which contributes to the well-being of residents and visitors. A sustainable neighbourhood integrates into its urban context while protecting and enhancing the social and economic health of its community, as well as the health of local and global ecosystems."
> (www.city.kamloops.bc.ca/mcdonaldpark/toolkit.shtm, accessed 20.03.05)

The goals of the resultant neighbourhood plan included:

- Maintaining and enhancing the McDonald Park Neighbourhood as a liveable and sustainable community within the City of Kamloops.
- Encouraging a strong sense of community and familiarity between local residents, businesses and services - local pride and a system of social networks.
- Creating a visually distinct, bounded and generally agreed upon character for the neighbourhood representing a range of needs, tastes and values.
- Maintaining a stable and consistent neighbourhood population who have a strong identification with the place.

The McDonald Park Neighbourhood Plan was presented to City of Kamloops Council and staff members in April 2004. This document is consistent with KAMPLAN 1997: A Community Plan for Kamloops. KAMPLAN 1997 is a growth management strategy that sets policy and establishes direction to guide Kamloops City Council and the community into the next century. Also presented was a neighbourhood planning toolkit that reflects the process the planning team went through in McDonald Park. The Neighbourhood Plan is intended to be implemented over the next several years and provides information about neighbourhood planning, priorities and proposed projects as well as guidance to those deciding whether or not they want to live or invest in the neighbourhood. It also makes a statement about neighbourhood values and expectations.

The identified top issues and priorities in the McDonald Park neighbourhood are:

- Community Identity: These issues, objectives, strategies, and recommendations are grouped into Collaboration and Capacity Building, Community Pride, Health and Wellbeing and Accessibility.
- Safety and Wellbeing: These issues, objectives, strategies, and recommendations are grouped into Liveability, Crime and Prostitution, Traffic Safety, and Lighting.

- Neighbourhood Design and Beautification: These issues, objectives, strategies, and recommendations are grouped into Park Design, Street Improvements, Parking, Lighting, Stormwater, Utilities and Public Works.
- Transportation and Connectivity: These issues, objectives, strategies, and recommendations are grouped into Transportation, Connectivity, and the Rivers Trail.

A potential role for the neighbourhood built environment is evident in all four priorities. Implementation is occurring through the combined efforts of the Friends of McDonald Park, City of Kamloops Parks and Recreation Department and City of Kamloops Development Services. Interested parties are invited to develop linkages through the Friends of McDonald Park or by contacting the City of Kamloops.

5.2 Working Towards Sustainable Neighbourhoods

5.2.1 Visioning

> "If a strategic plan (including goals, objectives, strategies, actions) is the 'blueprint'…then the vision is the 'artists rendering' of the achievement of that plan" (Leading Edge Consultants, CitiesPLUS, undated)

Visioning for sustainable urban areas is as diverse as urban areas are. According to Vancouver's CitiesPLUS programme (CitiesPLUS, undated), a vision should be enobling, memorable, imaginable, feasible, relevant, appealing, powerful and ambitious. Included within the vision should ideally be a definition of sustainability and the vision is represented as sitting at the top of a pyramid. This pyramid represents a framework that spreads from the vision into levels of increasing specificity.

In the Manual for Sustainable Neighbourhood Development in South Africa (du Plessis *et al*, undated), the visioning process is described as having four components:

1) Profiling the community
2) Community issues analysis
3) Prioritising the issues
4) Formulating the vision statement

Visioning is seen as the second step, after establishing partnerships and common values, of a five-step process towards neighbourhood sustainability.

For the Smart Communities Network, visioning is described as 'defining where your community would like to be 20 years from now" and "should be specific and idealistic, but achievable". It is the fourth step of their ten-step process towards sustainability (http://www.sustainabledoe.gov/management/tensteps.shtml).

Some visions of sustainability for specific neighbourhoods are listed below:

> "A sustainable society is one that is healthy, vital, resilient, and able to creatively adapt to changing conditions over time… Sustainable Racine has a vision… it focuses on meeting the needs of today as it involves our neighbourhoods…in the development of our lives in such a way that future generations will be able to carry on the effort to meet their own needs "
> (www.sustainable-racine.com/about_us.html, accessed March 20, 2005)

> "A sustainable neighbourhood…has physical, social and economical sustainable elements that formulate its structure into an equitable balance within the size of a neighbourhood."
> (www.13d.cs.colorado.edu/systems/mrrogers/intro/html, accessed April 10, 2005)

> "…sustainability can be defined as reducing our ecological footprint (e.g., resource inputs and waste outputs) while increasing the quality of life (e.g., housing choice, attractive public places, community interaction)."
> (Corporation of the City of Westminster, 2004)

Common themes that emerge from sustainable development vision statements at all levels are the:

- incorporation and integration of local, regional, national, and global perspectives (context)
- interdependence and interconnectedness of social, cultural, economic and environmental spheres (perspective/worldview)
- long term visions and shorter term actions (strategy)
- ongoing engagement, dialogue, participation and partnership between local people (stakeholders: residents and users) and "experts" (process and assessment),
- adaptability, flexibility, resilience, relevance, durability, diversity, integration and interconnection (application and outcomes/outputs)

While measurement and monitoring were acknowledged as critically important by most programmes and projects, they rarely featured in vision statements. It is important to emphasise that fundamental to sustainable neighbourhood renewal practice and visioning is a strong community empowerment focus that values the genuine partnership and participation of the local community and that this process is seen by many as just as important as the aims, aspirations and outcomes.

5.2.2 Connecting neighbourhoods, sustainability and the built environment

A number of different models have emerged internationally that connect various visions of sustainability and built environment responses. Some of the more relevant examples are summarised in Table 1.

Perhaps the approaches taken-up most enthusiastically are New Urbanism and Smart Growth. New Urbanism is anti-sprawl and promotes the creation and restoration of diverse, walkable, compact, vibrant, mixed-use communities (see Duany, Plater-Zyberk and Speck, 2000; Calthorpe, 1993). The policies that support New Urbanism are called Smart Growth and have significant implications for the urban built environment. The key principles of both New Urbanism and Smart Growth have been adapted to the New Zealand context in many examples including the Auckland Regional Growth Strategy ARGS (ARC, 1999). A key difference between the two philosophies is that while sustainability is an identified principle of New Urbanism, it is only implicit in the smart growth policies. Smart Growth has been defined as development that serves the economy, community, and the environment and works to improve liveability (EPA, 2001). It is a model that can be a means to a sustainable end, although it is important to recognise that sustainability is not a core aim.

The essence of the model is that both the activity and the synergy of a majority of these principles is required for success and the definition of success appears to be largely about improvements in quality of life for residents and users of the areas. Application is through planning methodologies and there are numerous checklists and scorecards available to guide the application (see http://www.smartgrowth.org; http://www.naco.org and Fleissig and Jacobsen, 2002 for examples).

New Urbanists believe that these principles should be applied to all levels of planning from the single building through to neighbourhoods, towns, cities and regions. This is the philosophy applied to the Auckland Region through the ARGS. All of these principles can have an implication for the sustainability of the form and function of the built environment at the neighbourhood level. Indeed, in the USA a tool called LEED-ND (Leadership in Energy and Environmental Design – Neighbourhood) is currently being developed into a national standard for neighbourhood design, integrating both smart growth principles and green building together. It is aiming for a consensus-based standard "to address the impacts of development projects" (see http://www.usgbc.org) with an emphasis on location, transport linkages, neighbourhood design and resource efficiency and is promoted as "an objective basis on which to certify developments as smart growth". It aims to be a set of guidelines for decision-making providing both signals of and incentives for better neighbourhoods and buildings.

Exactly how New Urbanist and Smart Growth policies are developed is very locality-specific and success depends on the needs and desires of the local community. An example of a master-planned community is described in Case Study Ai2. Communities, including those in New Zealand have not always, however, expressed great amounts of enthusiasm towards increased densities, and the associated changing form of the built environment, in particular (see, for

example, Cox, 2004; Eley, 2003; SGN, 2001; Nelson, 2001; O'Toole, 2001). There is also concern that master-planning does not allow adequately for creativity.

Case Study 2: Kelvin Grove Urban Village, Brisbane

Kelvin Grove Urban Village currently under development in central Brisbane. The project is a partnership between the Queensland Government, through its Department of Housing and the Queensland University of Technology. It is described as "a new integrated community" that brings together education, residential, health, retail, recreational and business opportunities.

Covering 16 hectares of former army land only 2kms from the CBD, Kelvin Grove is based on a "traditional village design" with a town centre and main street shopping that is connected to the existing neighbourhood by extending existing streets into the new area. The village is designed to become progressively more residential further from the town centre and incorporates integrated mixed land uses and economic opportunities with diverse housing, a distinctive character that reflects past uses of the site and high quality public open spaces. The design guidelines describe how the plans promote sustainability under three categories: social, economic and environmental sustainability. Aspects that relate to the built environment predominate and include the variety, mix, quality and design of housing; an emphasis on community facilities, shared public space and a mix of uses; provision of extensive infrastructure including information and communications technologies and employment of "appropriate development" techniques during construction. Kelvin Grove is described as "a real example of the Smart State in action" but is still under construction so no measures of success are yet available. (www.kgurbanvillage.com.au/about/index.shtm, accessed March 21, 2005).

The other concept that has become widespread in international visioning and practice is the idea of the liveable neighbourhood and community. Based on North American New Urbanism it also attempts to embrace social and economic perspectives which in Auckland City have operationalised into six central principles (ACC, 2000). Those are:

- Environmental Protection
- Location
- Integrated Development
- Strong Communities
- Urban Design
- Economic Development and Employment

Liveable Community Plans are intended to outline the urban design framework for an area, including the location of streets, open spaces and community facilities, as well as the future development opportunities for living and working and the services and infrastructure required to support future growth. But nowhere in the Liveable Communities 2050 strategy document (ACC, 2000) or the Growth Management Strategy (ACC, 2004) is sustainability mentioned.

Sustainability is, however, a core element of the Liveable Neighbourhoods model developed in Western Australian throughout the 1990s (www.sustainability.dpc.wa.gov.au). This model has been tested in the local context and includes an implementation tool (enquiry-by-design) as well as a set of principles. In 1997 the Liveable Neighbourhoods Community Design Code was released as a voluntary alternative to existing development control policies with the aim of creating environments that are responsive to changing social, cultural and economic needs as well as to those of the natural environment. Quality of life is seen as paramount and the Liveable Neighbourhood option is promoted as significantly increasing sustainability in Perth (see table Ai1). It is seen as a viable alternative to conventional designs on social, environmental and economic grounds. The built environment in this model provides a context for employment and local businesses to be viable, more equitable access to goods and services, employment and educational opportunities, less dependence on the automobile and more options for integrated public transport as well as providing opportunities for spontaneous social interaction. The Western Australian model of liveable neighbourhoods can provide both structure and inspiration for local interpretations that incorporate a more explicit sustainability focus.

One of the studies associated with the Liveable Neighbourhoods Community Design Code (MacKay, undated) in Western Australia, for example found that the design of suburbs expands or limits daily life choices through:

- the way in which streets are *connected*
- how well a place is *integrated* with other places
- how *understandable* the layout is
- how *safe* it feels to be in
- how much *choice* there is in the type and cost of housing
- the *variety* of locally available services and jobs
- how *easy* it is to get to those services, jobs and other places of need

Table 13: Summary of Various International Models

Philosophy/ Project	Core Principles	Application and Process	Tools	Measurement examples	Implications for built environment	International Best Practice example
New Urbanism (www.newurbanism.org)	Walkability Connectivity Mixed use and diversity Mixed housing Quality architecture and urban design Traditional neighbourhood structure Increased density Smart transportation Sustainability Quality of Life	planning synergy and integration community participation	stakeholder involvement design appropriate location SmartCode (http://tndtownpaper.com/images/SmartCode6.5.pdf)	Smart Scorecard LEED	connection and accessibility mixed uses density diversity design quality orientation public and open spaces	Melbourne 2030 (www.dse.vic.gov.au/melbourne2030online/content/policies) Seaside, Florida Celebration, Florida
Smart Growth (http://www.smartgrowth.org)	Walkability Strengthen and develop existing communities Mix land uses Range of housing Predictable, fair and cost effective Distinctive, attractive communities with strong sense of place Compact building design Variety of transport options Preserve open space, and physical environment quality Community and stakeholder	planning synergy and integration community participation numerous 'how-to' publications	stakeholder involvement design appropriate location 10 steps to sustainability (http://www.sustainable.doe.gov/management/tensteps.shtml)	checklists (http://www.smartgrowth.bc.ca/index.cfm) scorecards indicators Smart Growth INDEX (http://www.epa.gov/smartgrowth) LEED	connection and accessibility mixed uses density diversity design quality orientation public and open spaces	Kelvin Grove, Brisbane

	collaboration (SGN, 2001)					
Liveable Neighbourhoods (www.sustainability.dpc.wa.gov.au/caseStudies/LivableHoods)	1. Walkability 2. SAFE (Safe, Attractive, Friendly, Efficient) Street networks 3. Public Transport 4. Mixed use (inline with community expectations) 5. Variety of housing types and densities 6. Respecting culturally and environmentally sensitive areas 7. Combining waste water management with public open space 8. cost-effective and resource efficient development 9. increased availability of affordable housing	planning synergy and integration community participation	"Enquiry-by-design" tool Sustainability Checklist (discussion document March 2005)	viable local business more equitable access to goods and services employment and educational opportunities less private vehicle dependence integrated public transport opportunities for spontaneous social interaction (public and open spaces) sustainability checklist (under development)	six main elements of community design, movement network, lot layout, public parkland, urban water management and utilities	Liveable Neighbourhoods Community Design Code (Western Australia.)
Great Cities Initiative (www.pps.org)	1. Onsite analysis 2. Local community involvement/ownership 3. focus on opportunities/assets and identifies obstacles to improvement 4. small incremental changes 5. clear visioning of aesthetics and functioning of the place/building and its context	city-wide public space assessment step by step programs for individual places community participation workshops, training and research demonstration and catalyst projects	online resource centre includes placemaking tools and resources community support and technical assistance			Copenhagen,

HQE2R (http://hqe2r.cstb.fr/)	1. Economic efficiency – controlling costs and allowing all categories of 'actors' to share expenses 2. Social Equity - diversity, integration of both inhabitants and neighbourhoods, access and movement, conservation, creativity, lack of poverty 3. Environmental caution – improving quality of life through limiting urban sprawl; more effective use of public space, provision of cycle- , walk-ways and green spaces, preserving and enhancing habitat, improving quality of local environment and ensuring diversity of population, habitat, human activities and space 4. Long term visions and shorter term actions 5. Alliance of local with regional, national and global 6. Participation of ordinary citizens alongside those with expertise and power – close alliance of citizen needs with improvement in comfort and reductions in costs (use and	include elements of all 6 principles as well as prior consideration of sustainability at city scale 5 main sustainable development objectives 21 sustainable targets at building and neighbourhood level 51 key issues 61 "indisputable" indicators	4 phases: decision, analysis, assessment and action 3 assessment tools: INDI, ENVI and ASCOT	INDI: profiling the sustainability of neighbourhoods ENVI: calculating the environmental performance of a project ASCOT: estimating the global costs of a building	impact on material basis for life, actions and health of inhabitants/users as material wealth/investment/property energy and mass flows on macro and micro levels especially in relation to: 1.consumption and management of energy, water, land, materials; 2. Preservation of heritage (natural and built), landscape and visual comfort; 3. improvement of housing quality, health, safety and risk management, air quality, noise pollution, waste management, integration both within and between neighbourhoods 4. ensuring population diversity, housing supply,	

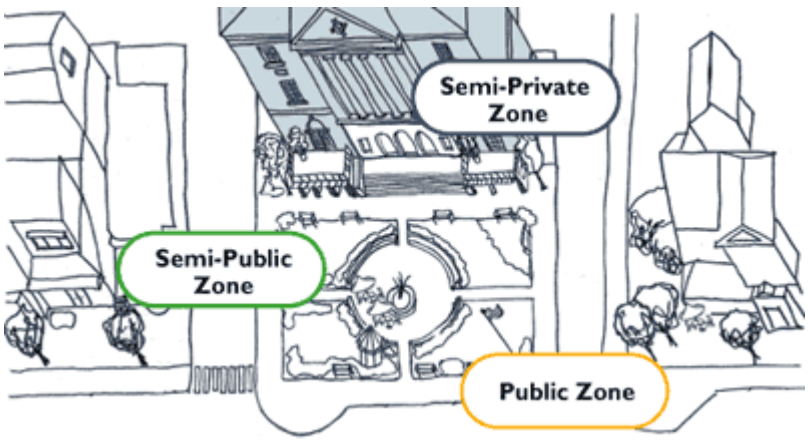
	maintenance)					
CitiesPLUS (http://www.citiesplus.ca)	Sustainability Resilience Liveability	Long term planning with shorter term actions over 17 'systems' within the urban form	one system approach adaptive management	indicators	The urban form is seen as the starting point for change towards sustainability. Specific aspects include mixed use, density, transit, green space, water quality and organisation of space	Vancouver
Urban Ecology Coalition's Neighbourhood Sustainability Indicators Project (UEC-NSIP) http://www.moea.state.mn.us/sc/neighborhoodguidebook.cfm	1. A focus on neighbourhood assets, 2. Engagement with local residents 3. Formal adoption of values 4. Identification of linkages amongst issues that had previously been considered separate 5. Aiming for equitable distribution of resources, opportunity and wealth for the current generation as well as future generations	Partnership based between broad cross-section of residents and users and professionals		Six broad types of indicators	Seward, Minneapolis	

New Urbanism, Smart Growth, and Liveable Neighbourhoods are dominated by central planning approaches. By way of contrast, there are approaches that emphasise incremental change at the neighbourhood level. The Project for Public Spaces (PPS) reflects this:

> "Great neighborhoods are rarely shaped by big developments, master plans, design standards, streetscape improvements, or a district management agenda… Nearly every neighborhood has the capacity to evolve into a good place. This happens when local people feel a growing sense of ownership, which extends beyond property lines to include informal partnerships with others living in the area."
> (adapted from:
> http://www.pps.org/info/newsletter/november2004/november2004_neighborhoods, accessed 21.03.05)

In this approach the built environment – whether for private or public, residential or other use – is seen as a public space. All buildings are public buildings. In design terms then, a neighbourhood's buildings are expected to communicate its purpose at several different scales in order to succeed.

Figure 5: The Built Environment as Public Space



> "Buildings that succeed as places, whether historic or modern in style, tend to have human-scaled bases that accommodate a range of uses, such as retail storefronts, art exhibits, or information windows and kiosks. Such buildings contribute much more to the social and economic vitality of downtowns than buildings with bigger, taller, wider, and blander bases…This comparison yields specific ideas for improving the ground floors of existing buildings, so that they more actively engage passers-by and positively impact their surroundings…"
> (adapted from www.pps.org/buildings/info/idea_book/, accessed March 21, 2005)

An initiative following a similar philosophy but a different implementation process is the pedestrianisation of Copenhagen (see Case Study 3).

Case Study 3: Copenhagen

In Copenhagen numerous small steps have been taken over a forty year period to transform the city from a car-oriented place to a people-friendly one. There has been no master plan and the gradual approach is interpreted to have yielded support from the wider population because it has moved at a pace whereby the positive effects have been seen and experienced by the public.

> "Because the city also made it gradually more difficult for people to drive and park, people had time to figure out that it's too complicated to take the car, and took the bus or bicycle instead… People had time to adapt to these changes. It's also cheaper for cities to implement these changes this way because they're only doing a small budget every year."
> (Gehl, in Markovsky, 2002)

Proponents say the research side of the programme proves that the steps have created " four times more public life" (Gehl, in Makovsky, 2002), and this appears to be directly related to the influence of the immediate built environment. While sustainability was not the key driver, the ten core principles illustrate both the steps taken and the inter-connectedness of the strategies with other aspects of the locality, including the built environment:

- Convert streets into pedestrian thoroughfares.
- Reduce traffic and parking gradually.
- Turn parking lots into public squares.
- Keep scale dense and low.
- Honour the human scale.
- Populate the core.
- Encourage student living.
- Adapt the cityscape to changing seasons.
- Promote cycling as a major mode of transportation.
- Make bicycles available.

(Adapted from Markovsky, 2002)

A quite different neighbourhood renewal project, HQE2R focussed on the sustainable renovation of buildings for sustainable neighbourhoods. This project ran in different areas of cities in Europe from 2001 until 2004. These areas included the inner city, former suburbs, suburbs and 'special areas to be rebuilt', which were largely brownfield areas, in cities as diverse as Bristol, Barcelona and Dresden (Blum, 2003). The project attempted to integrate both planned and incrementalist approaches to achieving neighbourhood sustainability in the context of neighbourhood renewal. The aim was to allow local authorities to implement regeneration action plans in their neighbourhoods and renovation of their buildings in a sustainable manner and to facilitate sustainable behaviour. Improvements in the quality of the built environment were seen to need to be closely linked with needs expressed by users, especially improvements in comfort and reductions of costs in use and maintenance. This required partnership and capacity building of the local community to achieve meaningful participation.

The HQE2R approach also recognised the role neighbourhoods have to play in the integration of the individual to the city, highlighting a need to limit urban sprawl, to make more effective use of public and green space, to control commuting by managing the economy and environmental impact of space use as well as managing mobility and use of public transport at the scale of the neighbourhood, town and conurbation, whilst controlling costs in a manner that allowed all categories of actors to share expenses.

> "Above [environmental sustainability] the overall question is how to develop towards a sustainable society taking into account the restrictions of nature together with the economic and social dimensions of behaviour…The development of new structures, organisations and technologies is as important as the inclusion of all people and communication between them. People have to learn to change their attitudes, show initiative and interact to ensure a viable future for themselves and the following generations. Therefore living conditions (e.g. within an urban neighbourhood) have to be organised in such a way that these changes are supported."
> (Charlot-Valdieu and Outrequin, 2003:14)

The built environment is acknowledged as a "basic condition of urban life…represent[ing] a huge share of human mass and energy flows" (Charlot-Valdieu and Outrequin, 2003:20) but the project recognised that the fundamental axes of sustainable local policy move beyond the built environment and include participation, diversity, integration, access and movement, conservation, creativity, and lack of poverty as well. In addition, the HQE2R project highlighted the need for sustainability to be assessed over the lifecycle of individual buildings as well as over the life of the neighbourhood built environment. This must include construction, maintenance, renovation and ongoing use costs. Several aspects are highlighted as targets:

- energy consumption and energy management
- water resource management and quality
- land consumption and land management
- the consumption of materials and their management
- preservation and enhancement of the built and natural heritage
- preservation and enhancement of the landscape and visual comfort
- housing quality
- cleanliness, hygiene and health
- safety and risk management
- air quality
- noise pollution
- waste management
- diversity of the population
- diversity of the housing supply
- integration of the neighbourhood in the city by creating living and meeting places for all the inhabitants of the city
- social networks and social capital

A toolkit consisting of 15 different tools developed within the project has been published (Charlot-Valdieu and Outrequin, 2004) including three models for i) profiling the sustainability of neighbourhoods (INDI), ii) calculating the environmental performance of a project (ENVI) and iii) estimating the global costs of a building (ASCOT). While HQE2R was expressly developed for European cities, where the urban built environment is quite different to that in New Zealand, there are possibilities for adapting the methodologies and tools for application here.

An example of long-term planning for sustainability involving both public and private collaboration is the CitiesPlus (cities Planning for Long-term Urban Sustainability) project in Greater Vancouver (http://www.citiesplus.ca). This project began in January 2002 and culminated in a win for the team at the International Sustainable Urban Systems Design competition in 2003.

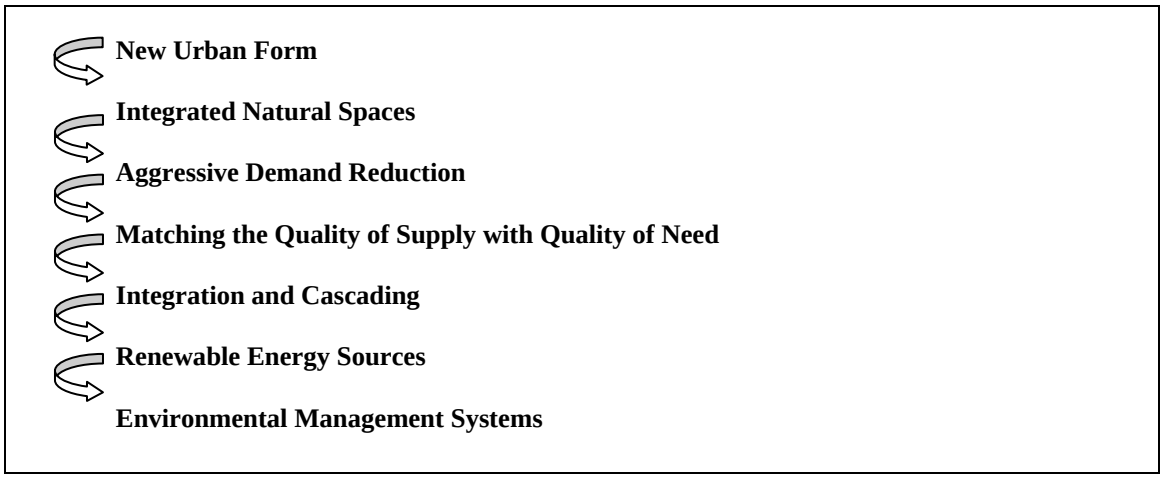
Three core themes were seen as integral to the region's desired future and each had an identified set of underpinning principles:

Table 14: Core Themes and Principles of the citiesPLUS approach.

Core Themes	Key Principles
Sustainability	Efficiency, interdependence, connectivity, stewardship, durability, appropriateness
Resilience	Adaptability, robustness, reliability, responsiveness, diversity, precaution
Liveability	Equity, dignity, accessibility, conviviality, participation, empowerment

The approach identified 17 interlinked "systems" that needed to work together in order to improve sustainability and focused on assets and successes, developed visions, end-state goals, indicators and targets for each one. Overarching these separate systems with their individual characteristics and goals is a "one-system approach" that advocates backcasting through a sequencing of strategies based on seven discrete steps:

Figure 6: Selecting Strategies in Sequence (citiesPLUS)



This means new urban forms underpin everything else. The primary aspects of urban form highlighted here are:

- The mix – the integration of residential, retail, work, cultural and recreational spaces.
- Density and the link to viability of transit systems, local facilities and open/green spaces.
- The organisation of space and function.

A selection of strategies occur at each step, although the exact sequence is not always crucial as so many of the strategies overlap. However, eight catalyst strategies, which are intended to stimulate a co-ordinated transition to the desired future are highlighted:

1) Protect and connect blue ribbons and green webs
2) Design multi-use spaces and convertible structures
3) Plan short loops and integrated infrastructure networks
4) Become net contributors
5) Experiment and learn as we go
6) Enhance the diversity of choices
7) Create shock resilient cells
8) Green and clean the import/export chains

Each catalyst strategy has one or more indicators to allow monitoring and feedback on the implementation of the strategy. The processes undertaken in Vancouver have been developed into a template for long-term planning that structures a process that is “simple and durable on the one hand, and sufficiently flexible to accommodate changing priorities and urban contexts, on the other”.

A number of other projects also offer tools, methodologies and assessment practices which may be suitable for adaptation to the New Zealand context. The Building Research Establishment in the UK, for example, has published a document for assessing the impacts of environmental and social issues arising from larger-scale developments (Brownhill and Rao, 2002). This is designed to be complementary to the BREEAM methodology, which reviews and assesses the environmental performance of buildings, and to facilitate discussions between developers, local authorities and communities (http://www.breeam.org). A similar adaptation of a building focus assessment programme is happening in New South Wales where the web-based Building Sustainability Index (BASIX), which is a planning tool for measuring the potential performance of dwellings against sustainability indices, is intended to be complemented by a broader spatial tool called METRIX. This is currently under development. Interestingly the TUSC (Tools for Urban sustainability Code of Practice) project in Auckland has developed from the BASIX scheme in NSW so there may already be the beginnings of a tool for assessing neighbourhood sustainability under development in New Zealand. Other environmental impact assessment structures for buildings are evaluated in a study report recently released by BRANZ (Hargreaves, 2005) and some of these may also have potential for development into a wider spatial application.

A different assessment criteria is applied through two programmes administered by the San Francisco-based Redefining Progress organisation (http://www.RedefiningProgress.org) who aim to measure the "real state" of the economy, environment and social justice. The two tools are the Genuine Progress Indicator programme (GPI) and the Ecological Footprint programme. The GPI subtracts destructive costs and adds in social and economic benefits ignored by the Gross Domestic Product whereas the Ecological Footprint tracks consumption and waste patterns, showing how much urban areas in particular overstretch the natural capacity of the planet. The latest reports from each programme are dated 2004 and available from the website. Redefining Progress also runs a community indicators programme which monitors and assists the efforts of communities as they develop and implement indicators.

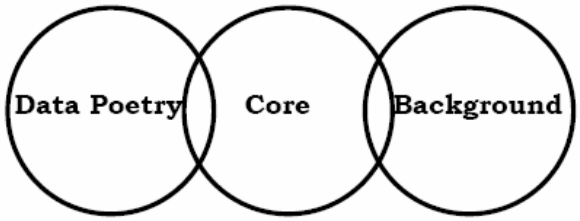
In the Urban Ecology Coalition's Neighbourhood Sustainability Indicators Project (UEC-NSIP), residents were engaged to define indicators of neighbourhood sustainability for their own communities (see Crossroad's Resource Centre, 1999, http://www.moea.state.mn.us/sc/neighborhoodguidebook.cfm). The specific goal of the project was to work out how neighbourhood residents could ensure that their neighbourhood would become more sustainable in the long term. The approach worked from:

- A focus on neighbourhood assets, rather than deficiencies;
- Engagement with local residents in thoughtful planning;
- Expression of values, that were later formally adopted by community residents;
- Identification of linkages amongst issues that had previously been considered separate (such as housing, economic development, transportation and public safety); and
- An aim of equitable distribution of resources, opportunity and wealth for the current generation as well as those who will follow.

Indicators were developed that measure both the direction of change and the outcomes of that change. This has helped to ensure that movement towards the community goals is sustained. Four types of neighbourhood sustainability indicators (Figure Ai3) were eventually defined, each a response to different needs and different audiences. These are each described in some detail and may be worth considering for adaptation to the New Zealand context.

Figure 7: UEC-NSIP Indicator Types

Four types of sustainability indicators



Purpose	Deepen and transform; Focus ngbhd action	Express Sustainability across ngbhds	Useful background information	Evoke long-term visioning
Links issues	Highly linked	Highly linked	Few linkages	Highly linked
Main use	Internal	Internal & External	External	Internal & External
Potential limitations	Do not allow comparisons across ngbhds; Focus more on action steps than on a complete picture of local sustainability concerns	It is difficult to define one set of indicators that apply to diverse ngbhds	Less integrating than Core and Data Poetry indicators	May be impractical to implement in short term
Number	10	25	45	24
Defined by	Residents	Residents & Researchers	Researchers	Residents & Researchers

The UEC-NSIP report also provides many useful links to other indicator-based frameworks including the US Environmental Protection Agency, which offers indicator frameworks for 'green communities' (http://www.epa.gov/greenkit/indicator.htm).This includes a section on sustainability as well as links to several other indicator-based websites. Many of these indicators are directly related to the urban built environment. Another, broader, indicator framework was developed by the United Nations in 1995. Called the Theme Indicator Framework it incorporates economic, societal, environmental and institutional indicators and includes a core set of 58 indicators.

5.3 Process

As can be seen from the descriptions above, many projects place an emphasis on process.

This often involves more than the engagement, participation and partnership of local people, although that is a fundamental precursor to successful local development, and includes an understanding of sustainability as a process as well. Principles of sustainability need to be applied to decisions made throughout the lifecycle of a building. Monitoring at regular intervals should be encouraged in order to assess the current state of sustainability as well as to plan and initiate any interventions.

Neither the process nor the outcomes are independent of the other. While positive and sustainable outcomes are paramount, the process of achieving such outcomes can be just as important for the local community (see Besleme and Mullin, 1997 for example). As well, neighbourhoods change and relevant and robust processes can help to ensure that changes are sustainable.

Measuring process is, however, an extremely subjective thing to do. There are a number of strategies employed internationally that attempt to assess the success of process as much as of the project aims, goals and outcomes. An interesting one that combines assessment of several aspects of sustainability, and includes the built environment and elements of process, is a community sustainability audit tool available through the Global Village Network website (http://gen.ecovillage.org/activities/csa/English/index.html). It aims to provide "measuring rods" to compare the current status of villages and communities with ideal goals for ecological, social and spiritual sustainability. It is subjective and requires good knowledge of the lifestyles, practices and features of the community and is designed to help chart directions towards improved sustainability.

Another project that included research on process was the DISCUS (Developing Institutional and Social Capacities for Urban Sustainability) research (http://www.governingsustainablecities.org). The results of the project were based on a detailed analysis of survey results from 40 local authorities from throughout Europe and Scandinavia. Oriented to capacity building within local government, some of the key findings of this project that were incorporated into the resultant policy guidelines were around process. These include:

- moving away from policy silos;
- making more effective alliances with local people and organisations;
- facilitating the process through credible leadership; and
- being open to creativity and innovation in the development of policies for sustainability.

Communication, facilitation and catalysing action are seen as key elements of the role of local government in conjunction with the wider community of interest.

5.4 Key findings for the Neighbourhood Sustainability Framework

These projects highlight the role of the built environment in sustainability at neighbourhood level. Several key aspects that can be influenced by the built environment, and were consistently present across the various projects, include:

- Consideration of location – both within and between neighbourhoods, including site orientation, shape, lay out as well as tenure and affordability.
- Density, diversity, and compactness of buildings.
- Design, amenity value, quality and aesthetic appeal of settlements - to create a distinctiveness between neighbourhoods that is reflective of the local area, including heritage, location, activities etc., as well as being flexible and adaptable as current uses change. Design also impacts directly on the daily lives of those who use the spaces as well as on how successive generations might be able to live.
- Integration, connectivity, and efficiency within and between neighbourhoods - a choice of transport options and ways to foster connection (a complete street network that is too narrow for fast driving for example) including integration with surrounding neighbourhoods and design of parking facilities that create inviting places to walk and don't dominate the residential landscape.
- Organisation of space: including buildings, public space and open space as well as the creation of mixed-use zones to provide economic and employment opportunities. Access to appropriate local facilities/amenities, including recreational areas and appealing public and open spaces that encourage local use including spontaneous social interaction whilst linking the various parts of the area. These areas can serve multiple functions - vegetation, for example, can improve absorption of stormwater and help absorb greenhouse gases as well as reduce the urban heat island effect, contribute to the attractiveness of places and provide habitat, green corridors, and urban farms/community gardens.
- Sustainable use of resources at all lifecycle stages of buildings, infrastructure and public/open spaces - environmentally friendly development, maintenance and running costs that include improved energy efficiency, water conservation, local management of stormwater and waste water treatment, less waste and reduced air pollution.
- Protection and enhancement of the natural environment.
- Minimising direct and indirect costs.

The urban built environment can be seen to influence environmental sustainability as well as social, cultural and economic sustainability. This occurs on the macro scale (be it at the neighbourhood level or wider urban area) as well as at the level of individual buildings of small areas, such as those surrounding open space or in a mixed-use zone.

At the neighbourhood level it includes how people experience the area: what they do there, how they go about it and how that makes them feel. Ideally it involves increased use of local

amenities/facilities, spontaneous meeting of neighbours, increased social interaction and more street life, increased patronage for local businesses and increased local economic opportunities, increased use of means of transport other than the private vehicle, alternative route options for those who choose to drive, increased health and fitness, a more heterogeneous community, less criminal activity, “ownership” of public spaces, increased affordability and increased equity.

The built environment provides the context for these things and can as easily facilitate or undermine them. The challenge, however, is not simply to implement identified strategies but to develop a framework for an integrated approach from which neighbourhoods can retain their uniqueness, and a strong sense of governance, whilst working towards common standards of sustainability.

6 Appendix Two: Critical Dynamics of Neighbourhoods and their Success: A Review of Learning from Social Research

Kay Saville-Smith, CRESA

6.1 Introduction

This paper has been generated out of a series of research activities focusing on neighbourhood sustainability. Those activities together are designed to provide a framework for developing tools to guide the design, building, retrofitting and management of neighbourhoods to maximise their on-going environmental, social and economic outcomes and mitigate the inevitable negative impacts on the environment of human settlement and human activities. Those tools will range from neighbourhood design and management guidelines to systems for monitoring neighbourhood performance.

This paper focuses on the dynamic between the neighbourhood built environment and the sustainability of neighbourhoods as sites of social and economic interaction. It is divided into four parts:

- The first part deals with the place of neighbourhoods within settlement systems, their definition, and the social and economic functions of neighbourhoods.
- The second part considers the implications of the functional diversity of neighbourhoods, the diversity of demands generated by the people living in neighbourhoods, and the dynamic nature of neighbourhoods over time for neighbourhood sustainability. That discussion culminates in a proposed set of domains for indicators for neighbourhood sustainability focusing on the built environment and its interaction with social and economic practices.
- The third part of the paper focuses on the design features of neighbourhood built environments that appear to facilitate the desirable attributes set out in the second part of the paper.
- Finally, the paper reflects on the problem of integrating the optimisation of the environmental performance of neighbourhoods with the social and economic sustainability of neighbourhoods.

6.2 Defining Neighbourhoods

There have been numerous attempts to define neighbourhoods. Those attempts broadly fall into three approaches. Firstly, there are attempts to describe neighbourhoods in relation to their spatial features, in particular population and building densities, travel times to services and other proximity measures. Secondly, there are attempts to define neighbourhoods using detailed descriptions of activities that are presumed to be uniquely sited in neighbourhoods. Thirdly, there have been attempts to define neighbourhoods in relation to expectations around the nature and quality of social relations, identity and attachment presumed to be generated by neighbourhoods. Those approaches frequently overlap.

Within the context of city planning, planners concerned with neighbourhoods have tended to emphasise a spatial/activity method of neighbourhood planning or an activity/attachment method of planning neighbourhoods. The first method treats the neighbourhood as merely a place in which residents live and may be used for administrative purposes and to locate goods and services that households need to access on a frequent basis. The second method treats the neighbourhood as a place through which people generate their identity, experience their intimate secondary relations, and develop a sense of social attachment (Hall, 2002:38-42). Ebenezer Howard and his successors tend towards the former and Clarence Perry and his successors veer towards the latter (Figure 8).

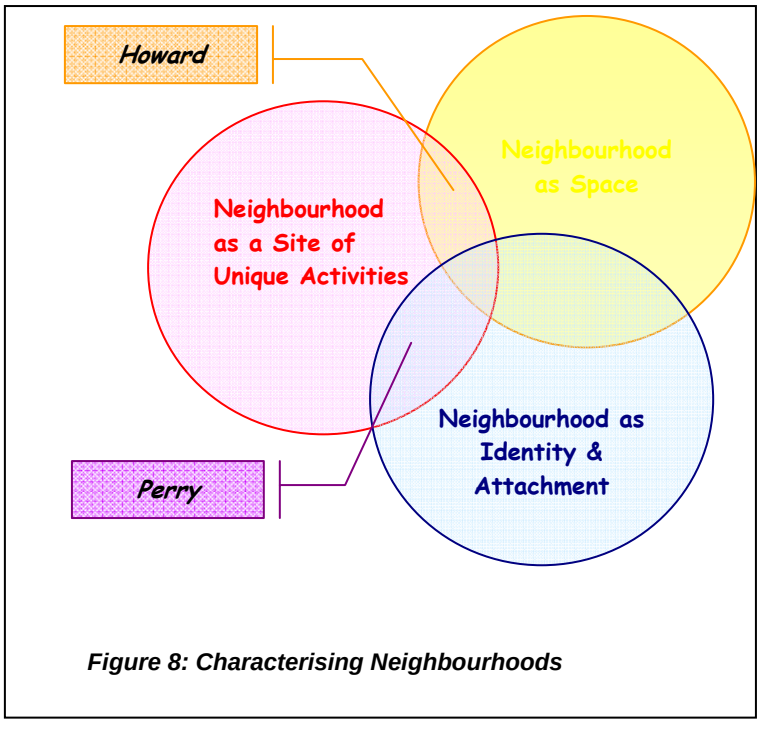


Figure 8: Characterising Neighbourhoods

Howard's treatment of the 'ward' in his Garden City planning is an example of the former view of the neighbourhood. Howard's ward or neighbourhood unit is simply a sub-unit of the city system. He and his successors use it to ensure access to service and goods for those residing in a particular area.

For Howard neighbour-hood boundaries are defined to ensure the proximity of a dwelling to those goods and services required by members of households daily. The calibration of proximity is undertaken in relation to walking times. Rather than defining the number of dwellings and the population size of a neighbourhood, then, Howard derives the neighbourhoods' dwelling numbers and population size using walking times and prevailing dwelling densities and occupancy rates.

By way of contrast, neighbourhood population size is predetermined for those who see neighbourhoods as places primarily functioning as generators of identity and attachment. That position, promoted strongly by the American planner Clarence Perry in the 1920s and still hugely influential, at least implicitly, treats the neighbourhood as a means by which the alleged anonymity and alienation of urbanised industrial society can be addressed by creating urban villages within the city system, largely self-sufficient to themselves and acting as the primary site of social intercourse, relationships, identification and attachment. Because the neighbourhood is effectively about generating relationships of reciprocity, recognition and commitment, both the delimitation of the neighbourhood from the wider city system and population size are important planning tools. The delimitation of the neighbourhood is to be accomplished through the provision of primary schools, an areal spread of around three-quarters of a mile radius and bounding of the neighbourhood by arterial roads. The population is limited to about 1,000 families, a number that was seen as comparable to the size of rural settlements allowing both differentiation but also close social relations between families.

Sociological research into community, neighbourhoods and neighbouring has confirmed the fundamental difficulties of defining neighbourhoods in terms of intimacy, identity and attachment. The reality is that identity is formed through a variety of processes including social and economic activities, and the transactions and relationships in which they are engaged. Neither those nor the parameters of self-identification, which can include among other things ethnicity, sex, age, kinship, occupation and class are restricted to place and are certainly not restricted to something as confined as the neighbourhood. Even in rural communities, networks, identities and attachments are multiple and overlapping and go beyond the boundaries of the community itself (Thorns, 1976; Bryson, 1972; Forrest, 2004; Gans, 1995; Kilmartin *et al.*, 1985; Young & Willmott, 1972). In urban environments the generation of identity, intimacy and attachment is similarly driven by diverse connections and relationships, some of which are place bound and some of which are not place attached at all.

The notion of neighbourhood as a place of identity is challenged by the amorphous nature of neighbourhood boundaries. Members of neighbourhoods typically identify somewhat different boundaries from each other and drawing neighbourhood boundaries is further complicated by the social differentiation between neighbourhoods and neighbours. That is, there is a spatial difference between the area that people identify as their neighbourhood and the area in which the households that people identify as their neighbours dwell. The former can reflect existing administrative boundaries or even boundaries used to differentiate an area for the purpose of marketing real estate.

In addition, while there is a tendency to promote neighbourhoods as sites of positive interaction, the neighbourhood itself can not be defined by the ‘quality’ of the interactions between people. Neighbourhoods exist whether their residents are satisfied with them or not, and irrespective of the extent and nature of interaction with people living within the boundaries of a neighbourhood.

The difficulty of defining neighbourhoods does not mean that neighbourhoods as sub-city units are unimportant and should be largely ignored in the planning of the sustainable city. We know from the work on neighbourhood renewal, housing and social exclusion, that the quality of neighbourhood life does have a profound effect on the satisfactions and life chances of the households living in them. We know also that the costs of ways of life at the neighbourhood level impact on the viability of the city system, the fiscal, environmental, governance and social risks of the city and the city's asset profile (Akundi, 2005; Bright, 2005; Fowler, 1992).

That neighbourhoods are crucial sites within settlements has long been recognised in both planning and social policy (Hall, 2002). Neighbourhoods are at once a unit of the larger settlement system, connected to it by flows of people, resources and the settlement infrastructure, while also being distinct entities, albeit entities with often ambiguous and 'soft' boundaries. The problem is to establish, if neighbourhoods do not function as primary sites for the generation of identity and attachment, why neighbourhoods are such crucial sites. Determining that issue provides a basis for establishing how the built environment of neighbourhoods generates or inhibits social, economic and environmental well-being.

What the research and experience of over a century of city and neighbourhood planning shows is that reducing neighbourhoods to areal measures and proximities or definitions that require a specific and unchanging range of functions or activities to be carried out within them has proved a largely futile task. Neighbourhoods are highly dynamic. The functions of and activities carried out in neighbourhoods vary from one neighbourhood to another, from city to city, from time to time, and according to the different social and economic roles of the diversity of people living in neighbourhoods. Neighbourhoods are important entities within city systems that both reflect and impact on the way in which people lead their everyday lives.

If the prescriptive expectations of neighbourhoods are stripped away, across the planning and research literature a set of key characteristics of neighbourhoods are discernable. Neighbourhoods:

- are spatial nodes in which households and dwellings are clustered;
- provide for residential functions;
- facilitate residential functions through a built environment that allows for the interconnection and mutual use of infrastructure and services among neighbours and neighbouring dwellings;
- are connecting spaces between individual dwellings and the city system;
- consist of the neighbours of a cluster of dwellings;
- consist of boundaries that are loosely defined although those boundaries will typically go beyond a household's directly adjacent neighbours;
- are a domain of casual social interaction; and
- are a key site of the routines of everyday life.

Those characteristics may appear highly abstracted. But it is only at the abstract level that the concept of the neighbourhood makes sense as a generalisable experience. While all neighbourhoods provide a site for residential dwellings, the extent to which other facilities, activities (social and commercial) and relationships are provided, taken-up or engaged in by residents can vary significantly. That variation is driven by three separable but intertwining factors. They are:

a) The broader pattern of the settlement in which the neighbourhood is one part. Neighbourhoods reflect and contribute to the degree of cross-settlement connectivity and integration. The extent, for instance, to which city systems are use-segregated spatially will drive the character of neighbourhoods and the range of goods and services produced and consumed within neighbourhood boundaries. Similarly, the way in which cross-city infrastructure and systems connect and service neighbourhoods will also influence the way in which people behave in the neighbourhood itself and the costs (environmental, social and economic) of living in the neighbourhood. That infrastructure embraces not only the built systems associated with critical aspects of city life from transport to water and energy reticulation to waste disposal, it also embraces governance and city administration.

b) The prevailing social and economic institutions and practices of which the neighbourhood is one expression. The structure of neighbourhoods and the activities that are undertaken within them vary over time and between cultures according to the way in which societies constitute and organise: private and public life; production and consumption, and divisions of labour. For example, the suburban neighbourhoods established in the 1950s, 1960s and 1970s in many western industrial societies, including New Zealand, reflected a prevailing culture that strongly separated production from consumption. Economic production was almost entirely excluded from the suburb just as paid work become almost entirely dominated by organisations and distanced from family and kinship. Those who stayed within the neighbourhood for much of their day were dependents – wives and children – who were not in the world of paid work. Reflecting and reinforcing the separation of the private world of the home and the public world of paid work was a rigid sexual division of labour between women and men and an associated construction of childhood and old age as dependent life stages.[2]

c) The diversity of social and economic positions of the people who live within the neighbourhood. People use neighbourhoods differently according to their social and economic roles, responsibilities and obligations as well as according to their resources, capabilities and tastes. Even neighbourhoods that appear socially homogenous are in fact accommodating households with members who have very different responsibilities

[2] Life stages refers to the broadly sequential patterning of people's lives from birth to death according to the prevailing social expectations of people at certain ages in relation to critical life events, relationships and roles.

and obligations and may be at very different life stages. The experience of and use to which a child puts the neighbourhood is different from the experience, use and tastes of an adolescent. The experience of the neighbourhood varies for parents who are in paid work and those parents who are not. Equally, the experience of and the use to which the neighbourhood is put for people confronting economic constraints or constraints on mobility is likely to be different from those who are without those constraints. Whether a neighbourhood provides conditions that are perceived by residents with diverse needs, roles and obligations as liveable, will depend on the extent to which the neighbourhood allows for that diversity of use.

6.3 Defining sustainability for dynamic neighbourhoods

It appears that sustainable settlements rest on sustainable neighbourhoods and sustainable connections between neighbourhoods and the city system. Moreover, sustainable neighbourhoods are more than simply an aggregation of buildings that exhibit high environmental performance. As such, generating sustainable settlements needs to go beyond simply a macro-level focus on overall settlement form and a micro-level preoccupation with improving the environmental performance of buildings (both residential and non-residential) or improving the environmental efficiency of the built systems that move goods, services, people and resources across the settlement.[3] While those are legitimate and important concerns, attention needs to be given to the neighbourhood because of its role in mediating the individual's experience of a dwelling and their experience of living in a city.

Overall, neighbourhoods are definable, but only in abstract terms. Neighbourhoods are marked by functional diversity, are subject to different demands by the people living in them, and are subject to change over time. Neighbourhood change is because:

- the people living in a neighbourhood changes, and/or because
- the social and economic positions residents occupy change, and/or
- the social and economic institutions which neighbourhoods reflect change.

The history of neighbourhoods and neighbourhood renewal (both spontaneous and purposeful) shows that the social and economic life of neighbourhoods can be expected to wax and wane. Neighbourhoods can lose but also regain their attraction. As such, it is difficult to determine what will make a neighbourhood sustainable socially and economically.

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3 In particular transport systems, energy production and distribution systems, and water distribution and waste disposal systems.

In recent years, there has been considerable emphasis on managing neighbourhood change and decline by attempting to generate neighbourhood 'social capital'.[4] That focus has been associated with a neglect of the built environment as an important element of neighbourhood life. There is, however, a significant body of research that suggests that the built environment is one a critical determinant of neighbourhood satisfaction and the well-being of the people who live within the neighbourhood (Forrest, 2004; Fowler, 1995). Moreover, it has been the repeated experience in neighbourhood renewal initiatives that reworking the built environment has been a critical platform for re-vitalising neighbourhoods and neighbourhood relationships and interactions (Centre for Urban and Regional Studies, 2004; Combined European Bureau for Social Development, 1999). The built environment is a strong factor in resident satisfaction with their neighbourhood.

The importance of neighbourhood satisfaction should not be under-estimated. Dissatisfaction with one's dwelling and neighbourhood are prime drivers of neighbourhood exit (Michelson, 1966; Parkes and Kearns, 2003; Parkes *et al.*, 2002). Neighbourhood exit and disinvestment are critical elements of neighbourhood decline and a vicious cycle of dilapidation and negative neighbourhood effects (Terry and Joseph, 1998; Stewart, 2003a; Stewart, 2003b; DETR, 2003; DETR, 2998; Green *et al.*, 2005).

The recognition of the importance of neighbourhood satisfaction has been one of the drivers of the interest of developers in urban design and what might be characterised by the phenomenon of neighbourhoods as commodities (Forrest, 2004). That is, neighbourhoods designed to meet the precise aesthetics, tastes and needs of targeted consumers. The problem with 'commodity' neighbourhoods is the problem of commodity obsolescence through rigid and fashion-based tailoring. There are a number of examples of commodity neighbourhoods that have, because of the lack of flexibility around the built environment, proved unsustainable without considerable investment. The development of Otara as a neighbourhood designed to be the dormitory for workers in industrial manufacturing enterprises is one example. There is concern that high rise apartments with very small floor plates will be another, and the sustainability of some other suburban developments is also questionable.

The research suggests that neighbourhoods work when there is:

- housing satisfaction – notably housing satisfaction also determined by neighbourhood satisfaction
- an acceptable physical appearance of the neighbourhood including low levels of dilapidation
- safety in the street both from traffic and other people
- low noise disturbance
-

[4] The discourse used around social capital and neighbourhoods reflects Putnam's formulation of 'social capital' rather than Bourdieu's. The former has significant conceptual and measurement problems associated with it, but the term has been taken-up in the policy and planning arena.

- access to facilities and services
- access to other sites in the settlement system
- manageable cost of both residences in the neighbourhood and in connecting to other parts of the city system
- ability to have pleasant, friendly and non-threatening casual social relations
- ability to provide opportunities for neighbourhood action on local issues, and
- low tenure mix.

Under those circumstances, four sets or domains of characteristics appear to emerge for the built environment of the socially and economically sustainable neighbourhood; that is, a neighbourhood that is likely to optimise the experience and use of its residents both now and into the future. Those domains are:

1) Neighbourhood Satisfaction.
2) Functional Flexibility.
3) Optimisation of Civic Participation and Governance.
4) Minimisation of Direct and Indirect costs and Cost Uncertainty to Households.

6.4 Design features for neighbourhoods

The optimisation of neighbourhood satisfaction, neighbourhood flexibility, civic participation and governance, and the minimisation of the costs of neighbourhoods is both a challenge to neighbourhood management within the city system and a problem of built environment design. With the built environment once more in the focus of city managers as a pathway for the improved environmental performance of cities, it is worthwhile to highlight those aspects of the neighbourhood built environment that research has shown to impact on neighbourhood and neighbourhood liveability.

Consistent with the neighbourhood's central function, the main buildings in neighbourhoods are dwellings. It is no coincidence that housing satisfaction and neighbourhood satisfaction have time and again shown a strong association in neighbourhood and community research. Research into community or neighbourhood decline has also repeatedly shown a tie between declining quality and condition of the neighbourhood housing stock and the liveability of neighbourhoods (Terry and Joseph, 1998; Stewart, 2003a; Stewart, 2003b; DETR, 2003; DETR, 2998; Green *et al.*, 2005; Parkes and Kearns, 2003; Parkes *et al.*, 2002). In addition, the redevelopment of the housing stock has been a critical component of neighbourhood revitalization.

Thus the importance of the housing stock, the basic component of the neighbourhood built environment, should not be under-estimated. There is some evidence to suggest that durable, attractive stock with functional noise, privacy and amenity control offsets anxieties around medium and high density housing. The limited research on this issue suggests that the migration of wealthier households to the suburbs has been prompted by a desire to consume housing of higher quality and newer design rather than necessarily a desire for the spatial characteristics of suburbia such as lower densities, detached dwellings and the private garden. Moreover,

suburbanisation has been, in the past, part of a broader desire to shift tenure positions from rental to home ownership rather than a desire for more space or a suburban 'way of life'. It was also driven by the relocation of industries into greenfields and the desire to increase social homogeneity (Fowler, 1992:187; Kilmartin *et al.*, 1985:102-103; Thorns, 1976: 56-58; Young and Willmott, 1957; Fowler, 1992:139-177; Calaita *et al.*, 2005: 43-44).

The amenities that people report as foregone by moving to suburbia for higher housing quality are access to facilities and services, the loss of casual social relations and increased isolation from place and people. The built environment does have an impact on levels of casual and purposeful interaction in neighbourhoods. That interaction – casual, fortuitous, routine and in the public space – is characteristic of neighbourhoods that give residents high degrees of satisfaction. The critical factors in the built environment in relation to the quality and intensity of interaction are dwelling density, public space; land use mix and diverse accommodation. Key research evidence (Appleyard, 1981) suggests that:

- Both low density and high density reduce the opportunities for satisfactory interactions within neighbourhoods. Interactions and friendliness are optimised with higher densities combined with accessible, policed but unregulated, and flexible public open space (Fowler, 1995; Michelson, 1966; Michelson, 1968; Michelson 1976; Young and Willmott, 1972; Engleshot, 1992; Thoms, 1976).
- In high density areas, increased land use mix is associated with increased interaction in the neighbourhood where walkability prevails (Michelson, 1976:67-69).
- High diversity areas characterised by mixed building use, short blocks, and diverse facilities and services including commercial activities, show people are more likely to undertake daily routines within the neighbourhood.
- The density of services and facilities in which people can meet fortuitously but regularly and predictably are critical determinants of interaction and a sense of belonging.
- Areas with diverse housing that serves the needs of residents at different life stages tend to generate more flexible neighbourhoods, which respond to diverse needs.[5]
- City systems that develop a mosaic of neighbourhoods are likely to reduce social tensions while optimising interactions.[6]

Even with an optimally designed built environment, the neighbourhood built environment, indeed, the neighbourhood as a whole, has its limits in relation to the servicing of needs. The neighbourhood can never be more than a partial community (Thorns, 1976: 60). Consequently, the transport connections between neighbourhoods and the rest of the city system are critical. So too is the sense of the neighbourhood as an entity of, as well as within, the city. Successful integration appears to be facilitated where:

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5 Notably social mix in relation to class and ethnicity does not generate residential satisfaction in neighbourhoods (Thorns, 1976:60).

6 This is in contrast to large uniform suburbs which deal with the tensions of social interaction by isolating households from each other in neighbourhoods that are designed for physical avoidance (Fowler, 1995:130)

- Firstly, the transport infrastructure is designed and built in such a way as to preserve the amenity of neighbourhoods. That is, the neighbourhood has not become merely a site for the feeding of the transport system to other parts of the city system.
- Secondly, neighbourhood integration with the city system appears to be optimised where transport connections between neighbourhoods and other parts of the city system allow people both choice and tailoring of transport options.
- Finally, neighbourhood integration with the city system appears to be optimised where the built environment of the city provides for neighbourhood differentiation while allowing seamless movement from one distinct neighbourhood or sector to another (Young, 1995: 266).

6.5 Integrating neighbourhood performance

Addressing and aligning environmental as well as social and economic sustainability is one of the most elusive aspirations of planners and all those concerned with the building and management of cities. The barriers to effective integration are only in part deficits in the knowledge platform relating to the impacts of the built environment and deficits in the technologies, techniques and systems that might mitigate those impacts. In part, however, integration has been hampered by an on-going struggle between environmentalists and built environment practitioners on one hand and social scientists, social advocates and economic interests on the other. The latter have been particularly critical of a tendency for primacy to be given to environmental outcomes irrespective of social and economic costs. Equally, there has been a reaction to the demonstrably untenable built environment determinism long evident among some engineers, urban designers and architects.

Despite those anxieties, there does seem to be good argument to undertake the sustainability analysis of the built environment of neighbourhoods as a sequential process by first establishing built environment options in relation to environmental performance. Those options need to be successively and iteratively considered in relation to social and economic sustainability. Such an approach recognises the considerable adaptability, diversity and dynamism of social and economic relationships and the diverse uses to which neighbourhood built environments are put. It also recognises the complexity of different values, interests and tastes associated with different social groups. Environmental impacts are clearly of importance to people. The quality of the built environment and the environmental performance of neighbourhoods are also an aspect of neighbourhood satisfaction. The acceptability of different environmental performance options, however, require both informed and on-going negotiation and renegotiation of built environment design and management choices if neighbourhoods are to be liveable.[7]

[7] ***The issue of the built environment/management nexus is outside the focus of this paper. It is, however, a critical pathway for the sustainability of neighbourhoods including the redevelopment and retrofit of neighbourhoods.***

7 Appendix Three: The Main Issues Affecting Neighbourhood Sustainability, their Scale and Boundaries and Possible Indicators: A Review of Sustainability Indicators

Katja Lietz

7.1 Introduction

This section looks at the main sustainability issues affecting neighbourhoods and comments on the scale and boundaries of these issues. It then identifies desired outcomes for neighbourhoods and the inputs or tools through which the built form can influence these outcomes. Most identified inputs are able to influence several outcomes. In international literature this is sometimes described as "well linked indicators or inputs" (Crossroads Resource Centre, 1999) and means that one action has multiple sustainability outcomes. Those inputs that are linked to multiple issues are described in more detail and indicators are suggested for them.
All issues or effects investigated are significant, however the scale used describes how much neighbourhood built form can influence each effect or issue.

At the neighbourhood level effects can be roughly divided into two categories. Those that are a direct result of the core functions of neighbourhood and those that are somewhat 'accidental'.

Neighbourhoods are designed to provide places for people to live and interact. Most of the social and economic effects described are part of this function. Neighbourhoods are designed to maximise the positive effects, such as creating a sense of community or access to employment. When negative social and economic effects occur, the neighbourhood is not fulfilling its core function adequately. Often this is a result of a lack of adaptability over time, as most neighbourhoods work relatively well to start with.

Environmental effects are somewhat divorced from the core function of neighbourhoods. Neighbourhoods are not designed to reduce global warming or increase biodiversity, however they do cause these effects unintentionally. A neighbourhood can work well for the people living in it while having significant negative effects on the environment, especially where these effects are not felt locally.

The challenge is therefore to design neighbourhoods that function well on a social and economic level while minimising environmental effects and ideally making a positive contribution to environmental sustainability.

Neighbourhoods are complex and must respond to the context they operate in to be successful. The issues described and the indicators suggested will not be applicable to every neighbourhood, but are intended to prompt discussion about what is important for a particular neighbourhood. It may not, for example, be appropriate to provide a large range of facilities in a neighbourhood that borders onto a town centre where those facilities are available. Aiming for neighbourhood sustainability should not result in inward facing neighbourhoods that try to address all issues locally, but in neighbourhoods that contribute to the sustainability of the wider community or city.

One of the aims of the Beacon project is to measure to what extent the built form of a given neighbourhood contributes to its sustainability. Possible indicators for this purpose are suggested below. Neighbourhood sustainability is the desired outcome of the Beacon project and there have been numerous attempts internationally to establish indicators that assess this outcome. However most are linked to people's behaviour or other aspects of neighbourhoods not directly attributable to neighbourhood form. Examples are vehicle kilometres driven by residents, employment or average income. These types of indicators can be referred to as "Outcome Indicators".

The Beacon project does not aim to directly influence people's behaviour. Rather, it is looking at tools that can be applied as part of the built form to make desired behaviour or outcomes more likely. The indicators suggested in this report are linked to these tools and can be referred to as "Input Indicators". One of the advantages of "Input Indicators" is that they can be applied to planned new neighbourhoods or to planned changes to existing neighbourhoods and will therefore aid the decision making process when considering various options. One of the dangers is that the inputs may not lead to the desired outcomes, such as reduced car travel or affordability. This is an area that needs more research in the New Zealand context, however at this stage certain assumptions can be made based on international experience.

7.2 Main neighbourhood sustainability issues

7.2.1 Environmental

7.2.1.1 Global Warming

Global warming is consistently listed as one of the most serious environmental threats facing the planet. In New Zealand the main greenhouse gas released is Methane from agricultural activity. However to date no practical way has been found to reduce Methane emissions significantly without reducing stock numbers, which is politically and economically undesirable. Reducing carbon dioxide emissions from the burning of fossil fuels is therefore New Zealand's main avenue for reducing greenhouse gas emissions and meeting its obligations under the Kyoto protocol.

The largest contributor to New Zealand's CO_2 emissions is the transport sector (over 40% of emissions), followed by the direct use of fossil fuels in the industry, commercial and residential sectors (over 35%), and the generation of electricity (20%) (NZ Climate Change Office, 2002).

It can therefore be argued that, at the neighbourhood level, global warming can best be addressed by reducing vehicle travel. Neighbourhood form, and specifically density, has a significant influence on travel behaviour (Bachels *et al*, 1999).

Residential energy consumption is also influenced by neighbourhood form. Section orientation and shape influence solar gain potential and different housing typologies have different thermal efficiencies. Party walls, for example, reduce the ratio of external walls to floor space and therefore reduce heat-loss. One study found that apartments required little heating in the Auckland climate (see http://www.bia.govt.nz/e/uploads/apartment-living.pdf).

At a regional level, neighbourhood density can determine how much land is taken up by residential development. The denser the settlement, the less land it consumes. Where the surrounding land is covered in dense vegetation (most notably native bush or wetlands), increasing density will protect carbon sinks. Planting within neighbourhoods will also help absorb greenhouse gas emissions, however the protection of larger natural carbon sinks regionally is more significant.

Global warming and neighbourhood built form:

Boundary:	Global
Scale:	Very significant
Desired Outcome 1:	less vehicle km travelled per person
Inputs to achieve outcome 1:	Walkable Neighbourhood
	Local facilities
	Local jobs
	Mixed-use
	Availability of high speed telecommunications
	Availability of public transport
	Provisions for cyclists
Desired Outcome 2:	Residential energy efficiency
Inputs to achieve outcome 2:	Party walls
	Section orientation
Desired Outcome 3**:**	Protection of regionally significant carbon sinks
Inputs to achieve outcome 3:	Increased density

7.2.1.2 Aquatic Health

Stormwater

It is widely acknowledged that urban neighbourhoods have significant impacts on aquatic health via stormwater run-off.

Quality, quantity and speed of stormwater run-off all impact on the receiving aquatic systems. One of the biggest impacts on stormwater quality is from non-point sources, mainly vehicles (ARC, TP124). The level of imperviousness in a catchment determines the speed, quantity and level of filtration of the run-off. Several studies have shown that the level of imperviousness in a catchment is a good indicator for stream health. However the distinction between impervious and pervious surfaces is somewhat simplistic. Many neighbourhood elements, most notably lawns are commonly counted as pervious but do not actually absorb a lot of water when compared to areas covered in dense vegetation, such as forests.

Another issue is that the level of imperviousness at which aquatic health is seriously compromised is relatively low. American literature suggests that stream degradation occurs at 10% (http://www.stormwatercenter.net/Practice/1-Importance%20of%20Imperviousness.pdf, accessed June 16 2005) and is severe at 25% (http://www.cwp.org/sun_article.htm, accessed June 16 2005). For developments at Green Bay in Auckland a limit of 15% has been suggested (http://www.nzwerf.org.nz/publications/sw602/sw602publications/section3.pdf, accessed June 16 2005). However achieving levels of imperviousness below this is probably unrealistic for most urban catchments. Increasing density and imperviousness in these urban catchment and concentrating on reducing imperviousness in those catchments where a level below 15% can reasonable be achieved may therefore be a more logical approach than reducing imperviousness in urban areas. However, even in more impervious areas, there is benefit to using stormwater treatment devices and the use of buffers such as planted riparian margins, because they will improve urban aquatic health.

Another major impact on stormwater quality is sediment run-off, caused by earthworks during construction (ARC, TP124). Reducing the amount of earthworks, especially on step slopes, will reduce sediment run-off. However neighbourhood form in itself does not have a significant impact on sediment run-off.

Stormwater detention and retention devices can reduce or slow run-off and treatment devices can improve water quality. However it is generally acknowledged that source control (reducing imperviousness and pollution) is more effective.

Regionally the protection of sensitive ecological areas is important for the health of streams and rivers.

Stormwater and neighbourhood built form:

Boundary:	Mainly local (receiving streams and harbours)
Scale:	Very significant
Desired Outcome 4**:**	Reduce run-off
Inputs to achieve outcome 4:	Reduce impervious surfaces
Stormwater management devices	
Desired Outcome 5:	Improve and maintain stormwater quality
Inputs to achieve outcome 5:	Plant riparian margins

Sewage

The disposal of sewage impacts on the receiving water systems. However decisions about sewage treatment and disposal are generally made at the city level, rather than the neighbourhood level (even though the solutions may be implemented at the neighbourhood level). Reducing water consumption will reduce the amount of sewage to be treated and disposed off. One significant issue in New Zealand cities is that new neighbourhoods are often built in areas with insufficient capacity in old and badly maintained sewage systems. As a result, overflows into local streams are common during rainfall events.

Sewage and neighbourhood built form:

Boundary:	Mainly local for overflows
	Depending on location of sewage plant
Scale	Not so significant
Desired Outcome 6:	Minimise sewage overflows
Inputs to achieve outcome 6:	Ensure infrastructure has sufficient capacity

Water Supply

Potable water to most New Zealand urban neighbourhoods is supplied via a central system. There are impacts associated with these systems, however in most New Zealand cities water shortages are caused by a lack of infrastructure capacity rather than draught. Reduction of water use and collection of water in rainwater tanks are initiatives that will reduce the pressure on water supply infrastructure and reduce the associated impacts, but these are generally addressed at the household level. There is however scope to install communal rainwater collection facilities.

Water use for garden irrigation can be significant, because it occurs at a time when rainfall is low and reservoirs a generally low. Reducing private gardens will reduce water use for irrigation. Irrigation of public green spaces also needs to be considered.

At a regional scale the protection of natural areas where water catchments are utilised for drinking water collection is important.

Water supply and neighbourhood built form:

Boundary:	City level
Scale:	Not so significant
Desired Outcome 7:	Minimise town supply consumption
Inputs to achieve outcome 7:	Minimise irrigation of green spaces with town supply
	Communal rainwater collection
Desired Outcome 8:	Protect water catchment area
Inputs to achieve outcome 8	Increase density

7.2.1.3 Air Quality

Air quality is increasingly recognised as a problem in New Zealand cities. It is now estimated that, in the Auckland Region, more people die from vehicle emissions than in vehicle accidents (http://www.arc.govt.nz/arc/index.cfm?210B8193-65A8-42F5-8E31-2FD9802A58AC). In Christchurch, emissions from domestic fires are causing serious air quality issues during winter months (http://www.ecan.govt.nz/Our+Environment/Air).

Air quality is a local issue, mainly related to human health. The main causes for air pollution vary from region to region. However pollution from transport is significant and the cause most easily influenced by neighbourhood form through the amount people travel.

Air quality and neighbourhood built form:

Boundary:	Mainly local
Scale:	Significant
Desired Outcome 9:	less vehicle km travelled per person
Inputs to achieve outcome 9:	Walkable Neighbourhood
	Local facilities
	Local jobs
	Mixed-use
	Availability of high-speed telecommunications
	Availability of public transport
	Provision for cyclists

7.2.1.4 Resource Use

The construction of neighbourhoods uses vast amounts of resources and there is some indication that neighbourhood form can influence resource use. Most importantly the trend to larger homes with fewer occupants has lead to an increase of resource use (both in materials and ongoing energy consumption). Denser housing styles, such as terrace or apartment buildings, tend to be more resource efficient because they have a lower external wall to floor space ratio than single dwellings. The amount of materials used for roading and other hard (impervious) surfaces is also significant. The types of materials used are not thought to be significantly influenced by neighbourhood form.

Redeveloping existing neighbourhoods can be resource intensive. Ensuring that neighbourhoods are flexible enough to cope with changing needs and desires can reduce resource use.

The generation of waste per household is also not thought to be significantly influenced by neighbourhood form and is covered by the framework for dwellings, which is being developed by Beacon.

Resource use and neighbourhood built form:

Boundary:	Global
Scale:	Significant
Desired Outcome 10:	Reduce resource during construction
Inputs to achieve outcome 10:	Smaller dwellings Party walls Reduce impervious surfaces
Desired Outcome 11:	Reduce the need for re-development
Inputs to achieve outcome 11:	Provide rental properties Mixed use Variety in housing typology and dwelling size Public realm designed for variety of uses

7.2.1.5 Biodiversity and Ecosystem Health

Neighbourhood form can impact on local and regional ecosystems. The provision of green spaces locally can provide habitat and can ensure that ecological corridors and sensitive areas are maintained or reinstated. The intensification of one area can protect biodiversity of other areas by reducing sprawl. It can therefore be argued that regional biodiversity can benefit from higher density developments as long as key ecological areas are protected.

Biodiversity and neighbourhood built form:

Boundary:	Regional
Scale:	Very significant
Desired Outcome 12:	Provide local habitat
Inputs to achieve outcome 12:	Ensure green network is intact
	Plant riparian margins
Desired Outcome 13:	Protect regionally significant ecological areas
Inputs to achieve outcome 13:	Increase density

7.2.1.6 Food Production

Recent research has suggested that significant environmental gains could be made if people grew their own food on site (Ghosh, 2004). On-site composting and on-site human waste disposal could mean minimum interference with the nutrient cycle and a very significant saving in transport energy (often referred to as 'food miles').

However experience has shown that in New Zealand the majority of people do not grow their own food, even though they have adequate space to do so. The issue has therefore determined in the course of this analysis to be behavioural rather than one significantly influenced by neighbourhood form.

At the same time it is important to protect the potential for local food production, either on individual sites or via community gardens. This will ensure that people have the choice to grow food.

Food Production and neighbourhood form:

Boundary**:**	Local
Scale:	Significant
Desired Outcome 14:	People have the choice to grow their own food
Inputs to achieve Outcome 14:	Variety in housing typology and dwelling size

Areas with valuable soils used for low-density development or communal green space/ community gardens

7.2.1.7 Other Issues

There are other issues that are sometimes considered in the literature, however the research team felt that they are not significant for this project:

Toxicity

The issue of persistent chemicals and other substances which cause serious environmental degradation is important globally and in New Zealand. This issue is reflected by the second system condition of the Natural Step framework for neighbourhoods described in the Beacon Report *NBH 1: Neighbourhoods Research Baseline*. The system condition states: *Eliminate neighbourhood contribution to dependence upon persistent chemicals and use of synthetic substances.* While the most important sources of such pollutants are the agricultural and industrial sectors, chemical use by households and to maintain public green space is significant. However neighbourhood form and structure does not directly contribute to this issue.

Nutrient cycle

Modern life interferes with the natural nutrient cycle in that human food is grown in centralised areas and that human waste and food waste is not returned to those areas. To alleviate this issue, disposal of human waste (sewage) to land (ideally to the area where food is produced) and the return of composted food waste to growing areas could be advocated. However the research team felt that these issues could not be significantly influenced at the neighbourhood levels within the current systems.

7.2.1.8 Solid waste

Solid waste is a significant sustainability issue that can be influenced through built form in that appropriate space is provided for waste separation and diversion to occur. There are specific challenges for multiunit developments in supplying practical waste, recycling and green waste facilities. However it was decided that this issue is more appropriately addressed at the dwelling level by designing in appropriate space for waste separation and at the city level by providing a collection service suitable for multi unit developments.

7.2.2 Social

7.2.2.1 Affordability

Housing represents the largest cost to households, followed by transport (Statistics New Zealand, 2004). Neighbourhood design can influence the cost of both. Several international studies have included the affordability of housing and access to local facilities (to reduce transport costs) as key sustainability aspects of neighbourhoods.

There is an assumption that higher density leads to more affordable housing because less land is required. The trend for larger homes however has reduced affordability.

People's ability to access the following local facilities easily (this is generally interpreted as within a 10 min walk) are often included in the social effects of neighbourhoods.

- Open space/neighbourhood park
- Leisure facilities
- Retail facilities
- Educational facilities/schools
- Medical facilities
- Entertainment facilities

Affordability and neighbourhood built form:

Boundary:	Local
Scale:	Very significant
Desired Outcome 14**:**	Housing is affordable
Inputs to achieve outcome 14:	Increase density Smaller dwellings Provide rental properties Provide low cost rental properties
Desired Outcome 15:	Accessing jobs and facilities is affordable
Inputs to achieve outcome 15:	Walkable Neighbourhood Local facilities Local jobs Mixed-use Availability of public transport Provision of public free facilities Provision for cyclists

7.2.2.2 Equity and Choice

Neighbourhood structure and form can help ensure that all segments of society can meet their basic needs and that people have choices to best meet their needs.

One common theme in international literature is access to basic facilities within walking distance to serve those unable or unwilling to drive (for example because they are too young or old). Access to public transport to access employment and those facilities that are further afield and to enable interaction with the wider community is also seen as desirable.

Even though New Zealand is very much a car-based society, nearly 10% of households do not own a car (Big Cities, 2003). Access to facilities and employment by alternative means therefore is an important equity issue.

Providing a variety of housing types (including rental properties and homes of various size and cost) will provide choice and prevent community segregation along socio-economic lines.

Envisaging future needs and creating spaces that will be flexible and able to be used for a variety of purposes will help provide choice and equity for future generation.

Equity and Choice and neighbourhood built form:

Boundary:	Local and Regional
Scale:	Very significant
Desired Outcome 16**:**	All members of society can access facilities and employment
Inputs to achieve outcome 16:	Walkable Neighbourhood Local facilities Local jobs Mixed-use Availability of public transport Provision of public free facilities Public realm designed for variety of uses. Availability of high-speed telecommunications Provision for cyclists
Desired Outcome 17:	People have housing choices
Inputs to achieve outcome 17:	Provide rental properties Mixed use Variety in housing typology and dwelling size

7.2.2.3 Sense of Community

Sense of community or sense of belonging contributes to people's perceived quality of life and can help prevent social problems. For example community cohesion and interaction between neighbours has been shown to reduce crime. Two important factors to build a sense of community are opportunities for people to interact and residents having the time and desire for these interactions to take place. Neighbourhood form has direct control over the first factor but only an indirect impact on the second (see also Time Use). Opportunities for community interaction include the provision of pedestrian space, the provisions of places to walk to and local focal points. Children play an important role as they often cause their parents to interact. They are also likely to form friendships locally while their parents are more likely to identify with networks sharing similar interests, irrelevant of location.

Building on the neighbourhood's cultural identity and reflecting this identity through the built form will help create a sense of place and can mark out one place from the next (Bianchini and Landry, 1994). For cultural identity to evolve, spaces need to be available for a variety of uses, such as restaurants for the sale of ethnic foods, community spaces for cultural activities and a variety of business space.

Sense of Community and neighbourhood built form:

Boundary:	Local
Scale:	Very significant
Desired Outcome 18**:**	People interact with one another
Inputs to achieve outcome 18:	Well-designed public realm
	Public realm designed for variety of uses.
	Walkable neighbourhood
	Mixed Use

7.2.2.4 Safety and Crime Prevention

It is widely acknowledged that neighbourhood design has an effect on safety from crime. Crime Prevention through Environmental Design has become a discipline looking at design features that improve safety by limiting opportunities for crime and by providing informal surveillance by residents. Additionally more vibrant neighbourhoods, where there are people on the street around the clock, will improve safety. To achieve vibrancy, some mixed-use development, such as commercial space for cafes, restaurants, etc is desirable. Reclaiming the streets and the public realm in general is a common theme in international literature. Iain Borden describes the role of skateboarders in bringing vibrancy and activity to the public realm (CABE, 2005). While on the surface skateboarding is often associated with risk to public safety and damage to property, the opposite is more likely to be the case. Skateboarding brings healthy young people out into the public realm, often at times of the day when few other people are around, therefore providing valuable surveillance. The very limited damage to property (especially if public space

is designed with skateboarders in mind) and small risk of physical injury to third parties (especially when compared to the risk associated with motor vehicles) seems a reasonable price to pay.

Safety and crime prevention and neighbourhood built form:

Boundary:	Local
Scale:	Very significant
Desired Outcome 19:	Opportunities for crime are reduced
Inputs to achieve outcome 19:	Well-designed public realm Mixed-use Public realm designed for variety of uses

7.2.2.5 Creativity (an Economic as well as a Social Issue)

Great cities and neighbourhoods need to give people space for creativity and there are considerable social and economic benefits from creativity. International literature criticises the predictability and sameness of many neighbourhood developments and suggests that this may cause social problems (http://www.cabe.org.uk/pdf/Skills%20Manifesto.pdf, accessed 05/04/05). Creativity on the other hand will provide vibrancy and uniqueness that is likely to result in a greater sense of pride or sense of place. Over the last years the "Creative Cities" movement has gained momentum with speakers such as Richard Florida and Charles Landry touring the word circuit. While there is some disagreement about the economic benefit of creativity, there are reoccurring themes in the literature.

Creativity can be in conflict with *perceived* safety. Creating safe and predictable spaces does not encourage creativity. For creativity to take place a degree of risk is necessary. At the neighbourhood level this may mean creating spaces where the unexpected can take place. In international literature people refer to creating spaces that act as the canvas for peoples' activity.

On the other hand Charles Landry and Franco Bianchini write (http://www.comedia.org.uk/pages/pdf/downloads/viability_indicators.pdf, accessed 05/04/05):

> "While we recognize that creative ideas often emerge from conditions of insecurity, pressure, anxiety and conflict, the development of a creative climate often needs long term thinking, planning and implementation which can only take place in a calmer and more secure environment."

In other words letting people move in and out of their comfort zone, by providing security and challenges in their environment will aid creativity.

Creative potential can be hindered by insufficient face-to face interaction, lack of density, insufficient diversity of facilities and functions, fear of crime and leakage of local talent.

The design of public space can provide for or hinder creativity and a range of public spaces is desirable, such as parks, squares and informal pedestrian space. Private public space, such as bars, restaurants and cafes are also understood to increase creativity because they allow for informal interactions.

The idea of the public realm is bound up with the ideas of discovery, or expanding one's horizons, of the unknown, of surprise, of experiment and of adventure.

Providing for a mix of uses in buildings is likely to give greater potential for creativity and availability of low cost land and buildings for creative uses is seen as desirable. Artists and other creative professionals need cheap space to start up businesses and live/work situations can help reduce set-up costs as well as bringing vibrancy to a neighbourhood.

The 'creative city' literature concentrates on cities rather than neighbourhoods and most of the issues covered are not directly related to built form. Charles Landry and Franco Bianchini describe (http://www.comedia.org.uk/pages/pdf/downloads/viability_indicators.pdf, accessed 05/04/05) the importance of the city centre for creativity and the dangers of inward focussed developments (or neighbourhoods). People need to travel to the city to interact with one another and to access facilities that will only ever be provided in the city centre because of the critical mass that is available there (such as main libraries, Universities, Theatres and Museums). The city centre also allows people from diverse neighbourhoods to interact and to stimulate each other's thinking.

The aim is not to provide all facilities within each neighbourhood but to ensure people have opportunities for interaction and cultural exchange. Access therefore becomes a major issue for neighbourhoods:

Accessibility creates an environment within which the process of creatively identifying and exploiting urban resources can more easily unfold in its fullness.

Creativity and neighbourhood built form:

Boundary:	City Wide
Scale:	Very significant
Desired Outcome 20:	The neighbourhood attracts and retains creative people

Inputs to achieve outcome 20:	Public realm designed for variety of uses Mixed use Reasonable cost of land and buildings for creative use Variety in housing typology and dwelling size Availability of high-speed telecommunications
Desired Outcome 21:	Residents have access to facilities and activities that encourage creativity
Inputs to achieve outcome 21:	Local facilities Mixed-use Availability of public transport
Desired Outcome 22:	People interact with one another and with the wider creative community
Inputs to achieve outcome 22:	Well-designed public realm Public realm designed for variety of uses. Walkable neighbourhood Mixed Use Availability of high-speed telecommunications Availability of public transport

7.2.2.6 Time use (an economic as well and social issue)

People spend a large amount of time doing things they do not want to do and that do nothing to enrich their or their communities' lives. Time spent travelling is probably the issue most closely linked to the built form.

As a result, people have less time for social interactions, which can threaten the functioning of neighbourhoods. Even though some people refer to the time spent in the car with their children as 'quality time', it is likely that overall family live is effected negatively by the amount of time people spent travelling.

Access to local facilities reduces travel time and alternative modes to the car let people engage in secondary activities, such as walking for enjoyment and exercise or talking to people and reading the paper on the bus.

Time use and neighbourhood built form:

Boundary:	Regional
Scale:	Significant

Desired Outcome 23**:**	People spend less time travelling in cars
Inputs to achieve outcome 23:	Walkable Neighbourhood Local facilities Local jobs Mixed-use Availability of high-speed telecommunications Availability of public transport Provision for cyclists

7.2.3 Economic

7.2.3.1 Employment

Neighbourhood structure and form can have some influence on employment opportunities for residents and on the likelihood of employment being offered within the neighbourhood. Mixed-use developments where there is a mixture of residential and commercial spaces available will mean that some employment is available locally. Home office provision and good telecommunication facilities will increase residents' opportunities to work from home. For those leaving the neighbourhood to travel to work, the availability of different transport options is important.

Access to jobs for residents and the availability of skilled labour to local industries is largely determined by the location of the neighbourhood, rather than neighbourhood form itself. However the quality of neighbourhoods in locations with skill shortages is an important factor in attracting highly skilled people. Neighbourhood quality can be enhanced by well designed public spaces and by the provision of local entertainment, such as cafes, restaurants, etc.

Employment and neighbourhood built form:

Boundary:	Regional
Scale:	Significant
Desired Outcome 24:	People have access to employment
Inputs to achieve outcome 24:	Walkable Neighbourhood Local jobs Mixed-use Availability of high speed telecommunications Availability of public transport
Desired Outcome 25:	The neighbourhood attracts and retains skilled people.
Inputs to achieve outcome 25:	Well-designed public realm Variety in housing typology and dwelling size

	Access to entertainment
	Mixed use

7.2.3.2 Strain on Wider Infrastructure

New neighbourhoods and the redevelopment of neighbourhoods impact on city infrastructure. When this infrastructure needs to be upgraded significant costs occur. However recent legislation ensures that these costs are met by the developer (and are passed on to the new residents), rather than the city. Infrastructure decisions also tend to be made at a city level, rather than be determined by neighbourhood form.

Boundary:	Regional
Scale:	Not Significant

7.2.3.3 Ongoing maintenance costs

Neighbourhoods require maintenance. This cost is generally met by the ratepayers. Costs can be reduced if public spaces are built using high quality materials and designed to minimise vandalism. The redevelopment of neighbourhoods is costly and ensuring that spaces are flexible enough to met changing needs will help reduce costs.

Ongoing maintenance costs and neighbourhood built form:

Boundary:	Regional (cost to ratepayers)
Scale:	Significant
Desired Outcome 26:	Ongoing maintenance costs are minimised
Inputs to achieve outcome 26:	Well-designed public realm
Desired Outcome 27:	The neighbourhood can adapt to change
Input to achieve outcome 27:	Provide rental properties Mixed use Variety in housing typology and dwelling size Public realm designed for variety of uses.

7.2.3.4 The Economic Cost of Congestion

The Auckland Chamber of Commerce estimates that congestion costs business in the Auckland Region $1 billion annually, due to lost productivity and delays in transporting goods (Auckland Chamber of Commerce, Undated). As discussed above neighbourhood form has a significant influence on transport issues.

The cost of congestion and neighbourhood built form:

Boundary:	Regional
Scale:	Significant
Desired Outcome 28:	People spend less time travelling in cars
Inputs to achieve outcome 28:	Walkable Neighbourhood Local facilities Local jobs Mixed-use Availability of high speed telecommunications Availability of public transport Provision for cyclists

7.3 Summary of inputs that influence neighbourhood sustainability and suggested indicators:

The previous section described neighbourhood sustainability by listing desirable environmental, social and economic outcomes that can be influenced through the built form. This section looks at the inputs that will help achieve the described outcomes in more detail and groups them under headings that describe the physical neighbourhood building blocks of *buildings, space* and *infrastructure*. The indicators suggested at this stage are for discussion purposes only, and need refinement.

7.3.1 Buildings

7.3.1.1 Mixed use (linked to 16 outcomes)

Mixed use means that several uses are accommodated within one building, such as a home/work arrangement or that several uses are accommodated in the neighbourhood, such as commercial as well as residential use. Both are beneficial to neighbourhood sustainability:

- Mixed use provides local jobs and businesses
- Mixed use can provide local facilities and entertainment, such as restaurants, medical centres, etc. Therefore reducing car travel and adding vibrancy to the neighbourhood.
- Mixed use gives people choices and provides long term flexibility.

Objective: There is a mix of residential and commercial properties and/or commercial and residential use is accommodated within the same building

Possible Indicators:

1) Ratio of residential dwellings to commercial properties.
2) Percentage of dwellings suitable for home occupation.
3) Percentage of buildings that accommodate residential and commercial activities.

7.3.1.2 Local facilities (linked to 7 outcomes)

The provision of local facilities is linked to mixed use. However mixed use will not necessarily result in the provision of local facilities. The type of commercial space provided is also crucial. A restaurant will for example require quite a different space than a medical centre. Local educational facilities can play an important part in neighbourhood sustainability because they encourage interaction as well as reducing trip length for students. Providing local facilities will increase neighbourhood sustainability by:

- Reducing travelling distances, therefore encouraging alternative modes to the car.
- Bringing vibrancy to the neighbourhood.
- Encouraging interaction

Objective: Residents can meet their day to day needs locally.

Possible Indicators:

1) Number of premises suitable for retail
2) Number of premises suitable for professional services
3) Number of premises suitable for cafes/restaurants
4) Number and type of educational facilities
5) Number and type of community facilities

7.3.1.3 Local jobs (linked to 7 outcomes)

The provision of local jobs is also linked to mixed use. Providing local jobs will:

- Reduce travel distances.
- Provide convenient employment opportunities for those unable to drive.
- Provide activity during working hours and therefore increasing informal surveillance.

Objective**:** Local jobs are available.

Possible indicator:

1) Number of local jobs likely to be created

7.3.1.4 Increase Density (linked to 4 outcomes)

Increasing density results in less land being taken up for development, therefore protecting rural and regionally significant natural areas. Higher density also makes public transport more viable (see also Availability of Public Transport).

Objective: A suitable level of density is achieved.

Possible Indicator:

1) Residents per hectare

7.3.1.5 Provide Rental properties (linked to 4 outcomes), Provide low cost rental properties (linked to 1 outcome)

Providing rental property ensures that people have choices, increases the flexibility of the neighbourhood and provides for people unable or unwilling to own their own homes.

Objective: Rental and low cost residential rental properties are available

Possible Indicators:

1) Percentage of Housing New Zealand dwellings
2) Percentage of rental properties

7.3.1.6 Variety in housing typology and dwelling size (linked to 6 outcomes)

Providing a variety of housing options helps reduce community segregation and ensures a wide range of people are catered for. It also ensures long term flexibility of the neighbourhood.

Objective: People have a variety of housing types to choose from.

Possible Indicator:

1) Percentages of one, two, three and four bedroom units
2) Percentage of detached homes
3) Percentage medium density units
4) Percentage of apartments
5) Percentage of homes with gardens

7.3.1.7 Party Walls (linked to 2 outcomes)

Party walls reduce heat loss and therefore increase energy efficiency. They also reduce resource use.

Objective: Energy and Resource Use is minimised through the use of party walls.
Possible Indicator:
1) Average number of shared walls/ceilings/floors per dwelling

7.3.1.8 Section orientation (linked to 1 outcome)

Section orientation can influence the potential for passive solar design of dwellings.

Objective: The potential for passive solar design is maximised through appropriate section orientation.
Possible indicator:

1) 1. percentage of streets that are aligned within 30 degrees of east-west

7.3.1.9 Smaller dwellings (linked to 2 outcomes)

The size of New Zealand homes has been increasing drastically over the last 20 years or so, this is resulting in increased resource use and higher up-front and running costs.

Objective: Dwellings are appropriately sized.
Possible indicators:

1) Average size for 1 bedroom homes
2) Average size for 2 bedroom homes
3) Average size for 3 bedroom homes
4) Average size for 4 bedroom homes

7.3.1.10 Reasonable cost of land and buildings for creative use (linked to 1 outcome)

To encourage creative activity low cost space needs to be available.

Objective: Space suitable for creative use is available at low cost.
Possible indicator:

1) Percentage of commercial space x% (to be determined) under average commercial rent.

7.3.2 Public space

7.3.2.1 Walkable Neighbourhood (linked to 9 outcomes)

A walkable neighbourhood is one where people can easily and safely walk to local destinations. People-scale designs, high quality pedestrian environments and a street layout that reduces trip length all result in walkable neighbourhoods.

Objective: People can easily and safely walk to local destinations.
Possible Indicators:

1) Percentage of dwellings within 400m and 800m walk of public transport stop.
2) Percentage of dwellings within 400m and 800m walk of neighbourhood shops.
3) Percentage of dwellings within 400m and 800m walk of a neighbourhood park.
4) Percentage of dwellings within 400m and 800m walk of a primary school.
5) Percentage of dwellings within 400m and 800m walk of a café/restaurant.

6) Quality of pedestrian space satisfies independent urban designer.

7.3.2.2 Well-designed public realm (directly linked to 5 outcomes, but able to influence most outcomes)

The importance of design can not be overstated. All inputs or tools described will only work successfully if designed well.

Objective: The public realm is designed well.
Possible Indicator:
1) Public realm design satisfies independent urban designer.
2) Design follows crime prevention through environmental design guidelines

7.3.2.3 Public realm designed for variety of uses (linked to 7 outcomes)

Accommodating a variety of uses makes it more likely that peoples needs will be met in the short and long term, encourages vibrant street life, and fosters creativity and innovation.

Objective: Public realm supports a variety of activities.
Possible Indicators:
1) Width of footpaths
2) Ratio of public squares to residents
3) Ratio of public green space to residents
4) Public realm design meets barrier free standard
5) Public realm suitable for skateboarding, trikes, pushchairs, mobility scooters, wheelchairs, etc.

7.3.2.4 Plant riparian margins (linked to 2 outcomes)

Planting of riparian margins is both a stormwater management tool and a tool to enhance bio-diversity. In order for stream edges to provide habitat, streams need to be left in a natural state or even re-instated.

Objective: Riparian margins are planted to enhance bio-diversity and aid stormwater management.
Possible Indicators:
1) % of riparian margins planted
2) % of stream length not piped.

7.3.2.5 Reduce impervious surfaces (linked to 2 outcomes)

Impervious surfaces increase run-off and reduce stormwater filtration. They are also an indirect indication of resource use.

Objective: The amount of impermeable surface per resident is minimised.
Possible indicators:
1) m^2 of impermeable surface per resident
2) % of impermeability in the catchment

7.3.2.6 Ensure green network is intact (linked to 1 outcome)

To enable wildlife to move between green spaces and other habitats, corridors of planted areas need to exist.

Objective: Neighbourhood development enhances or protects the green network.
Possible Indicator:
1) Regionally significant ecological corridors intact or re-established

7.3.2.7 Provision of public free facilities (linked to 2 outcomes)

Providing basic free facilities in the neighbourhood increases the quality of life, especially for low-income people

Objective: People can engage in recreational activities that are free.
Possible Indicators:
1) Children's playgrounds provided
2) Public spaces for recreation and interaction

7.3.2.8 Areas with valuable soils used for low-density development or communal green space/ community gardens (linked to 1 outcome)

Objective: To protect valuable soils.
Possible Indicator:
1) Percentage of valuable soil covered in hard surface.

7.3.3 Infrastructure

7.3.3.1 Availability of Public Transport (linked to 9 outcomes)

The availability of public transport is largely determined by citywide decisions, rather than decisions made at the neighbourhood level. However depending on the size of the neighbourhood, decisions about the location and quality of public transport stops and about routes and may be made. Decisions about density will have an impact on the viability of the public transport system and will influence the number of people choosing public transport options.

Objective: People have access to an effective public transport system.
Possible Indicators:

1) Highest density housing is near public transport stops
2) All public transport stops have seating and shelter
3) Number of houses per hectare (and/or FTEs) within 800 metres of a rail station, ferry terminal, or bus interchange
4) Number of houses per hectare (and/or FTEs) within 400 metres of a bus shelter

7.3.3.2 Availability of high-speed telecommunications (linked to 8 outcomes)

The availability of high-speed telecommunications infrastructure enables residents to work from home, supports business activity and ensures residents have access to information and networks that foster learning and creativity.

Objective: High-speed telecommunication infrastructure is available to all households and businesses.
Possible Indicators:

1) Percentage of properties with access to high-speed communications infrastructure.

7.3.3.3 Provisions for cyclists (linked to 6 outcomes)

Encouraging cycling helps reduce car use, increases physical activity and adds vibrancy to streets. This does not necessarily mean providing separate bike paths or lanes, but does mean that the road network is suitable for cyclists.

Objective: To encourage cycling.
Possible Indicators:

1) Adequate lane width on distributors
2) Cycle lanes marked at intersections
3) Shared walking/cycling tracks through open space

7.3.3.4 Ensure infrastructure has sufficient capacity (linked to 1 outcome)

This ensures that development is concentrated where there is infrastructure capacity or where infrastructure can be upgraded.

Objective: To ensure that environmental, social and financial costs due to infrastructure overload are avoided.
Possible indicator:

1) Sufficient stormwater infrastructure capacity to accommodate development
2) Sufficient sewage infrastructure capacity to accommodate development

7.3.3.5 Stormwater management devices (linked to 1 outcome)

Stormwater management devices can help treat and delay run-off from impermeable surfaces.

Objective: To incorporate sustainable stormwater management devices.
Possible Indicator:

1) % of impermeable area treated by stormwater management devices.

7.3.3.6 Minimise irrigation of green spaces with town supply (linked to 1 outcome)

Reducing the irrigation need of green spaces and/or collecting rainwater for irrigation will reduce the pressure on the town supply.

Objective: To minimise the irrigation needs of green spaces with town supply.
Possible Indicator:

1) 1. m^2 of public green space requiring irrigation via town supply

7.3.3.7 Communal rainwater collection (linked to 1 outcome)

Rainwater collection traditionally happens at the household levels. However especially in denser neighbourhoods, where space for individual tanks is limited, communal rainwater collection will contribute to sustainability.

Objective: To incorporate communal rainwater collection systems.
Possible Indicator:

1) Percentage of households served by communal rainwater collection system

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