# Neighbourhoods
## NBH1: Neighbourhood Research Baseline

**For Beacon Pathway Ltd – Sustainability in the Residential Built Environment Research Programme 2004-2010**

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# EXECUTIVE SUMMARY

The purpose of this report is to **identify existing national and international initiatives that address sustainability issues at the neighbourhood level**, with the broader aim of developing a model strategy for designing or redesigning neighbourhoods to accelerate the opportunity to enhance sustainability in the residential built environment.

In identifying these initiatives, the project team considered the following issues:

- the theoretical basis of what is meant by neighbourhood, especially in the New Zealand context
- the differences and/or similarities in achieving sustainability at the level of houses (residential dwellings) vs. neighbourhoods and the role of neighbourhoods in achieving sustainability at the city level
- what a sustainable neighbourhood might look like

As a result, this report provides:

- a discussion around neighbourhoods and neighbourhood sustainability
- an inventory of existing initiatives for achieving sustainability in New Zealand neighbourhoods, and an inventory of similar international examples
- a critical assessment of a selection of these initiatives drawing out replicable elements and lessons for future initiatives especially with regard to Beacon's goals (what 'success looks like')
- recommendations regarding how the proposed Neighbourhoods programme should proceed, with emphasis on how to achieve the same results in shorter time

The report is structured as follows:

**Section one** introduces the Beacon Programme and the neighbourhood (NBH) work-stream.

**Section two** explores the term 'neighbourhood', and considers what neighbourhoods mean in the context of the Beacon programme.

**Section three** introduces the New Zealand neighbourhood – the space where Beacon's neighbourhood sustainability objectives will be applied.

**Section four** addresses how Beacon might measure the success of neighbourhood

sustainability initiatives.

**Section five** presents an inventory of neighbourhood sustainability initiatives from New Zealand and internationally.

**Section six** profiles ten examples from the inventory in detail.

**Section seven** provides a discussion about the detailed profiles and presents a potential model for evaluating the sustainability of neighbourhoods.

**Section eight** concludes with a series of recommendations for the future direction of the Beacon programme. These are summarised as follows:

1. **Recognise the significance of neighbourhood form and development to the sustainability of the residential built environment.**

- Ensure Beacon dedicates a substantial part of the research and implementation phase of the NBH programme on the sustainability features beyond the building envelope.

2. **Investigate and where necessary develop measures to better quantify the sustainability impacts of New Zealand neighbourhoods**

- Investigate and quantify the impact of neighbourhood form on specific sustainability issues (e.g. water quality, greenhouse gases, biodiversity, community cohesion etc.).
- Develop a taxonomy of different neighbourhood forms (e.g., conventional low-density suburbs, infill developments, medium density housing, mixed use town centres etc.) and compare the impacts of those forms on sustainability outcomes.
- Compare the potential for improvement in new development and retrofit situations (e.g., does achieving density through infill have equivalent transport and GHG impacts as a comprehensively planned dense development).
- If it is not being done in another part of the Beacon programme, quantify the substantial sustainability gains that can apparently be made with terraced housing forms in comparison with detached housing.
- Identify the location and number of planned or potential new neighbourhoods in New Zealand (within a fixed horizon, say by 2014), with a view to quantifying the potential sustainability impacts of wide uptake of the Beacon programme.

3. **Develop a simple yet meaningful framework to guide the sustainable development and redevelopment of New Zealand neighbourhoods**

- Retain the four system conditions of The Natural Step as high-level guiding principles for a neighbourhood sustainability framework.
- Further explore whether and how neighbourhood level sustainability initiatives address all four system conditions – and if they don't, whether and how they might.

- Determine the appropriate level, approach and point of application of the framework. For example, the framework could constitute a set of high-level principles, more detailed indicators or design specification guidelines; it could be applied as part of the brief for initial designs, or as a set of assessment criteria in the development approval process.
- Develop a robust goal/indicator matrix for measuring success, including identified desired performance standards or targets in each of the impact areas. (Alternatively, consider the weighting of different elements within an aggregated index.)

**4. Ensure wide application of the framework through both practical and procedural efforts**

- Pilot studies
  - Demonstrate the quadruple bottom-line benefits of application (economic, environmental, social and cultural) to the diverse range of stakeholders that will influence uptake (e.g., developers, regulators, consumers, etc.)
  - Identify potential neighbourhood (re)developments and partners in the development and local authority sectors, including the Northern Strategic Growth Area in Waitakere City.

- Address procedural barriers
  - Partner with 'progressive' New Zealand government agencies (the programme will be reliant on planning and building regulations to effect change).
  - Explore the potential to 'upgrade' NZS HB44:2001 into a Standard, and the potential to revise territorial authorities' District Plans and codes of practice to reflect this (as appropriate).
  - Investigate the barriers to sustainable neighbourhood development through analysis of the drivers of development (economic, regulatory and otherwise), examination of recent 'conventional' projects, and interviews with key stakeholders.

To support the achievement of these recommendations, it is further recommended that Beacon:

**5. Establish links with relevant national and international programmes.**

**6. Be transparent and regularly report on progress (even if it only shows small steps).**

**7. Identify the appropriate mix of research and practical skills necessary to deliver the programme.**

Because of the limited amount of focussed/specific neighbourhood sustainability work being

undertaken in New Zealand both currently and in the past (although this is now moving forward reasonably quickly), Beacon is an ideal position to make significant changes and show leadership in this field. The neighbourhoods work stream has the potential to offer people the opportunity to live and work in a way that significantly improves lifestyles, makes this choice attractive and cost-effective, and is appropriate to the New Zealand context. This report provides the first step in making this a reality.

# 1. THE PROJECT

## 1.1 Background

Beacon Pathway Ltd (Beacon) is a research consortium funded by shareholders and the Foundation for Research Science and Technology (FRST) to carry out research into the uptake of greater levels of sustainability in the residential built environment. Much of the housing stock in New Zealand is considered to be below par for even basic sustainability issues such as energy and water efficiency and in many cases are below World Health Organisation guidelines for human health requirements. Even houses perceived as higher quality are expected to fall short of future requirements proposed by upcoming national goals for sustainability (e.g., Building Act 2004[1], Sustainable Development Programme of Action 2003).

Beacon's goal is to establish a 'sustainability standard' for New Zealand houses, and inform a programme of interventions that will bring about uptake of greater levels of sustainability features such that 90%+ of houses meet the 'standard' by 2012. In addition, Beacon intends to inform the development framework for neighbourhoods, so that as neighbourhoods are developed and/or redeveloped, the principles of sustainability are taken into account.

Beacon has defined a programme of research to be carried out over 2004-2010 to determine the means by which these goals will be achieved. The programme contains nine 'objective areas', each with a varying number of milestones to be met over the 5-year research period. The objective areas are categorised as follows:

- Consumers
- Industry
- New Build Technologies
- NOW Home
- Sustainability Framework
- Retrofit
- Neighbourhoods
- National Scorecard
- Integration

The first stage (July-September, 2004) involves eleven 'programme confirmation phase' projects to ensure the overall programme is well informed and that the structure of the

[1] Passed into law 18 August 2004.

programme is optimal. The projects are:

- SF1.1: Sustainability Framework Design
- INT1: Prioritisation/Optimisation Tool
- CON1: Consumer Research Impacts and Alternatives
- IND1: Industry Research Impacts and Alternatives
- NEW1: New Technology Impacts
- NOW7: Demonstration Home Hypothesis
- FR1: Housing Stock Analysis
- NBH1: Neighbourhood Research Baseline
- NS1: Macroeconomic Models – availability and relevance
- SF1.2: NOW Home vs. REF Home
- NOW1: NOW Home Knowledge and Future Monitoring Recommendations

For more information about the overall programme and the programme confirmation phase projects, refer to the 'Research Programme' (commercial in confidence) and 'Research Project Specification' (dated 18 May 04) documentation, available from Beacon Pathway Ltd (via Paul Minett, Acting General Manager: paulminett@strategic-lift.com)

This report documents the findings of **NBH1: Neighbourhood Research Baseline**

### 1.2 Project Definition

Beacon's overall aim for the Neighbourhoods objective area is to develop a model strategy for designing or redesigning neighbourhoods to accelerate the opportunity to enhance sustainability in the residential built environment. The Neighbourhood programme targets the development and adoption of a 'neighbourhood sustainability framework' that ties in strongly with the sustainability framework for individual homes. This programme needs to be challenged and alternative programmes considered ensuring that the most effective programme is carried out.

The purpose of this project is to establish the state of play in New Zealand and globally, recommend the role that Beacon should play in achieving the target in New Zealand (a nationally accepted framework used from 2008), and critically assess the programme that has been developed to achieve the target.

Key issues that this project considered:

- the theoretical basis of what is meant by neighbourhood, especially in the New Zealand

context

- the differences and/or similarities in achieving sustainability at the level of houses (residential dwellings) vs. neighbourhoods and the role of neighbourhoods in achieving sustainability at the city level
- what a sustainable neighbourhood might look like

### 1.3 Relationship with SF1.1 and other Beacon Projects

The NBH1 project is related to other projects being carried out by Beacon at the same time, in particular the 'sustainability framework' project (SF 1.1) which looks at sustainability on a house by house basis, and the 'integration' project (INT 1).

Once reports are submitted, some relevant links may be identified with the 'industry' project (IND 1) given that developers make many neighbourhood configuration decisions, and also the 'consumer' project (CON 1).

On completion of Stage 1 (the 'programme confirmation phase'), this report is intended to inform (and ideally form the basis of) Stage 2 of the Neighbourhoods objective area: NBH2 "development of a prototype Neighbourhood Sustainability Framework".

# 2. NEIGHBOURHOODS

This section provides an introductory discussion to the meaning of neighbourhoods and neighbourhood sustainability, and outlines a preliminary approach to evaluating neighbourhood sustainability. 'Neighbourhoods' is a complex area of inquiry and at this stage of the NBH programme we are not so much interested in finding all of the answers, rather to provide a broad level discussion of the key issues and to highlight the range of factors involved in this field. We propose a working description of neighbourhoods for this phase of the research, and anticipate that a more specific definition appropriate to Beacon's purposes will be derived as the NBH research programme develops.

## 2.1 The meaning of neighbourhood

While a seemingly simple concept, the boundaries (scale) and parameters (scope) of a neighbourhood can be difficult to pin down, depending as much on people's perceptions as they do on spatial or geo-political limits. As a result, neighbourhoods mean different things to different people; meanings which may change both circumstantially and over time.

The dictionary defines a neighbourhood as 'a local community with characteristics that distinguish it from the areas around it'. This doesn't help us much as the terms 'local', 'community' and 'area' are similarly context specific. For example, just from a spatial/built environment perspective, terms that can be used to describe a neighbourhood or community include:

- area
- district
- region
- locality
- zone
- quarter
- environs
- immediate area
- village
- hamlet
- commune
- centre of population
- subdivision
- suburb
- street

The HQE²R Project[2] argues that a neighbourhood can be better described than it can be defined, and suggests a range of issues that contribute to the 'identification, explanation and role of a neighbourhood within the urban context', namely:

[2] Pan-European project Haute Qualité Environnementale et Economique Réhabilitation (HQE²R), translated as Sustainable Renovation of Buildings for Sustainable Neighbourhoods. http://hqe2r.cstb.fr/ accessed 12/8/04.

- the inhabitants having a sense of community, or belonging to the community, derived from local centres, services and a sense of place or specific symbolic elements
- neighbourhood life, the collective management of public property
- urban consciousness, social and political participation, and founding history of the neighbourhood
- economic characteristics
- the area's functions and role in the city
- physical cohesion created by the dominant architectural style and the arrangement of public space
- urban morphology (i.e., structure) as well as its topography and natural aspects

The urban design profession offers further useful parameters for definition. Duany and Plater-Zyberk (1994) define neighbourhoods as 'urbanized areas with a balanced mix of human activity.' They outline five principles of an ideal neighbourhood design:

- the neighbourhood has a centre and an edge (the combination of focus and limit contribute to the social identity of the community)
- the optimal size of a neighbourhood is a quarter mile (400m) from centre to edge
- the neighbourhood has a balanced mix of activities – dwelling, shopping, working, schooling, worshipping and recreating
- the neighbourhood structures building sites and traffic on a fine network of interconnecting streets
- the neighbourhood gives priority to public space and to the appropriate location of civic buildings

These descriptions are useful in that they capture the dynamic and holistic nature of neighbourhoods, but even from this brief introduction, it is clear that the neighbourhood is a 'diffuse concept' – one that has multiple meanings and no one universally agreed definition. The following discussion attempts to clarify what this project means by a neighbourhood by elucidating what neighbourhoods might mean to the Beacon programme.

## 2.2 Neighbourhoods in the Beacon programme

What does a neighbourhood mean in the context of the Beacon programme? There is no indication in the Beacon programme documentation of the scope and scale of a neighbourhood, other than reference to future validation of the eventual framework at 'regional' and 'citywide' applications. In other words, a neighbourhood is greater than one house and yet less than a region or city – but that the framework should be mindful of broader applications.

The scope of the Beacon Programme suggests a particular approach to neighbourhoods. Factors to take into account include:

- the focus on the residential built environment
- the programme's emphasis on the sustainability of dwellings (new and existing)
- the fit between elements of the programme, i.e. how the NBH project complements the other, primarily dwelling-focussed, components of the programme

For the purposes of the Beacon programme, it is therefore considered that the term neighbourhood describes:

**The residential built environment as it exists or is developed 'above' the level of the individual dwelling and 'below' the city or regional level.**

In other words, the neighbourhood encompasses elements of the residential built environment that cannot be controlled in the design, construction and occupancy of individual dwellings. Some of these elements may address the same issues as dwellings, but at a larger scale (e.g., neighbourhood wastewater treatment systems). Other elements can only be addressed at the neighbourhood level (e.g., roading design). At the same time, neighbourhoods are smaller than cities or regions (and consequently, city or regional level decisions, such as infrastructure supply).

Having ascertained this, the next step is to clarify the components or characteristics of a neighbourhood. The HQE$^2$R Project describes four, which are considered appropriate to the Beacon programme's focus on the residential built environment:

- residential space (houses and gardens and private spaces around houses)
- non-residential space (buildings and spaces hosting public and private sector facilities, services and activities)
- non-built space (all parts of the neighbourhood which are not built, even if they are not really natural)
- infrastructure (roads, streets, pavements, networks – electricity, water, sewage, communication)

To conclude, the broad conceptualisation of neighbourhoods proposed here is necessary to ensure the wide range of existing neighbourhood sustainability initiatives is captured in this study. Whilst it poses challenges for the identification and comparison of neighbourhoods, it

is considered that there is no workable alternative, at least at the preliminary project definition and confirmation phase. As the NBH project develops, it may be appropriate to adopt more definite parameters. The Western Australian Planning Commission, for example, use techniques such as 'ped-shed' mapping[3] that can be applied to neighbourhoods for the purposes of measuring different sustainability aspects.

## 2.3 Neighbourhood sustainability

Just as the scope and scale of a neighbourhood can vary, so too does the meaning of sustainability in relation to it (sustainability in itself has multiple meanings). In reading through the literature, 'neighbourhood sustainability' is packaged in a number of different ways, such as:

- Smart Growth and Neighbourhood Conservation
- Smart Neighbourhoods
- Creating Quality Places
- Liveable Neighbourhoods
- Neighbourhood Renewal
- Healthy Communities
- Successful Communities
- Low Impact Urban Design
- Transit Oriented Development
- New Urbanism
- Sustainable Model Districts (Model Codes)

Implicit in these terms is the understanding that a sustainable neighbourhood is more than sum of its parts, i.e., it is not just a string of sustainable houses, or a sustainable transport system – it's the combination of these and many other sustainability objectives across a predetermined scale (whether defined or not). As will become clear in subsequent sections, despite the different labels, these projects share a number of common elements and themes, e.g. rebuilding communities (quite often through intensification and mixed use) and limiting impacts on the natural environment.

### 2.3.1 More than houses

What benefit is to be had in looking at neighbourhoods? Given Beacon's focus on

[3] Ped-sheds map 400m and 800m radii from a defined central point, such as a town centre. These represent five- and ten-minute walking distances – considered reasonable for most people to choose to walk (Western Australia Planning Commission, http://www.wapc.wa.gov.au/udmp/documents/Whichsubshow.pdf accessed 13/9/04)

sustainability of the residential built environment, there are a number of reasons why neighbourhood sustainability is as important to address as sustainable houses:

- the sustainability of dwellings is substantially affected by neighbourhood form and development decisions (e.g. layout and solar access, neighbourhood-level zoning/planning provisions and housing typologies, connections to infrastructure, proximity to other services)
- certain aspects of the residential built environment cannot be managed at the scale of the individual dwelling (e.g. common infrastructure, movement networks)
- density and housing typology are particularly important decisions with sustainability implications made at the neighbourhood zoning level
- density has been demonstrated to directly correlate to transport (e.g. urban density vs. car km's per capita, car ownership, public transport trips, etc)
- neighbourhoods generate social sustainability benefits (e.g. social cohesion, stability, access to education, employment and services)

Looking at this list, it could be argued that neighbourhood sustainability is the critical element for the sustainability of the built environment as a whole (see Figure 1). However, sustainability literature involving the built environment is generally concerned with sustainable building or sustainable cities (especially in relation to the vast number of metrics/indicators available to measure the sustainability of either). While these two angles are important, it would seem that neighbourhoods (the 'middle bit') has been the subject of less attention (perhaps because of the difficulties in defining neighbourhoods and the relative lack of measures, or maybe it has been blurred with work on sustainable cities). Because of the potential of sustainable neighbourhoods to bridge the gap between cities and buildings, it is critical to gain an understanding of how this can be achieved (and is what the NBH programme of work is all about).

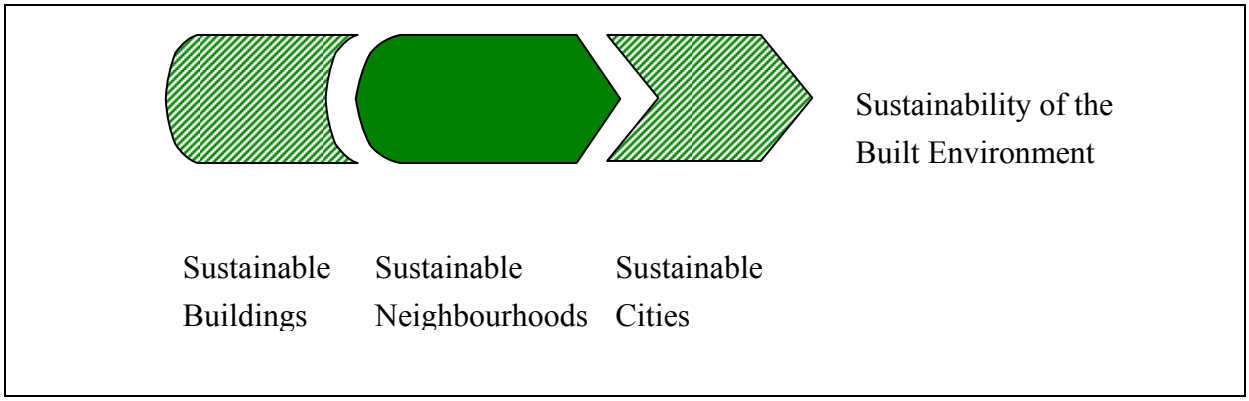


**Figure 1: Sustainable neighbourhoods as the critical link**

In sum, neighbourhoods are the building blocks of cities. It is highly unlikely that sustainable cities can be planned and developed in one step. Indeed, it tends to be the cumulative impact of city development over time that causes the problems (e.g., overloaded infrastructure, uneven economic development, 'slums'). Whilst it's possible to develop a strategy to address such issues at the city level, their operationalisation will almost inevitably take place at a neighbourhood scale.

# 3. NEW ZEALAND NEIGHBOURHOODS

Before turning to the question of frameworks for neighbourhood sustainability initiatives, it is important to establish the context of their potential application. The neighbourhood sustainability framework proposed by Beacon is intended to be applied to New Zealand neighbourhoods. Given that only a small percentage of neighbourhoods will be newly developed in the next decade, for Beacon's findings to make a significant difference to sustainability in the residential built environment, they will need to be relevant to existing neighbourhoods as well as new-build. It is therefore critical that the Beacon programme develops appreciation for the nature, form and impacts of New Zealand neighbourhoods as they currently exist (what might be termed 'conventional' neighbourhoods). The following discussion provides a 'short history' of the development of the New Zealand neighbourhood and identifies some key trends – sustainable or otherwise – over time. It highlights key drivers of current urban development patterns, and briefly sketches the development process and actors.

## 3.1 The development of New Zealand Neighbourhoods

The first New Zealand neighbourhoods, Māori kainga, were developed in close relationship with the landscape. Building on a strong vernacular knowledge, sites were selected for their security, stability and ability to provide for the daily needs of the people. They tended to be designed organically – a contrast to the straight surveying lines of the first Wakefield New Zealand Company settlements.

Modern New Zealand, along with Australia and North America, is a 'settler society'. Its built form is relatively new, and reflects the technologies that have been increasingly available since the turn of the twentieth century. The critical connection between urban form and mobility is evident throughout the development of New Zealand's neighbourhoods. The first European settler development created compact towns and cities with extensive rural hinterlands. Then, in the early twentieth century:

'*…there occurred a surge in two mobility inventions of profound significance. One of these, the elevator, enabled the corporate fortresses and city-centre apartments to grow up; the other, the mass-produced automobile, enabled the residential fringe of these same cities to grow out.*' (Riddell, 2004: 190)

The introduction of trams sparked early suburban development along fixed routes that radiated from city centres (e.g., Dominion Rd in Auckland and Colombo Street in Christchurch. New neighbourhoods were strung along the routes, with shops and community

facilities concentrated at tram stops, and residential development spreading within walking distance.

After World War I, with the increasing affordability of automobile ownership and the rise of the nuclear family household, suburban development surged, creating the 'edge city' phenomenon we live with today (Garreau, 1992). With cars to deliver residents from their homes to other activities, the need for walkable neighbourhoods was no longer so immediate, and traditional neighbourhood development began to falter. The orthogonal forms of pre-WWII developments gave way to more hierarchical roading networks, sequestering residential areas in curvilinear cul-de-sacs and 'rat-runs'.

The previously co-located functions of neighbourhoods – described by Duany and Plater Zyberk (1994) as dwelling, shopping, working, schooling, worshipping and recreating – have dispersed. Local shops have given way to 'big box' shopping malls and central business districts now compete with peripheral industrial parks.

Suburban form and automobiles are effectively locked in a vicious circle – increased mobility led to greater sprawl which fostered increasing car dependence etc. The increasing centrality of the car to residential development is visible in the changing design of the garage from free-standing 'shed' to an integrated (and often most-prominent) feature of the house.

### 3.2 The sustainability implications of New Zealand neighbourhoods

In a sense, New Zealand's early suburban development was a response to the 'unsustainable' aspects of inner city living – such as overcrowding, unsanitary conditions, poverty, crime and exposure to industrial hazards.[4] Increased mobility made it possible to put distance between homes and workplaces, separating functions into spatially defined 'zones' (Duany and Plater-Zyberk, 1994).

Yet suburban development was more than a technical solution to the problems of central city life. Around the world, suburbs were depicted as safe-havens for women and children, away from the hazards of the central city (i.e., neighbourhood as fortress – currently being rediscovered with the rise of the gated community). In New Zealand, '*[e]arly suburbia represented freedom and became 'utopia' … a flight from rural drudgery and mid-city congestion*' (Ridell, 2004:189). The quarter-acre paradise was born.[5]

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[4] Note that rail-based transport was available before adequate sewerage systems were developed.

[5] Indeed, Riddell (2004:191) suggests that the suburban imperative was deeply rooted in the settler society's psyche: 'a clear majority of the immigrants to the New World were attracted by 'possessive individualism' and

Suburban development has continued to be the predominant form of residential development in New Zealand. Today, 86% of the population lives in cities and towns (Towards Sustainable Development in New Zealand, 2002); the bulk of these people live in low-density suburbs.[6] The 2001 census indicated that 80% of private occupied dwellings were separate (i.e., stand-alone) houses (1,030,077 of a total of 1,287,888).

Whilst responding to the un-sustainability of early-20th century city living, the suburban style of development has generated unsustainable impacts of its own. It will be important for Beacon to be able to quantify these impacts – in order to establish a baseline for improvement, and also to be able to target the most significant aspects of sustainable neighbourhood development.

The availability of research in this area is mixed, and tends to focus on specific aspects of sustainability, e.g., stormwater. This section highlights some key research trends in New Zealand and draws on international examples to further illustrate issues. However, further literature review and research would be necessary to establish a more complete picture of the (un)sustainability of conventional suburban New Zealand neighbourhoods.

### 3.2.1 Energy and Greenhouse Gases (Transport)

- Lower urban densities have been demonstrated to generate proportionally higher levels of private automobile use and consequently $CO_2$ emissions (Bachels, Newman and Kenworthy, 1999) (see Figure 2).

- The greatest consumer energy use is in the transport sector – substantially greater than the energy used in houses. In 2000, transport accounted for 44% of greenhouse gas emissions, whereas emissions from national electricity generation only accounts for 20% overall. Of this 20%, residential electricity consumption only accounts for 33%, the remainder of the 20% being made up by commercial and industrial electricity consumption (see Figure 3). In other word transport energy use results in over 6 times as much greenhouse gas emissions as residential electricity use.

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wanted never again to be obliged to integrate their domestic lives with others on a shared plot, in a shared building, and on shared transportation.'

[6] The ARC provides guidelines as to the range of houses associated with different levels of density (www.arc.govt.nz). Conventional suburban houses equate to 10 dwellings/hectare; townhouses 15-20/ha; terraced houses 25-30/ha; and high-rise apartments 100+/ha. As a rule of thumb, public transport is estimated to require a density of at least 20 dwellings/hectare.

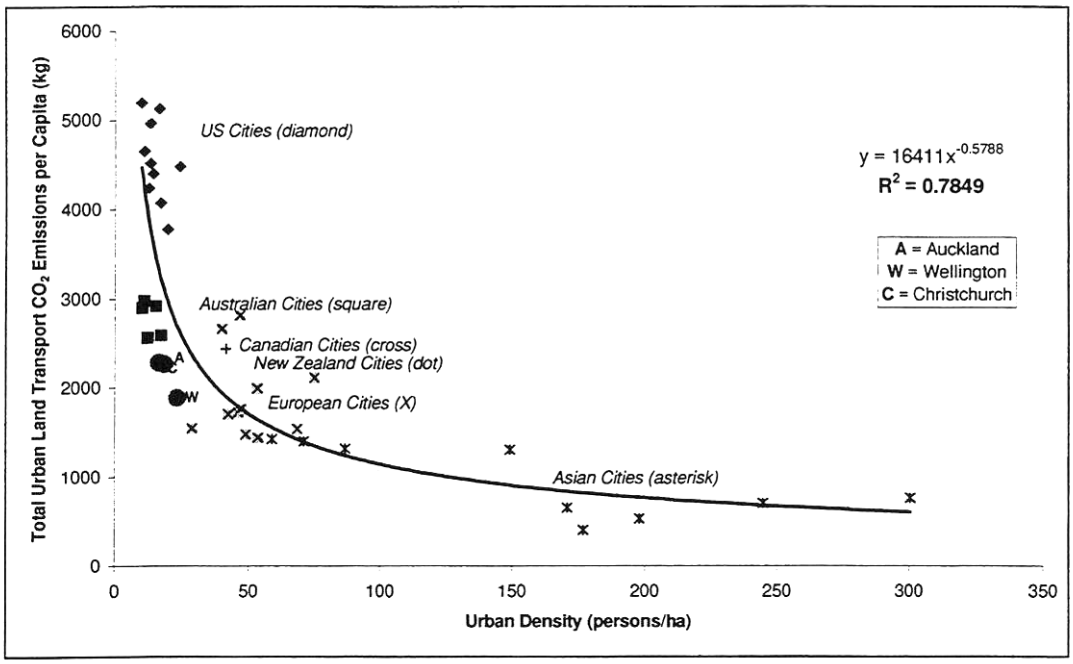


**Figure 2: Total Urban Transport $CO_2$ Emissions per Capita and Urban Density 1991**

(Source: Bachels, Newman & Kenworthy, 1999)

- The amount of $CO_2$ produced by household transport is increasing at a rate far greater than population and GDP growth.

- Victoria's Greenhouse Project estimated that the traditional neighbourhood / urban village model saved 57 percent of transport energy per household compared with conventional practice. These savings were achieved through a greater mix of land uses, density increases and interconnected streets resulting in reduced trip length, and facilitation of a shift from car use to public transport, walking and cycling.

### 3.2.2 Automobile Dependence

- Bachels, Newman and Kenworthy (1999) demonstrate the negative correlation between car ownership and urban density – that is, the lower the density the higher the level of car ownership. Data from New Zealand cities supports this finding.

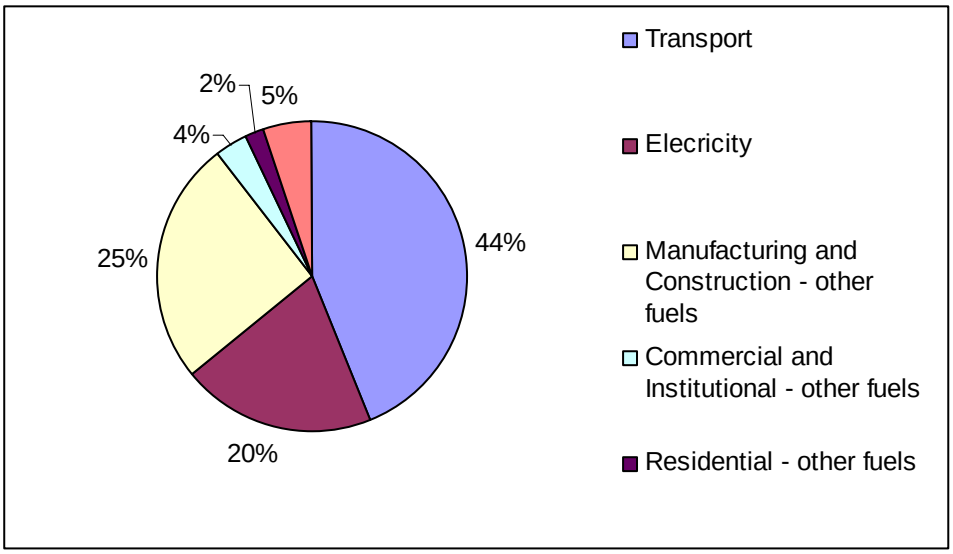


**Figure 3: National Greenhouse Gas Emissions from Energy and Waste $CO_2$ Equivalents**

(Source: Adapted from NZ Climate Change Office, 2002)

- An analysis of 83 American metropolitan areas, conducted by Rutgers and Cornell Universities (Ewing, Pendall and Chen, 2002:5-6), identified the following impacts of sprawl:
    - Higher rates of driving and car ownership
    - Increased levels of ozone pollution
    - Greater risk of fatal crashes
    - Depressed rates of walking and alternative transport use
    - No significant difference in congestion delays (refuting the notion that it is possible for cities to 'sprawl their way out of congestion').

### 3.2.3 Energy (Residential)

- Victoria's Greenhouse Project estimated that the traditional neighbourhood/ urban village model saved 26 percent of heating and cooling energy per household compared with conventional practice. These savings were achieved primarily through changes in building design; solar orientation and access.[7]

- Energy Victoria (1996:9) concludes that whilst 'energy efficiency improvements can be achieved for all new dwellings … the savings are more likely to be achieved in an urban village setting.' Contributing factors include smaller floor space and shared

[7] Note that the different climates and use of heating/cooling technologies between Australia and New Zealand would likely lead to different levels of efficiency.

walls/ceilings/floors, and the potential to improve the energy efficiency of multiple dwellings at once (e.g. in an apartment building) rather than single dwelling by single dwelling.

- A recent study of apartment living conditions in Auckland found that 19 out of 40 apartment occupants reported to not use any heating because they found their apartment to be sufficiently warm even in winter. The studied apartments did not put any specific emphasis on thermal performance; in fact they were selected from the bottom end of the market. (http://www.bia.govt.nz/e/uploads/apartment-living.pdf, page 15). This finding suggests that there are substantial energy benefits from party walls and multi-story apartment construction.

### 3.2.4 Water and other Natural Environment Impacts

- The LIUDD project (Environmental Communications, 2003) summarises extensive research of the stormwater impacts of conventional subdivision, and highlights:
    - infrastructure costs ("The Auckland region will be spending NZ$5,000 million over the next 10 years to replace aging pipes and meet the demands of new development for water, wastewater and stormwater services alone")
    - downstream impacts of discharges on coastal and inland waterways
    - increasing impervious surfaces, ground compacted to the point of near-total loss of permeability, and loss of topsoil

- One of the major contributors to urban stormwater contamination is vehicle emissions that are subsequently washed from roads into the stormwater system.

- A comparative study of two suburban neighbourhoods in Nashville, Tennessee found that the more dense neighbourhood (Hillsboro) occupies two thirds the land (Antioch), consumes 13% less water per capita, emits 7% less vehicular air pollution and 25% less $CO_2$ per capita, and generates approximately half the annual stormwater runoff and associated water pollution (Allen and Benfield, 2003).

### 3.2.5 Health and Safety Effects

- Automobile dependence impacts water quality and air quality – approximately 400 people are estimated to die prematurely each year in New Zealand from causes related to vehicle air pollution (Fisher et al., 2002).

- The Auckland Regional Council estimates that 58% of PM10 emissions in the region are caused by vehicles. PM10 emissions are the main factor in premature deaths from

air pollution (presentation by Gerda Kuschel, ARC, September 2004).

- Conventional suburbs may also be linked to the current 'obesity epidemic': a US study concluded that people living in automobile-dependent neighbourhoods (i.e., neighbourhoods that suppress walking) walk less, weigh more, and are more likely to suffer from high blood pressure (McCann and Ewing, 2003).

- The field of crime prevention through environmental design highlights the links between neighbourhood form, crime and perceptions of safety. Through, for example, clear delineation of public and private space and appropriate co-location of activities, good urban design can support the creation of safer neighbourhoods (Bartlett, 2001).

### 3.2.6 Affordability, Equity and Choice

- Expenditure on transport accounts for approximately 18% of total household expenditure (second to rent and home ownership costs) (Towards Sustainable Development in New Zealand, 2002).

- Given the lack of public transport, and perceived hazards of walking and cycling, those who are unable to drive (e.g., the young, the elderly, the poor) are often forced to rely on the chauffeuring services of family members or be relegated as 'second-class citizens'. In 1998, New Zealand children spent on average almost four hours per week as passengers, half an hour on a bus, an hour walking, and less than fifteen minutes on a bicycle (LTSA, 1998). In comparison, 25 to 64-year olds spent an average of six hours driving.

- The cost of housing (both ownership and rental) has increased over the last fifteen years, most markedly in the Auckland region (DTZ Research, 2004) (see figure two). Whilst this is due to a range of factors, it could be surmised that elements of conventional development patterns have contributed. For example, decades of low-density development in the Auckland region have consumed most of the available greenfields land. Further, the conventional model of suburban development has, for the last 50 years, offered very little other choice of housing type or location.

- The conventional model of suburban development has, for the last 50 years, offered very little other choice of housing type or location. As population and household structures diversify, there is a need to provide different lifestyle options.

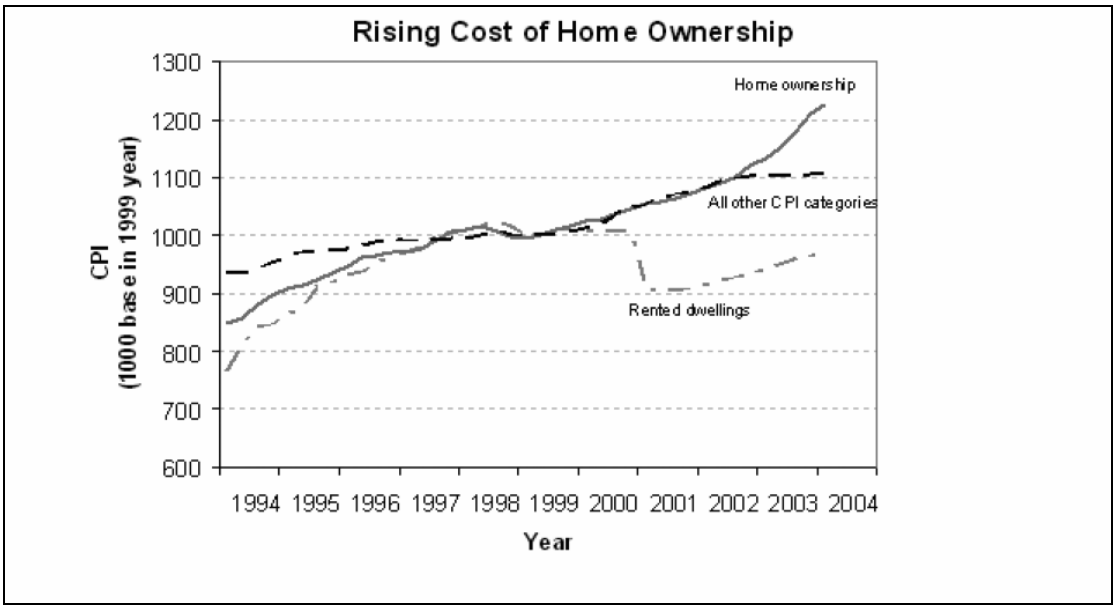


**Figure 4: Rising Cost of Home Ownership**

(Source: BIA, 2004)

- Housing New Zealand (2004) estimates that the number of households is expected to increase 12% over the next decade, but the size of individual households is projected to fall.

### 3.3 Where to for New Zealand neighbourhood development?

As New Zealand society and household structures diversify, the suburban model of neighbourhoods is a less universally appropriate model. Issues around housing affordability (compounded by the cost of buying and maintaining at least one car), increased population mobility and diversifying lifestyle choices all mitigate towards different kinds of neighbourhood development and re-development.

It appears that New Zealand is approaching the limits of suburbia – both in terms of physical capacity and of our tolerance for the costs of suburban living. We are turning back towards urban living and intensification (admittedly with mixed results). The NZ Residential Market Survey (June 2002 Quarterly Survey Volume 5, Number 2) observed that while detached housing remains the dominant housing preference, there is an increased move toward more intensive housing as the preferred option. Whilst this is provided for the most part through medium density housing (e.g. town-houses), the rate of apartment construction also continues to trend upwards (BIA, 2004) (see Figure 4). 53.3% of all new housing developments in Auckland City in 2002 were new apartments (Big Cities, 2003).

This shift in neighbourhood typology potentially promises improved sustainability outcomes,

particularly in the transport-related areas (e.g. increased viability of public transport options). However, the implications of neighbourhood typology for sustainability need to be further explored. Further, the potential for improved sustainability in the existing mass of suburban neighbourhood form needs to be taken into account.

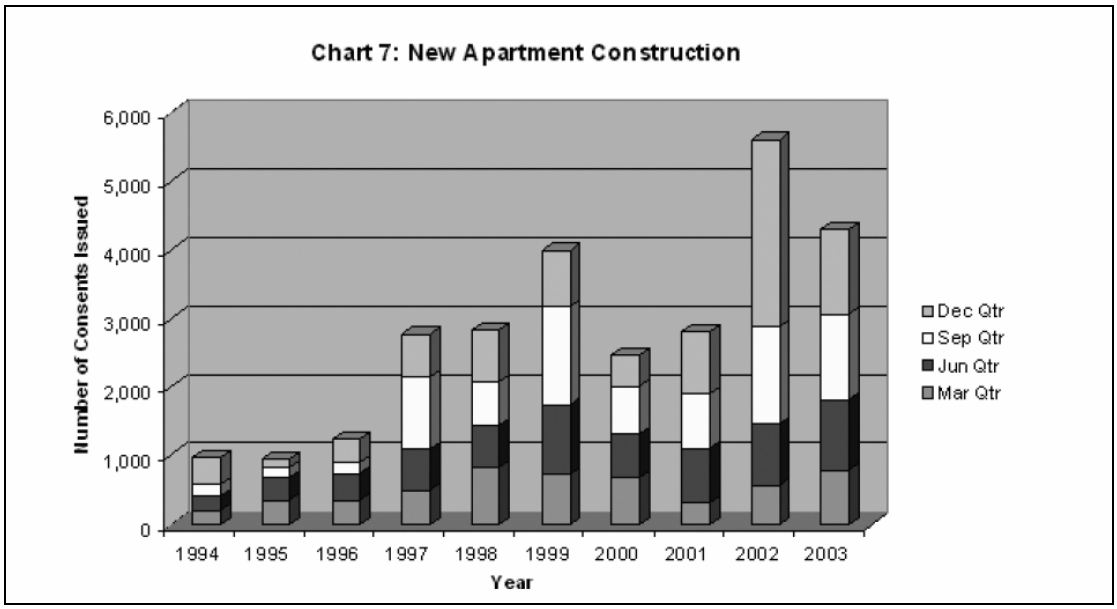


**Figure 5: New Apartment Construction**

(BIA, 2004)

### 3.4 Key drivers of neighbourhood development

The purpose of this subsection is to briefly introduce the process by which New Zealand neighbourhoods are developed and re-developed today. The discussion is intended to signal key leverage points to Beacon – areas where they might exert influence over the sustainability of neighbourhood development.

As already discussed, population growth combined with changing household structures is driving a demand for more housing. New Zealand is currently experiencing a building boom, driven largely by the residential sector. 2003 saw the highest level of new dwelling construction since the mid-1970s. The boom is centred in the Auckland region (which accounted for 40% of residential development in the first quarter of 2004) [8]. There are, however, some signals that this growth may slow down to due rising construction costs, a tight labour market and wider economic factors (BIA, 2004).

8 Thirty percent of New Zealanders live in the Auckland region, which represents only 2% of New Zealand's land mass (Auckland Regional Growth Forum, 1999).

Physical constraints are also a key driver of the kind of neighbourhood development that can occur. For example, in the Auckland region a metropolitan urban limit constrains further sprawl. The dwindling availability of land within the limits is driving regional efforts to develop more compact urban forms. Table 2 indicates a breakdown of where new dwellings were located in the Auckland region between 1996 and 2001, and shows a nearly even split between vacant land (largely at the fringe of metropolitan Auckland) and residential infill (including medium density housing developments).

**Location of New Residential Units Consented to, 1996 – 2001, Metropolitan Auckland:**

| | | |
|---|---|---|
| Vacant Land | 15,500 | 40% |
| Residential Infill | 16,000 | 41% |
| Business Zoned Land | 7,100 | 18% |
| | 38,600[9] | 99% |

**Table 1: Location of New Residential Consents**

(ARGF, 2003).

The two kinds of development have different implications for neighbourhood formation:

1. **Greenfields development** offers a 'clean slate' for developing new neighbourhoods, yet – at the periphery of the urban area – has tended to stick with conventional car-dependent designs. Given the significance of transport-related energy use, air and water contamination, the sustainability of peripheral development is immediately thrown into question.

2. **Infill development** must work within the constraints of the existing fabric of the metropolitan area. Roading networks, site orientations, and so forth are pre-determined, and there are few opportunities for comprehensive neighbourhood-scale re-development. Early attempts at infill simply added another house on existing sites, generating substantial adverse effects (e.g., on stormwater systems, roading networks, privacy and amenity). More recently, low-density dwellings have been replaced with multi-unit medium density development. This can have the benefit of reinforcing existing neighbourhood centres and transport systems, however the quality of development to date has been uneven, to say the least.

The development process walks through a number of steps and involves a range of key actors, all of whom influence the final shape of the neighbourhood. As it develops its programme,

[9] Note that only 35,000 dwellings were actually constructed, as not all building consents were acted upon.

Beacon needs to consider where and how it might achieve its neighbourhood sustainability objectives working within this process and with this constellation of actors. The role of industry and consumers has already been identified in the programme, but it may be appropriate to consider others, as mentioned in Figure 6.

**The development process**

The following steps are likely to be undertaken in greenfield neighbourhood development. Depending on the circumstances of the development, not all steps will be necessary, and they will not necessarily occur in the listed order. Some of the steps may not be relevant to infill development.

- land acquisition
- surveying
- design
- subdivision/resource consents (controlled by TLA's)
- building consents (administered by TLA's, but controlled by central government)
- construction phase – earthworks, infrastructure, roads, amenities
- sale of lots/units

**Key actors**

Local authorities:

- set strategic direction for development of the city/district (e.g., adopting "compact city" or greenfields approach, setting urban limits, staging of development)
- regulate zones, lot sizes and shapes, street widths, open-space requirements, range of accepted activities, building size, site coverage and yard requirements, etc.
- assess applications for new developments under the Resource Management Act and the Building Act
- invest in public spaces, parks, community facilities etc. and thereby influence the quality of neighbourhood amenity
- build and maintain roads and other infrastructure

Land developers:

- lead the development process
- specify the type of development to take place
- work to financial bottom lines
- vest assets and amenities in public ownership
- often 'landbank' areas for future development

Surveyors, planners, engineers, architects and other built environment professionals:

- design the layout of neighbourhoods
- interpret and implement local authority and client requirements

Building industry:

- Provide materials, construction, labour, training, design
- Advance of new technologies and techniques

Consumers:

- Generate market preferences for neighbourhoods (e.g. locations, typologies)
- Populate neighbourhoods

Communities:

- Contribute to neighbourhood vitality, connectivity, social fabric etc.

**Figure 6: The Development Process and Key Actors**

### 3.5 Summary: New Zealand neighbourhoods

To conclude, this section has discussed the nature, form and sustainability impacts of New Zealand neighbourhoods. It has touched on several challenges for the Beacon programme:

- The need for Beacon's NBH programme to be relevant to the redevelopment of existing neighbourhoods as well as new developments.
- The paucity of comprehensive research into the sustainability impacts of New Zealand neighbourhoods.
- The need to quantify the (un)sustainability of existing New Zealand neighbourhoods.
- The need to consider at what stage in the development process, and where in the constellation of development stakeholders, Beacon can exert most leverage over neighbourhood sustainability.

The section has also highlighted some of the key sustainability concerns, challenges and opportunities, including:

- The predominant neighbourhood form in New Zealand is the low-density suburb, populated with single dwellings and with a high level of private automobile dependency.
- Transport is a significant contributor to residential energy use, and a substantial contributor to air and water pollution.
- The housing market is changing, with increasing rates of medium density housing and apartments. This offers potential for more sustainable neighbourhood development, but this needs to be further explored.
- Two different forms of neighbourhood development – greenfields and infill – pose different sustainability challenges.

This report now turns to the question of how Beacon might evaluate neighbourhood sustainability, through use of indicators and frameworks.

# 4. MEASURING SUCCESS

The next logical question from here is how we will know what success looks like or, put another way, what features distinguish a sustainable neighbourhood from a non-sustainable one. Indicators are one way of determining which features are relevant. There are many indicators of urban sustainability available (at least 400)[10]; the challenge is knowing which ones are relevant to a) neighbourhoods (as opposed to regions or cities, or dwelling units) and b) the specific neighbourhood under investigation. In the case of the Beacon programme, we are more interested in New Zealand neighbourhoods in a generic sense, not individual or specific neighbourhoods within the greater set (although it is likely that one or several neighbourhoods may be redeveloped at any one time). This being the case, we are looking for indicators of sustainability at the neighbourhood level (including residential clusters) in a general sense.

In developing generic neighbourhood sustainability indicators, it is not a case of more is better, or less is better. Rather the number and choice of indictors is dependent on the end goal (or ultimate aim) of the initiative. If the indicators are to be used by different departments within large organisations, 50 to 100 might be appropriate. If the indicators are to be used to keep the public informed, a smaller number of 10 to 20 would make more sense. Bearing in mind that the overall aim of this programme is to create a neighbourhood sustainability framework, and assuming this framework will include the same user-groups as the sustainability framework for houses (project SF1.1) – consumers, industry, local and central government – it would seem appropriate that around 50-100 indicators be developed (with the larger set for local and central government, the mid-sized set for industry, and a smaller set for consumers).

Indicators can be organised in one of several ways, including category or issue lists, goal-indicator matrices, and pressure-state-response tables. A further alternative identifies endowments, liabilities, current results, and processes. Each of these is explained below.

**Category or issue lists** based on the main focus of each indicator show whether all aspects of the community (environment, society, and economy) are represented. For example (including a breakdown for 'housing'):

- Economy
- Environment
- Government

[10] For a wide selection, see http://www.sustainable-cities.org/docroot/sustainablecities/idimain.html

- Health
- Housing
    - Availability indicators (house price to income ration, number of homeless people, distribution of affordable housing throughout the city, etc)
    - Condition indicators (floor area per person in housing, low income housing with severe physical problem, percent of dwellings in need of major repair etc)
    - Cost indicators (affordability of single family home, renters who cannot afford to live in the city, low-income renters paying more than 30% of income on rent, etc)
- Population
- Public safety
- Recreation
- Resource use
- Society
- Transportation

**A goal-indicator matrix** can show how each indicator relates to many issues or a set of community goals. The matrix shows whether all issues or goals are evenly addressed. This model has been used by the Government of Alberta, for example (further breakdown for Society):

- Society
    - People will be healthy (indicators related to life expectancy at birth, health status measures, etc)
    - Children will be well cared for, safe, successful at learning and healthy (indicators related to the well-being of children, health status measures, etc)
    - Those unable to provide for their basic needs will receive help (economic status measures, health status measures), etc
- Economy
    - Neighbourhood to have a prosperous economy
    - Workforce will be skilled and productive
    - Neighbourhood will have an efficient and effective infrastructure, etc
- Environment
    - Neighbourhood renewable and natural resources will be sustained
    - People will have the opportunity to enjoy natural, historical and cultural resources, etc

(Adapted from http://www.finance.gov.ab.ca/publications/measuring/measup03/index.html accessed 13/9/04)

**Pressure-state-response** tables balance measures of pressures or driving forces; measures of the results, or state; and measures of programs and other human activities designed to alter driving forces with the goal of improving the state. This provides a secondary level of analysis mainly for use by policy-makers or decision-makers. The following figure shows OECD's use of the pressure-state-response model (see Figure 7):

Inset 3 **Structure of OECD Indicators Core Set by Environmental Issue**

| Major issues | PRESSURE<br>**Indicators of environmental pressures** | STATE<br>**Indicators of environmental conditions** | RESPONSE<br>**Indicators of societal responses** |
|---|---|---|---|
| 1. Climate change<br>2. Ozone layer depletion<br>3. Eutrophication<br>4. Acidification<br>5. Toxic contamination<br>6. Urban environmental quality<br>7. Biodiversity<br>8. Cultural landscapes<br>9. Waste | | | |
| 10. Water resources<br>11. Forest resources<br>12. Fish resources<br>13. Soil degradation (desertification, erosion) | | | |
| 14. Socio-economic, sectoral and background indicators | | | |

Broadly speaking, the first nine issues relate to the use of the environment's "sink capacity", dealing with issues of environmental quality, whereas the other issues relate to the environment's "source capacity", focusing on the quantity aspects of natural resources.

Not all indicators can be directly associated with a specific environmental issue. Some reflect background variables and driving forces, such as population growth and economic growth; others deal with selected sectoral trends and patterns of environmental significance, or factors such as economy-wide environmental expenditure and public opinion. An additional category of indicators has therefore been introduced in the framework. This category also provides an opportunity to further integrate indicators from sectoral sets into the OECD Core Set.

**Figure 7: OECD use of the Pressure-State-Response indicator framework**

(From http://destinet.ewindows.eu.org/aEconomic/5/OECD_P-S-R_indicator_model.pdf/ accessed 14/9/04).

**Endowments, liabilities, current results, and processes** are headings in another indicator matrix to check for balance among measures of what we are leaving for the future, what we have now, and what is happening to create both situations. The US Environmental Protection Agency use this model, for example (further breakdown for outdoor air):

- Cleaner Air: Impacts of indoor air quality on human health and of outdoor air quality on health and ecosystems.
    - Outdoor Air (number and percentage of days that Metropolitan Statistical Areas (MSAs) have Air Quality Index (AQI) values greater than 100, number of people living in areas with air quality levels above the NAAQS for particulate matter and ozone, Ambient concentrations of particulate matter: PM2.5 and PM10, Ambient concentrations of ozone: 8-hour and 1-hour, Ambient concentrations of lead, Visibility, Ambient concentrations of selected air toxics, Emissions of particulate matter (PM2.5 and PM10), sulphur dioxide, nitrogen oxides, and volatile organic compounds, etc)
    - Acid Deposition
    - Indoor Air Quality
    - Stratospheric Ozone
    - Climate Change
- Purer Water: Drinking water, recreational water use, the condition of the nation's water resources, and the living resources sustained by them.
- Better Protected Land: Land use and activities that affect the condition of the landscape, including information on agricultural practices, Integrated Pesticide Management, waste management, emergency response and preparedness, and recycling.
- Human Health: Trends in diseases, human exposure to environmental pollutants, and diseases thought to be related to environmental pollution.
- Ecological Condition: The state of living and natural resources, current pressures or stressors on these resources, and an indication of their sustainability into the future.

(From http://www.epa.gov/indicators/roe/html/tsd/index.htm accessed 14/9/04)

Again, it is not a case of one set being better than another. For organising indicators in a report, a category list is easily understood by many people. The Goal-Indicator matrix is useful for showing whether the indicator set measures all the goals of a community. The Pressure-State-Response framework shows the connections between human activities and environmental states. The Endowments framework can highlight the longer term aspects of sustainability. What is most important about the choice of indicators is that it works well for the intended purpose (Sustainable Measures, online at http://www.sustainablemeasures.com/ accessed 13/9/04).

While only a suggestion at this stage of the project, the 'goal-indicator' model – with its emphasis on the achievement of neighbourhood goals (and that one indicator is suitable for multiple goals) may be an appropriate choice for organising the sustainability indicators in further stages of this programme. This idea is further developed in the following subsection.

## 4.1 Proposed evaluation matrix

Project SF1.1: 'Sustainability Framework Design' recommends that The Natural Step be used as the guiding principles for achieving sustainability at the level of a house (see the SF1.1 report for details). It follows that the recommendations for achieving neighbourhood sustainability (and the creation of the neighbourhood sustainability framework) should also work to these principles. To recap, the Natural Step is a sustainability framework that outlines Four System Conditions or Guiding Principles that serve as a process for affecting across-the-board change.

Guiding Principles (adapted for neighbourhoods, from James and Lahti, 2004):

1. Eliminate neighbourhood contribution to fossil fuel dependence and use of mined metals and minerals
2. Eliminate neighbourhood contribution to dependence upon persistent chemicals and use of synthetic substances
3. Eliminate neighbourhood contribution to encroachment upon nature (e.g., land, water, wildlife, forests, soil and ecosystems degradation)
4. Meet human needs fairly and efficiently

Taking these four principles and adding the structural neighbourhood elements from the HQE$^2$R project (and using the 'goal-indicator' model, s.2.3.2), we can develop a matrix to guide assessment of the sustainability of any neighbourhood initiative (see Table 2).

The matrix provides 16 analytical fields; each field will need to be filled in with the specific goals that would need to be met at each structural level for the Guiding Principle in turn to be met. Our hypothesis is that if the goals listed in the 16 fields are met in a neighbourhood initiative (or to a predetermined metric as specified by that goal), we can say it is representative of a '100% sustainable neighbourhood' (or at least a 'high standard').

The challenge is to establish appropriate content (goals) and measures (indicators) for each of the fields.

The proposed matrix will be used in the second half of this report as a means of summarising the initiative profiles (section 5) and for providing the basis for discussion in section 6. Once this is completed we will be in a better position to recommend the 'ideal' content of the matrix – if indeed this is the most appropriate response.

| The Natural Step Guiding Principles (System Conditions) | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space (houses and gardens and private space around houses)* | *Use SF1.1 framework goals/indicators* | *Use SF1.1 framework goals/indicators* | *Use SF1.1 framework goals/indicators* | *Use SF1.1 framework goals/indicators* |
| Non-residential space (buildings and spaces hosting public and private sector facilities, services and activities) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) |
| Non-built space (all parts of the neighbourhood which are not built, even if they are not really natural) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) |
| Infrastructure (roads, streets, pavements, networks) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) | - Goal (indicator/s)<br>- Goal (indicator/s) |

**Table 2: Proposed neighbourhood sustainability evaluation matrix**

In sum, the proposed matrix is provisional at this stage of the NBH1 project (as the use of the Natural Step is dependent on the outcome of project SF1.1). Assuming The Natural Step is accepted as the guiding framework, and after the analytical sections of the project, we will be able to further develop and refine this pilot version, and it may be used to inform future stages of the Beacon NBH work programme (in particular the neighbourhood sustainability framework).

# 5. INVENTORY OF INITIATIVES

The purpose of this inventory is to list as many neighbourhood sustainability initiatives that have been, or are being, undertaken in New Zealand and overseas that we could find in the time available, in order to show the diversity of work going on in this field. The initiatives were chosen on the basis of **self-selection** – in other words, if the initiative called itself a 'sustainable neighbourhood' project or if it thought it was/is contributing to neighbourhood sustainability, it was included in the inventory. As a result, the list of initiatives varies greatly in scope and scale.

*Note: It can be argued that from the range of projects listed, few could be described as seriously or comprehensively sustainable. Without a definition of a 'sustainable neighbourhood' available to us at this stage of the NBH programme (and it assumed that this will be developed further in stage 2, the neighbourhood sustainability framework) no judgement has been made as to the relative merits of each initiative in this inventory.*

*The following section (s.5) addresses this issue somewhat in that it provides a detailed analysis of ten of the more progressive initiatives (by common opinion).*

While the role of an inventory does not include detailed discussion of each initiative, for ease of navigation, initiatives have been sub-grouped into notional categories and their collective approaches generalised. This is to highlight, that despite the large variation in initiatives, the degree of commonality across the various principles. Weblinks have been included (where available) to allow readers to pursue / investigate initiatives that are of interest to them.

## 5.1 Co-housing and eco-villages

**New Zealand**:

- Earthsong Eco-Neighbourhood**.**
  *(http://www.earthsong.org.nz/*
  *http://www.eeca.govt.nz/Content/EW_NEWS/84jan04/cohousing.htm)*
- Otamatea. *(www.otamatea.org.nz)*
- Awaawaroa. *(http://pl.net/~simong)*
- Kohatu Toa. *(http://www.koanga.co.nz/pages/eco_village.html)*
- Anahata Community. *(www.anahata.org.nz)*

**International**:

**Australia** ACT: *Canberra Cohousing*

Queensland: *Gold Coast Cohousing, Kookaburra Park Eco-Village*

Tasmania: *Cascade Cohousing, Hobart*

Victoria: *Merri Cohousing, Melbourne, Moora Moora, Healesville, Not Melrose Place*

Western Australia: *Pinakarri Community, Perth, Rosneath Farm*

**Belgium:** *Woongemeenschappen in Belgie*

**Canada** Alberta: *WholeLife Housing Urban Calgary*

British Columbia: *Cranberry Commons Cohousing, Middle Road Community, Quayside Village, Vancouver*, *Roberts Creek, Sunshine Coast, WindSong, 50km from Vancouver*

Ontario: *Whole Village*

Vermont: *Champlain Valley Cohousing, Cobb Hill Intentional Community, Hartland*

**Denmark:** *Fælleshave* , *Munkesogaard, BO 90, Copenhagen*

**Germany:** *WOGENO Munchen*

**Netherlands:** *GW-project*

**Sweden:** *BFG Tunnan, Foreningen EKBO, Fullersta Backe, Kollektivhuset Kupan, Stolplyckan, Understenhodgen, Tullstugan Collective housing unit*

**UK:** *Amadea, Cardiff Place Cohousing Community, Frankleigh House Cohousing Community, Mandorla Cohousing, Stroud Cohousing, SW, Thundercliff Grange, Cohousing Bristol, Warwickshire cohousing, Cohousing Edinburgh, Tweed Valley Ecovillage project*

**USA:** Arizona: *Manzanita Village, Prescot, Milagro, near Tucson, Sonora Cohousing, Tucson, Stone Curves Tucson*

California: *Central Coast Cohousing, Monterey*, *Doyle Street, San Francisco , East Bay Cohousing, Los Angeles Eco-Village, Marsh Commons, Arcata, Muir Commons, Davis, N Street (retrofit) Cohousing, Davis, Nevada City Cohousing, Oak Creek Commons, Central Coast, Pacific Gardens Cohousing Community, Pleasant Hill Cohousing, Contra Costa County, Sacramento El Dorado Cohousing, San Mateo Cooperative, Sonoma County Cohousing, Swan's Market Oakland, Tierra Nueva, Valley Oaks Village Chico*

Colorado: *Casa Verde Commons, Colorado Springs, Denver Cohousing, Colorado Springs Cohousing Community, Creekside Cohousing, Greyrock Commons, Harmony Village, Hearthstone, Heartwood Cohousing, Durango, Highline Crossing, Littleton Cohousing, RiverRock Commons, Fort Collins*

District of Columbia: *Takoma Village, Washington*

Florida: *Emerald Place, South Florida Cohousing*

Indiana: *Indiana Cohousing (forming), Deleware Street Commons, Lawrence*

Maine: *Two Echos Cohousing*

Maryland: *Liberty Village*

Massachusetts: *Jamaica Plain Cohousing in Boston, Mosaic Commons, New View Cohousing, Acton.*

Michigan: *Sunward Cohousing, Ann Arbor*, *Great Oak Cohousing, Ann Arbor*

Missouri: *Village in the City*

North Carolina: *Eno Commons, Solterra, Durham*

Ohio: *Dayton Cohousing, HomeTown Village, Cincinatti Eco Village,*

Oregon: *Cascadia Commons in Portland*

Texas: *Central Austin Cohousing, Austin Rural Cohousing*

Virginia: *Blueberry Hill, Northern Virginia*

Washington State: *Forbes Creek Commons Kirkland, Dearborn Commons, Seattle Cohousing, Sharingwood Cohousing Snohomish County, Songaia Cohousing, north of Seattle, SouthSound Cohousing in Tacoma*

From http://home.vicnet.net.au/~cohouse/ accessed 17/8/04.

Co-housing and eco-villages are generally based around the principles of **permaculture**, including environmental protection, social cohesion and community participation, and self-reliant economies. Co-housing and eco-village projects generally describe themselves as models demonstrating the highest standards of sustainable human settlement.

| **PRINCIPLES OF PERMACULTURE** | |
|---|---|
| 1. LOCATION OF COMPONENTS<br>Everything is connected to everything else. Plan accordingly. Let the needs of one be filled by the other. | 6.ENERGY (RE)CYCLING<br>Use as little energy as possible. Use waste energy in a second cycle, e.g. the dirty water from the duck's tub is excellent for the vegetable garden. In Permaculture one don't only recycle, but aims to catch, store and reuse everything before its energy use is degraded more and more. |
| 2. MULTIPLE FUNCTION<br>Each element has more than one function. For example, chickens lay eggs, loosen the soil, eat insects, eat food scraps, and produce fertilizer. | 7. NATURAL SUCCESSION.<br>Create a natural succession of the plants and animals that you grow. Don't wait until harvesting before planting new. |
| 3. MULTIPLE ELEMENTS | 8. MAXIMISE EDGES |

| | |
|---|---|
| Each important function is supported by many elements. For example, fire control through a pond with water, through firebreaks and slow burning windbreak trees. | Edges are the areas where two different systems meet. The forest and the meadows, the ocean and the shore, the pond and the vegetable patch. Life flourishes here because the resources of both systems are available. |
| 4. EFFICIENT ENERGY PLANNING<br>Place the elements according to how much they are used and how often they have to be serviced (zone planning). Keep the distance from the kitchen door to the vegetable garden short! Place the elements in such a way, that they make the best use of external energies, e.g. sun, light, wind, rain, bushfire (sector planning). Some plants need hot, dry areas, others the opposite. | 9. DIVERSITY<br>Permaculture is always polyculture. Polyculture creates a greater biological stability and protection against pests and sicknesses. Plant different strains of tomatoes, potatoes, beans. |
| 5. BIOLOGICAL RESOURCES<br>Use renewable biological resources wherever possible. Build up biological resources that reproduce. These can be animals from chickens to cows or herbs on the windowsill. | |

From http://www.kavenga.com/subperma/permaculture%20princ.htm accessed 20/8/04.

## 5.2 New and renewed town development

**New Zealand:**

- Flat Bush New Town, Manukau City. *(http://www.manukau.govt.nz/flatbush.htm http://www.transurban.co.nz/pro_human_eg1.html)*
- Pegasus Bay New Town, Canterbury. *(http://www.common-ground.co.nz/project4.htm)*
- Ruakura New Town, Hamilton. *(http://www.transurban.co.nz/frameprofile.html )*
- Chedworth Park, Waikato. *(http://www.transurban.co.nz/frameprofile.html )*
- New Haven, Tamaki. (*http://www.skmconsulting.com/allaire/spectra/system/mediastore/9_Residential_Neighbourhoods.pdf*)

**International:**

- Quartier Vauban, Freiburg. *(www.quartier-vauban.de)*
- Millennium Village, London. *(www.greenwich-village.co.uk)*
- Leidsche Rijn, Utrecht. *(www.leidscherijn.nl) (http://www.sibart.org/texte_3.html)*

- ParcBIT Masterplan, Mallorca, Spain.
- Mernda New Town Centre, Victoria, Australia. *(http://www.skmconsulting.com)*
- Forde, Gunghalin, ACT. *(http://www.skmconsulting.com)*
- Pasadena Redevelopment. *(www.uctc.net/access/access23lite.pdf)*

New and renewed town development projects tend to be focussed on creating strong healthy communities, balancing development and environmental protection, creating/stimulating economic development, and providing better transportation choices. These relate closely to the principles of **Smart Growth**; town-centred development that recognises the connections between growth and quality of life.

| **PRINCIPLES OF SMART GROWTH** | |
|---|---|
| 1. STRENGTHEN AND ENCOURAGE GROWTH IN EXISTING COMMUNITIES/AREAS<br>Concentrating new growth into existing areas makes more efficient use of land and infrastructure and reduces the need to urbanise the rural environment and open space. It also contributes to the economic competitiveness of towns and cities by making them more efficient places to work and do business in. | 6. FOSTER WALKABLE, CLOSE-KNIT COMMUNITIES<br>Walkable communities increase transport choices, lower transport costs, foster social interaction, and improve environmental quality and personal health. They provide pedestrian-friendly environments which are attractive, enable ease of access to a variety of desired destinations, and are easy to find ones way around in, due to recognisable routes, intersections and landmarks. |
| 2. INCLUDE MIXED LAND USES<br>The mixing of land uses in the same proximity makes destinations more accessible by cycle and foot, creating more sociable and safer public places, and enables developments to be more adaptable. | 7. TAKE ADVANTAGE OF EXISTING COMMUNITY ASSETS<br>Taking advantage of existing community assets gives precedence to the original natural setting of location and incorporates environmental assets into the design, in contrast to giving priority to using the land for construction. It also takes into account using land that is abandoned or greatly under-used, e.g., brownfield and greyfield sites. |
| 3. CREATE A RANGE OF HOUSING OPPORTUNITIES<br>Providing housing that meets the needs of different lifestyle, age, culture and incomes contributes to the diversity, resilience, identity, and equity in | 8. PROMOTE DISTINCTIVE, ATTRACTIVE COMMUNITIES/AREAS WITH A STRONG SENSE OF PLACE, INCLUDING REHABILITATION AND USE OF HISTORIC BUILDINGS<br>A strong sense of place contributes to the quality of life in |

| | |
|---|---|
| communities. | a community and its attractiveness to investment. Factors which contribute to a sense of place include good urban design, and development which relates well to its physical, cultural and historical context. This would include safe, uncluttered and attractive public spaces, thoroughfares and public/private interfaces that work well for all users. |
| 4. PRESERVE OPEN SPACE, FARMLAND, NATURAL BEAUTY, AND CRITICAL ENVIRONMENTAL AREAS<br>Preserving valued environmental features contributes to community health and cultural richness, and contributes economically through ecological services such as moderation of water cycles and pollution. | 9. ENCOURAGE CITIZEN AND STAKEHOLDER PARTICIPATION IN DEVELOPMENT DECISIONS<br>Participation of the community in new development proposals can foster creativity, resolve development issues speedily, and improve community understanding of the importance of design and development issues. |
| 5. PROVIDE A VARIETY OF TRANSPORTATION CHOICES<br>A wider range of transport options provides greater lifestyle choices for people, greater resilience to the transport system, and reduces transport impacts on the environment and human health. The type and location of development influences the transport choices available. | 10. MAKE DEVELOPMENT DECISIONS PREDICTABLE, FAIR AND COST-EFFECTIVE<br>Decision-making processes affect the feasibility of new development. Councils which reduce the barriers to quality development support both economic growth and enhanced liveability in their communities. |

## 5.3 New and renewed residential development

**New Zealand:**

- Harbourview Estate, Te Atatu Peninsula. *(http://www.skmconsulting.com/allaire/spectra/system/mediastore/9_Residential_Neighbourhoods.pdf)*
- Homestead Bay, Queenstown. *(http://www.common-ground.co.nz/project3.htm)*
- Walnut Grove, Rotorua. (*ph. Don Parkes 07 347-7517)*
- Rush Creek, Waitakere City. (*http://www.skmconsulting.com/allaire/spectra/system/mediastore/9_Residential_Neighbourhoods.pdf )*
- East Park, Manukau City. (*http://www.skmconsulting.com/allaire/spectra/system/mediastore/9_Residential_Neigh*

bourhoods.pdf)

- Ambrico Place. (http://masseynews.massey.ac.nz/_2001/news_releases/18_07_01.html)
- Beaumont Quarter, Auckland City. (http://www.beaumontquarter.co.nz/start.html)
- Wigram Urban Village, Canterbury. (http://www.common-ground.co.nz/project13.htm)
- Arthur St Precinct, Christchurch. (Contact Fliss Butcher, fliss.butcher@earthlight.co.nz)

**International:**

- Kronsberg, Hannover. (http://www.eaue.de/winuwd/190.htm)
- Rieselfeld, Freiburg. (www.rieselfeld.com.de) (www.rieselfeld.Freiburg.de)
- Hockerton, Nottinghamshire. (www.yourhome.com.au)
- Viikki, Helsinki. (www.hel.fi/Ksv/English/projects/Viikki_Kivikko/2latokartano/plans.html) (http://www.sibart.org/texte_3.html)
- Nieuwland, Amersfoot. (www.amersfoot.nl/balie/index_bouwenenwonen.htm) (http://www.sibart.org/texte_3.html)
- Christie Walk, Adelaide, South Australia. (www.greenhouse.gov.au/yourhome/technical/fs73.htm )
- East Perth, East Perth Redevelopment Authority, Western Australia. (http://www.epra.wa.gov.au/epra/content.asp)
- Subiaco, Subiaco Redevelopment Authority, Western Australia. (www.sra.wa.gov.au)
- The Village on the Twelve, St Catherines, Ontario. (http://www.traditionalneighbourhoods.com/index.html)
- The Bo01 Project, Malmo, Sweden. (home.att.net) (http://www.sibart.org/texte_3.html)
- Pilestredet Park, Oslo. (http://www.sibart.org/texte_3.html)
- Vesterbro, Copenhagen. (www.resetters.org)
- Chattanooga, Tennessee. (www.chattanooga.gov)

While very similar to the principles endorsed by town development projects, new and renewed residential developments are more focussed on increased housing density and choice, better mobility options and lifestyles for residents, and the creation or retention of community character and style. There is also attention to the sustainability features of the buildings and associated infrastructure. These relate quite closely to the principles of **New Urbanism**.

| **PRINCIPLES OF NEW URBANISM** | |
|---|---|
| 1. WALKABILITY<br>Most things within a 10-minute walk of home and work.<br>Pedestrian friendly street design.<br>Pedestrian streets free of cars in special cases. | 6.TRADITIONAL NEIGHBORHOOD STRUCTURE<br>Discernable centre and edge.<br>Public space at centre.<br>Importance of quality public realm; public open space designed as civic art.<br>Contains a range of uses and densities within 10-minute walk.<br>Highest densities at town centre; progressively less dense towards the edge. |
| 2. CONNECTIVITY<br>Interconnected street grid network disperses traffic & eases walking.<br>A hierarchy of narrow streets, boulevards, and alleys.<br>High quality pedestrian network and public realm makes walking pleasurable. | 7. INCREASED DENSITY<br>More buildings, residences, shops, and services closer together for ease of walking, to enable a more efficient use of services and resources, and to create a more convenient, enjoyable place to live. |
| 3. MIXED-USE & DIVERSITY<br>A mix of shops, offices, apartments, and homes on site.<br>Mixed-use within neighbourhoods, within blocks, and within buildings.<br>Diversity of people - of ages, classes, cultures, and races. | 8. SMART TRANSPORTATION<br>A network of high-quality trains connecting cities, towns, and neighbourhoods together.<br>Pedestrian-friendly design that encourages a greater use of bicycles, rollerblades, scooters, and walking as daily transportation. |
| 4. MIXED HOUSING<br>A range of types, sizes and prices in closer proximity. | 9. SUSTAINABILITY<br>Minimal environmental impact of development and its operations.<br>Eco-friendly technologies, respect for ecology and value of natural systems.<br>Energy efficiency.<br>Less use of finite fuels.<br>More local production.<br>More walking, less driving. |
| 5. QUALITY ARCHITECTURE & URBAN DESIGN | 10. QUALITY OF LIFE |

| | |
|---|---|
| Emphasis on beauty, aesthetics, human comfort, and creating a sense of place<br>Special placement of civic uses and sites within community.<br>Human scale architecture & beautiful surroundings nourish the human spirit. | Taken together these add up to a high quality of life well worth living, and create places that enrich, uplift, and inspire the human spirit. |

### 5.4 Social housing / community renewal development

**New Zealand:**

- Aranui, Christchurch
- Clendon, South Auckland
- Fordlands, Rotorua
- Talbot Park, Auckland City
- Eastern Porirua, Wellington
- Northcote, North Shore, Auckland *(http://www.hnzc.co.nz/aboutus/initiatives/communityrenewal)*
- Mt Roskill Neighbourhood, Auckland. *(http://www.transurban.co.nz/frameprofile.html)*

**International:**

- BedZed, Sutton. *(http://www.bedzed.org.uk/)*
- Pichling, Linz. *(www.solarcity.linz.at) (http://www.sibart.org/texte_3.html)*

Social housing / community renewal projects are based around increasing the empowerment of residents, creating local business opportunities, improving social cohesion and safety, and encouraging community participation in decision-making. In other words, is about more than just housing; they seek to address community issues around employment, safety, health, education and social service delivery. The principles of **community development** are generally used to implement community led solutions.

| **PRINCIPLES OF COMMUNITY DEVELOPMENT** |
|---|
| Promote active and representative citizen participation so that community members can meaningfully influence decisions that affect their lives. |
| Engage community members in problem diagnosis so that those affected may adequately understand the causes of their situations. |

| |
|---|
| Help community leaders understand the economic, social, political, environmental, and psychological impact associated with alternative solutions to the problem. |
| Assist community members in designing and implementing a plan to solve agreed-upon problems by emphasizing shared leadership and active citizen participation in that process. |
| Disengage from any effort that is likely to adversely affect the disadvantaged segments of a community. |
| Actively work to increase leadership capacity (skills, confidence, and aspirations) in the community. |

From *http://maaori.com/develop/princip.htm* accessed 20/8/04.

### 5.5 Community-based cultural development

**New Zealand:**

- Hoani Waititi Marae.
- Te Piringatahi o te Maungarongo Marae.

Community-based cultural development in New Zealand is largely based on the Maori worldview which embodies a range of values to empower communities to help themselves and create sustainable neighbourhoods in the process.

| **ETHICS OF THE MAORI WORLDVIEW** |
|---|
| TE AO MÄRAMA: ethic of wholeness, cosmos |
| MAURI: ethic of life essences, vitalism, reverence for life |
| TAPU: ethic of being and potentiality, the sacred |
| MANA: ethic of power, authority and common good |
| HAU: ethic of spiritual power of obligatory reciprocity in relationships with nature |
| WAIRUATANGA: ethic of the spirit and spirituality |
| TIKA: ethic of the right way, of the quest for justice |

| |
|---|
| MANAAKITANGA: ethic of care and support, reverence for humanity |
| WHANAUNGATANGA: ethic of belonging, reverence for the human person |
| TE AO HURIHURI: ethic of change and tradition |
| KOTAHITANGA: ethic of solidarity |
| KAITIAKITANGA: ethic of guardianship of creation |

From *http://www.devnet.org.nz/conf/Papers/manuka.pdf* accessed 20/8/04.

**International:**

- Congress for the New Urbanism
- Institute of Classical Architecture
- International Association for the Study of Traditional Environments
- Institute for Traditional Architecture of the University of Miami
- Vernacular Architecture Forum
- Prince of Wales's Urban Task Force
- University of Notre Dame School of Architecture
- African Heritage Architecture
- Building Conservation Centre Trust
- Post-war Reconstruction and Development Unit (PRDU) of the University of York
- Slow Cities
- International Conference On Monuments and Sites
- International Centre for the Preservation and Restoration of Cultural Property
- Organisation for Economic Cooperation and Development, Territorial Development Service (formerly OECD Urban Affairs Division) *(http://www.intbau.org/Downloads/CaseStudiesReport.pdf)*
- The International Network for Traditional Building, Architecture & Urbanism (INTBAU) *(http://www.intbau.org/)*

International community-based cultural development initiatives are well represented. The manifesto's of many of these international organisations mention a number of principles of **New Urbanism** but also include the characteristics of the urban fabric and on the recovery and reuse of **traditional building**. These principles are most closely aligned to those proposed by the 'Slow Cities' movement (as below).

| PRINCIPLES OF TRADITIONAL BUILDING |
|---|
| Maintain and develop the characteristics of their surrounding area and urban fabric, placing the onus on recovery and reuse techniques |
| Invest in infrastructure which is functional for the improvement, not the occupation, of the land |
| Promote the use of technologies to improve the quality of the environment and the urban fabric |
| Encourage the production and use of foodstuffs produced using natural, eco-compatible techniques |
| Promote the quality of hospitality as a real bond with the local community and its specific features, removing the physical and cultural obstacles which may jeopardise the complete, widespread use of a city's resources |
| Promote awareness among all citizens, with special attention to the world of young people and schools through education |

Adapted from *http://www.intbau.org/Downloads/CaseStudiesReport.pdf* accessed 13/9/04

## 5.6 Government-led initiatives

**New Zealand:**

- Sustainable Development Programme of Action, Department of Prime Minister and Cabinet (*http://www.mfe.govt.nz/publications/sus-dev/sus-dev-programme-of-action-jan03.html*). Including a regional work programme in Auckland, and the Draft Urban Design Protocol, Ministry for the Environment. (*www.mfe.govt.nz*)
- Towards More Sustainable Cities, Ministry of Transport.
- Quality Planning. (*http://www.qp.org.nz/index.php*)
- Quality of Life. (*http://www.bigcities.govt.nz/*)
- Auckland Regional Growth Strategy (*www.arc.govt.nz*)
- Waitakere City District Plan *(www.waitakere.govt.nz)*
- Citizens for a Sustainable Community, Hamilton City Council. *(www.sustainablehamilton.org/study.htm)*

**International:**

- Millennium Communities Programme, UK. (*www.urban.odpm.gov.uk)*
- Creating Sustainable Communities. Office of the Deputy Prime Minister's (UK). *(http://www.odpm.gov.uk/stellent/groups/odpm_communities/documents/sectionhomepa*

*ge/odpm_communities_page.hcsp)*

- Sustainable Communities and Neighbourhoods Project, Enfield Council, UK. *(http://www.enfield.gov.uk/green/sustcomm.htm)*
- Community Visions Programme, City of Vancouver[11]. (*http://www.city.vancouver.bc.ca/commsvcs/planning/cityplan/visions/index.htm*)
- Sustainable Urban Landscapes (the Headwaters Project), Surrey Department of Planning and Development, Vancouver. (*http://www.sustainable-communities.agsci.ubc.ca/projects/Headwaters/Headwaters_intro.html*)
- Livable Communities, Local Government Commission, USA. *(http://www.lgc.org/center/about/center.html)*
- Creating Great Neighbourhoods: Density in Your Community. Environmental Protection Agency, USA). *(http://www.epa.gov/smartgrowth/density.htm)*
- Livable Communities Initiative. Federal Transit Administration, USA. *(http://www.fta.dot.gov/library/planning/livbro.html)*
- Agenda 21. Chapter 7: promoting sustainable human settlement development. United Nations.
- METRIX, Department of Infrastructure, Planning and Natural Resources (DIPNR), NSW, Australia[12].
- Which Suburbs Work? Western Australian Planning Commission. *(http://www.wapc.wa.gov.au/udmp/documents/Whichsubshow.pdf)* *(http://www.wapc.wa.gov.au/udmp/LNprinciples.html)*

Government-led initiatives, while varied, tend to be policy, **planning** and/or advocacy based, and tend to be largely **transport** (transit oriented development) and/or **intensification** (of housing) driven. There is also an emphasis on partnerships and increased public participation.

| **GOOD PLANNING PRINCIPLES** |
|---|
| Well planned city and town centres |
| Dedicated areas for growth, and areas where growth is restrained |
| Effective public and private transport networks |

[11], [12] Identified as examples of 'best practice' in terms of neighbourhood sustainability work (Peter Newman, Pers. Comm. Sept 04).

| |
|---|
| Public spaces we can enjoy |
| A choice of affordable housing options |
| Protection for our environment |
| New and upgraded infrastructure |
| Access to jobs and a healthy economy |

From *http://www.arc.govt.nz/arc/index.cfm?03621BB3-E018-8BD1-320D-5DE6FD0AE862* accessed 13/9/04

| **PRINCIPLES OF TRANSIT ORIENTED DEVELOPMENT** |
|---|
| Walkable design with pedestrian as the highest priority |
| Train station as prominent feature of town centre |
| A regional node containing a mixture of uses in close proximity including office, residential, retail, and civic uses |
| High density, high-quality development within 10-minute walk circle surrounding train station |
| Collector support transit systems including trolleys, streetcars, light rail, and buses, etc |
| Designed to include the easy use of bicycles, scooters, and rollerblades as daily support transportation systems |
| Reduced and managed parking inside 10-minute walk circle around town centre / train station |

Accessed 13/9/04 from *http://www.transitorienteddevelopment.org/pages/1/index.htm*

| **PRINCIPLES FOR INTENSIFICATION** |
|---|
| Access: all intensification areas to be served by an effective and efficient passenger transport system |
| Employment choice: all intensification areas to be within walking distance of a commercial or employment |

| |
|---|
| centre |
| Heritage: all intensification areas to be located in a manner that maintains identified residential character areas |
| Open space: all intensification areas to be located and developed in a manner that provides adequate open space for the needs of local residents |
| Social infrastructure: all intensification areas to have access to appropriate and affordable education, health, community, recreation, social services and facilities |
| Housing choice: all intensification areas to provide a range of dwelling types and densities including mixed use development activity where appropriate |

Adapted from *http://www.arc.govt.nz/arc/library/d13300_2.pdf* accessed 13/9/04

### 5.7 Non-government organisation/research sector-led initiatives

**New Zealand:**

- Sustainable Households Project. (*http://www.sustainablehouseholds.org.nz/index1.htm*)
- Subdivision for People and the Environment NZS HB:44:2001 *(www.standards.co.nz)*
- TUSC (Tools for Urban Sustainability Engineering Code of Practice), *(www.tusc.org.nz)*
- LIUDD (Low impact urban design and development). *(http://www.landcareresearch.co.nz/about/tamaki/liudd.asp)* *(http://www.landcareresearch.co.nz/research/urban/liudd/maori_urban_sustainability.pdf*
- Sustainable Cities and Settlements, OPUS et al.
- Reducing Transport $CO_2$ Emissions, OPUS and the Centre for Social and Health Outcomes Research and Evaluation [SHORE].

**International:**

- Sustainable Communities Information. Nova Scotia Environment and Development Coalition. *(http://www.chebucto.ns.ca/Environment/SCN/SCN_home.html)*
- Carfree.com *(http://www.carfree.com/)*
- EcoCity Cleveland, Ohio. *(http://www.ecocitycleveland.org/)*
- EnAct, Madison. *(http://www.enactwi.org/about.htm)*
- The Main Street Programme, National Main Street Centre, Washington. *(www.mainst.org) (http://www.mainstreet.org/About/index.htm)*

- Congress for New Urbanism. *(www.cnu.org)*
- Project for Public Spaces. *(www.pps.org)*
- Sustainable Neighbourhoods Programme, Groundwork Coventry and Warwickshire Trust. *(http://www.groundwork-coventry.org.uk/index.asp?page=30)*
- ICLEI's Guide for Sustainable Communities. *(http://www.iclei.org/LA21/ONESTOP.HTM)* *(http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter7.htm)*
- Ontario Healthy Communities Coalition (*www.sustreprot.org/issues/sust_comm2.html)*
- Sustainable Neighbourhood Audit Project (SNAP). *(http://www.gaiagroup.org/architects/development-planning/snap/)*
- The Concerto Initiative, European Commission. *(http://www.sibart.org/newsletter-5.html)*
- SIBART (Seeing is Believing As a Replication Tool). *(http://www.sibart.org/page_11.html)*
- HQE$^2$R: Sustainable Renovation of Buildings for Sustainable Neighbourhoods. *(http://hqe2r.cstb.fr/)*
- Sustainability Design Guidelines for Urban Release Areas, Institute for Sustainable Futures. *(http://www.isf.uts.edu.au/publications/SDGURA.pdf)*
- Multiple Housing for Community Sustainability Project, CHMC. *(http://www.cmhc.ca/publications/en/rh-pr/tech/98132.htm)*
- Sustainable Communities Network. (*http://www.sustainable.org/*)
- Vital Communities. (*http://www.vitalcommunities.com/sustain.htm*)
- Funders Network for Smart Growth and Livable Communities. (*http://www.fundersnetwork.org/info-url_nocat2778/info-url_nocat.htm*)

Non government-led initiatives are numerous and varied. They tend to be focussed on improving **quality of life**, or liveability (especially through the delivery of better housing and urban form), and for empowering local communities through grass-roots action. Of special note is Standard New Zealand's Handbook 'Subdivision for People and the Environment'. While a non-mandatory handbook at present, it has been flagged for development into a Standard in the future. This would provide a much needed and valuable resource to advancing sustainable neighbourhoods in New Zealand.

| **INDICATORS OF QUALITY OF LIFE** |
|---|
| People: population growth, ethnicity, age, family and households |
| Knowledge and skills: suspensions and stand-downs, early childhood education, school decile ratings, |

| |
|---|
| community education, qualification levels |
| Economic standard of living: household expenditure, social deprivation, income, costs |
| Economic development: growth in business, building consents, economic growth, employment, retail sales, tourism |
| Housing: housing costs and affordability, government housing provision, urban housing intensification, household crowding, household tenure |
| Health: mental health and wellbeing, modifiable risk factors, low birth rates, teenaged parents, life expectancy, infant mortality, access to GP's, health status, diseases |
| Natural environment: waste management and recycling, beach, stream and lake water, drinking water quality, biodiversity, air quality |
| Built environment: look and feel of the city, traffic and transport, city green space, public transport, noise pollution, graffiti |
| Safety: perceptions of safety, child safety, road casualties, crime levels |
| Social connectedness: community strength and spirit, electronic communication, quality of life, diversity |
| Civil and political rights: involvement in decision making, representation, voter turnout |

(From http://www.bigcities.govt.nz/indicators.htm accessed 14/9/04)

## 5.8 Conclusion

This inventory demonstrates the wide-ranging nature of projects that self-identify as 'sustainable', from policy to practice, on different scales, and led by different stakeholders with different worldviews or priorities within the sustainability spectrum. Few of the examples identified would stand up to scrutiny under the Natural Step principles identified in section four. The inventory highlights the challenge for Beacon in determining exactly what neighbourhood sustainability looks like, and in developing measurable parameters. The next section examines in further detail some of the key relevant initiatives listed in the inventory.

# 6. PROFILES

This section profiles ten key initiatives from the inventory presented in section four (five national examples and five international examples). The purpose of this section is to:

- further determine the features and objectives of sustainable neighbourhoods (process and content elements)
- identify the purpose, drivers, strengths and weaknesses of each initiative (where available)
- begin to draw out replicable elements of what a sustainable neighbourhood 'looks like' (lessons / success factors)

The following initiatives were selected for evaluation:

**New Zealand:**

1. Earthsong Eco-Neighbourhood, Waitakere City
2. Ambrico Place, Waitakere City
3. Tiritiri and Verbena Rd, North Shore City
4. Sustainable Cities and Settlements, Opus Consultants et al
5. Auckland Regional Growth Strategy, Auckland Regional Growth Forum

**International:**

6. BedZed Urban Housing Project, Peabody Trust, UK
7. Quartier Vauban, City of Frieberg, Germany
8. East Perth, East Perth Redevelopment Authority, Australia
9. METRIX, Department of Infrastructure, Planning and Natural Resources (DIPNR), NSW, Australia
10. Community Visions Programme, City of Vancouver, Canada

While difficult to select from the large number if initiatives available, we feel that these ten provide a good cross section for analysis: some are representative of making their first steps towards neighbourhood sustainability (e.g., Tiritiri and Verbena Rd), while others are well on the way to representing sustainable neighbourhoods (e.g., BedZed). Of the 'policy' type initiatives, there is also a mix of representation. The Canadian and New South Wales initiatives are considered leading examples of progress in this field (P. Newman, Pers. Comm., 4 Sept 04).

The following evaluation template was used to analyse each initiative (see Table 3):

| **Introduction:** |
|---|
| - Name of initiative<br>- Location<br>- Contact person<br>- References / resources |
| **Process elements:** |
| - Description of project brief (aims of project, etc)<br>- Who/what were the principal drivers (who were the decision makers, what processes did they go through to get the design signed off)<br>- Any other project history |
| **Content elements:** |
| - Map/graphics demonstrating layout, building features, range of dwelling types etc.<br>- Description of sustainable neighbourhood /project features/ objectives |
| **Results:** |
| - Strengths (what worked)<br>- Barriers (what didn't work)<br>- Lessons |
| **Summary:** |
| - 'Matrix' assessment (using the evaluation matrix as proposed in section 4) |

**Table 3: Profile evaluation template**

The profiles are presented in a narrative style and have varying levels of detail depending on the scope of the sourced information and due to the limited amount of time available for compiling each profile. Relying on initiatives' own reports and other secondary sources presented a challenge to the project team – the information available was highly variable and not necessarily focussed on the neighbourhood issues that we were looking for. This point, and the need for more detailed independent analysis is picked up in the discussion and recommendations.

All information is assumed accurate at the time of writing, although some errors may have unwittingly occurred in transcription / paraphrasing.

**Earthsong Eco-Neighbourhood, Waitakere City**

**Introduction:**

Earthsong Eco-Neighbourhood is a 1.67ha urban co-housing initiative located at 499-457 Swanson Rd, Waitakere City, Auckland (Lat 36 51 S; 1151 HDD@18$^{o}$C; 2102 sunshine hours). Key contact people are architects Robin Allison (development co-ordinator) and Bill Algie (designer).

Information about the project has been sourced from the following websites: http://www.earthsong.org.nz/ and http://www.eeca.govt.nz/Content/EW_NEWS/84jan04/cohousing.htm

**Process elements:**

The purpose of the project was to build a co-housing project that would allow people to live in a way that encouraged sharing of resources and social interaction and reduced environmental impact.

The first stage of the project (17 houses) was completed and occupied by mid 2003. The second stage, which will take the total to 32 dwellings, is planned for completion by late 2004. Also still to be built is the central community house, which is an essential element of co-housing developments, and roadside facilities such as a café and other commercial premises that will enable members to contribute to the wider community and work close to home. In the meantime, the stucco farmhouse that came with the site's organic orchard serves as a community house. The annual body corporate fee is $1500 per household, which includes site works and extensive landscaping.

A detailed history of the project and full project goals/design brief can be viewed at:
http://www.earthsong.org.nz/process/history.html
http://www.earthsong.org.nz/design/design_brief.html

**Content elements:**

The homes are compact and built to a standard design with a narrow range of variations. They are grouped in terraces, ranging from studio units to four bedrooms. Some single floor dwellings are designed for accessibility, while others have stairs to the upper level, and loft spaces accessed by ladders. The houses have concrete floors and rammed earth walls for the lower floor, and macrocarpa cladding and floors upstairs, although some have two levels of rammed earth walls and a concrete inter-tenancy floor.

Each household has its own solar water heater panel, backed up by a 3.6kW electric booster element. Cooking is by gas from a refillable 9 kg cylinder. Ventilator cowls on the roofs are part of a passive ventilation system which removes hot air from the ceilings to prevent overheating in summer. Shading prevents the sun from overheating the homes in summer. At colder times of the year, the solid concrete floors (thermal mass) absorb heat from the sun and warm the air.

Cars are kept to the perimeter to create a safe central area. Paths between the houses encourage neighbourly interaction (whilst still being wide enough to accommodate fire trucks).

Stormwater is collected in swales (vegetated channels), marshes and a pond so it doesn't discharge all at once in flash floods. Rainwater is collected in tanks and supplemented with town supply. Low flush toilets have been installed and the taps are set at a flow of seven litres a minute and the shower at nine litres per minute. The houses are dual-plumbed, for potable and non-potable water. Wastewater goes to the public sewer system.

Low toxic finishes were specified (e.g., organic paints). There is onsite planting to preserve biodiversity and food is grown on-site both individually and through shared labour. All organic waste is composted on-site; other waste production is also reduced. The development is located 5 minutes from Ranui railway station, reducing transport demand.

**Results:**
During 12 months, Earthsong took 190 litres of city water per household per day, and 220 litres for non-potable purposes. Total water use is only 59% of a typical household's, saving each household $210 for the year. Hot water consumption is estimated to be around 160-200 litres a day.

Each household has its own check-meter for internal billing and the average combined water and energy bill per household has been around $39 a month. The more economical occupants are rewarded with a tariff of 14.5 c/kWh up to 600 kWh usage a month. The more profligate are charged 19.5 c/kWh for usage above 600 kWh. The individual households are not billed for a daily ‘lines charge’. The power company's lines charge of $2.71 a day for the entire site is built into the households' cents per kilowatt-hour charge.

The houses don't have double glazing and use uninsulated rammed earth construction. The winter performance is good, but could have been even better if these features were included.

The initiative is popular with the residents. However, the houses are relatively more expensive to buy (similar to Auckland 'townhouse' prices) and co-housing is not a philosophy that suits all people. The uninsulated construction is not recommended for wider use.

**Summary:**

| **The Natural Step Guiding Principles (System Conditions)** | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space* | *Passive solar design (solar hot water heating, passive ventilation, thermal mass, orientation)* | *Low-toxic finishes*<br>*Low-toxic materials, durable and low maintenance* | *Reduced water demand (house and garden)* | *Design for re-use and accessibility (diversity of residents)*<br>*Designed to be affordable and reduce operating expenses* |
| Non-residential space | (Community house not yet built, but will be designed for energy efficiency and maximise solar access)<br>Reduced car use because facilities are within walking distance | Will be designed for low toxicity | Will be designed for water efficiency<br>Recycling centre | (Café and commercial premises to be built)<br>Public spaces designed to be people oriented, safe and secure |
| Non-built space | | Organic gardening and landscaping | On-site planting (biodiversity) | On-site food production |
| Infrastructure | Reduction of car use | Natural paths | Minimise paved and impermeable surfaces<br>On site passive stormwater management<br>On-site greywater / wastewater treatment planned | Pedestrian/cycle friendly (cars at perimeter)<br>Close to public transport |

## 6.1 Ambrico Place, Waitakere City

**Introduction:**

Ambrico Place is located close to the centre of New Lynn, Waitakere City, within 500m of the New Lynn train station. By road it is accessed via Rankin Ave, and is bounded on the other sides by Margan Ave, Manawa Wetlands and the rail line. Originally part of the New Lynn pottery and brick industry, the site was vacant for many years. It is a medium density development housing approximately 800 people in nearly 300 units. The key contact person is Janet Cole, Waitakere City Council. Research on the social and economic aspects of Ambrico Place has been conducted by Dr Ann Dupuis, Massey University, Auckland. Less information was available on the environmental dimension.

Information about this case study has been sourced from the following:
http://masseynews.massey.ac.nz/_2001/news_releases/18_07_01.html
http://www.waitakere.govt.nz/AbtCit/ps/pdf/stateofcity/ch06.pdf

**Process elements:**

The site was identified as a suitable location for medium density housing in the New Lynn community design process in 1995. The community and children were also very involved in the development of two local parks: Ambrico Place and Manawa Wetlands. There has been a rapid market uptake in the area, and the project is seen as a pioneer housing development in Waitakere City.

**Content elements:**

The design incorporates local parks and playgrounds as well as access to the larger Manawa Wetland, which treats stormwater from the development.. Most units have parking and garage space, although there is considerable 'informal' parking taking place in shared driveways.

The location provides easy road and walking access to rail, road, bus, leisure, shops, schools and local services. The interior roads, while not fully connected, provide for residential access as well as truck access to the building depot in the centre of the development. Well-connected pedestrian walkways link to various reserves and the town centre.

**Results:**

Ambrico Place was an early attempt at medium density housing in Waitakere City, and has delivered a mixed result, with piecemeal development of the site diminishing the original 'new urbanist' vision, particularly with regard to delineation between public and private

spaces. A high level of crime in the development (burglary and ex-car theft), and is most likely partly attributable to environmental design factors (and perhaps also due to introducing a visibly affluent development/target into the area).

Nonetheless, research shows that residents' perceptions of safety are reasonably high. Most people are happy with the open space provision and enjoy the sense of community in the development. Thirty-five percent of the households have children and they feel that they have enough space to play and have more friends than in their previous residences.

While well located to access a wide number of facilities, pedestrian access is considered difficult over main roads, e.g., to the main retail area. Ten percent of residents work from home. The most common reasons for moving into Ambrico Place included location to facilities and good design features. Most people had not changed their transport methods much, although some reduction in car use has been reported.

The primary results of the research were about the actual living experience of living and / or working in a medium density housing environment. The main findings included:

- Main reasons for choosing medium density housing – security, safety, low maintenance
- All respondents had some kind of positive contact with their neighbours
- Main negative issues are around noise, storage space and parking
- Best factor was convenience – location to New Lynn, transport, shops and leisure activities
- Average income levels above national and city average
- Most people happy with level of privacy of their unit
- Suitable for a range of household types

**Summary:**

| **The Natural Step Guiding Principles (System Conditions)** | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space* | | *Low maintenance* | *Brownfield site development*<br>*Medium density* | *Suitable for a range of household types*<br>*Reasonably affordable* |
| Non-residential space | | | | Located close to shops and community facilities<br>Rapid market uptake |
| Non-built space | | | Parkland development and wetland restoration | Public open space provision, playgrounds and wetland area<br>Reasonably safe and secure |
| Infrastructure | | | Manawa wetland treats stormwater | Convenient access to rail / bus |

## 6.2 Tiritiri and Verbena Rd, North Shore City

**Introduction:**

This case study includes two medium-density suburban housing developments in Birkenhead, North Shore City – one at 35 Tiritiri Road, the other at 47 - 51 Verbena Road. The key contact person is Peter Nagels, Stormwater Consents Engineer, North Shore City Council. The developer is Ottow Burke Developments. Tiritiri Rd consists of 13 dwellings on 0.628 Ha and Verbena Rd consists of 26 dwellings on 0.82 Ha (total site is 1.585 Ha, leaving 0.765 Ha of bush).

**Process elements:**

The main aim for both sites is to reduce and treat stormwater run-off from a medium density residential development through some on-site attenuation and re-use. The on-site stormwater treatment systems are the responsibility of the developments' bodies corporate, which are created after the sale of dwellings at both case study sites.

North Shore City Council has catchment management plans to manage the effects of peak stormwater runoff in all of its catchment areas. The District Plan requires on-site stormwater detention and quality measures for all medium and high density housing developments. In addition, to give effect to the catchment management plans in those areas where there are infrastructure constraints or flooding, the Council enacted bylaw 22 which requires post development flows to be managed so they are no greater than pre-development levels (http://www.northshorecity.govt.nz).

**Content elements:**

Tiritiri Rd:

Sewage is connected to existing public sewer network. The residential units are grouped and are of compact design with small windows to reduce heat losses and prevent excess heat gain. There are conventional lights and appliances, hot water supply, hot water storage and ventilation. Energy supply is via mains electricity. Potable water supply is via mains connection, however rainwater is collected (13,500 l tanks) and re-used for toilets, laundry and external uses.

There is some on-site stormwater treatment, with the overflow going to surface water drainage. This is achieved by rainwater tanks, for detention only, to 5 houses. Swales are used for surface flow. Paved areas drain through enviropods to the stormwater drain. Materials and finishes are conventional. There are no sustainability features related to biodiversity,

transport, food or waste.

Verbena Rd:

As above, except that stormwater (from driveways and roofs) is captured via raingardens. The remaining water goes to detention tanks and is fed into city stormwater drains. Some on-site planting is retained with the retention of the bush area to the south of the development.

**Figure 8: Cascading runoff treatment structure (under construction) at Verbena Road**

**Results:**

In both Tiritiri and Verbena Rd, stormwater flow to drainage is reduced, but the actual reduction is not known.

Positive results include (Tiritiri and Verbena Rd):

- Smaller, higher density houses use less land
- Houses seem smaller than NZ average for new construction, so reduced materials demand
- Proximity and shared driveways etc. may help create sense of community among residents
- Example of "normal" development trying to improve performance in a limited area (stormwater)

Less favourable results include (Tiritiri Rd):

- Highly impervious surfaces round houses
- Rainwater tanks occupy large part of small garden, but visual impact has been reduced by planting
- Would have been better if all 13 houses had had rainwater harvesting

Less favourable results include (Verbena Rd):

- Highly impervious surfaces round houses
- Serious site run-off during construction, which has damaged adjacent bush area.
- Raingardens not yet planted, but negative visual impact at time of visit
- The development is at the top of the catchment. The City Council would have liked rainwater harvesting to have been used so as to reduce the overall run-off to the catchment.

**Summary:**

| **The Natural Step Guiding Principles (System Conditions)** | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space* | | | *Medium density*<br>*Reduced materials demand*<br>*Rainwater collection and use* | |
| Non-residential space | | | | |
| Non-built space | | | Bush retention | |
| Infrastructure | | | Stormwater management<br>Rainwater tanks, swales and enviropods | Proximity and shared driveways |

## 6.3 Sustainable Cities and Settlements, Opus Consultants et al

Information about this case study has been sourced from the following:

- Foundation for Research, Science and Technology web-site (www.frst.govt.nz/database/abstracts/, accessed 17/9/2004)
- Urban Design Research in New Zealand (www.mfe.govt.nz, accessed 17/9/2004)
- Personal communication with Vince Dravitzki (7/9/04, 21/9/04) and Darren Walton (21/9/04), Opus International Consultants Ltd.

**Process elements:**

Sustainable Cities and Settlements is a FRST-funded programme, scheduled to run from October 2003 – 2010. The project is a joint effort between Opus International Consultants Ltd, the Centre for Research Evaluation and Social Assessment (CRESA), the Centre for Social and Health Outcomes Research and Evaluation, ('SHORE', Massey University), and Environmental Sciences Research (University of Auckland). This inter-disciplinary, inter-organisational research team brings together expertise in bio-physical dynamics, the built environment and infrastructural systems, the behaviours of individuals, governance, and social and economic dynamics.

The purpose of the programme is 'to develop more effective approaches to the ongoing need to adapt and manage the shape and form of our cities and settlements so as to reduce the environmental degradation generated by New Zealand cities and settlements and optimise the environmental, social, cultural and economic performance.

**Content elements:**

According to the FRST research abstract: 'This research recognises the strong relationships between settlement form, liveability and environmental performance, and addresses the polarised debate between those arguing that sustainable cities and settlements are best achieved through the compact form, and those who argue for dispersed forms of human settlement. There are environmental as well as social and economic risks if inappropriate settlement models are imposed on our cities, towns and rural areas.

'This will be achieved through three research objectives: Objective 1: To enhance the environmental management of cities and settlements by establishing the extent to which the form and spatial characteristics of NZ cities and settlements determine environmental performance; Objective 2: To enhance the active management of the form and spatial characteristics of our cities and settlements to optimise their social, cultural, economic and environmental performance; and Objective 3: To enhance the ability of communities to respond to, and maintain sustainable management practices.

Personal communication with project team members provided further detail of the research programme, which will address three areas:

- 'Form, spatial characteristics and environmental performance': relationships between form and environmental performance (especially around intensification in urban areas and the capacity of rural areas to cope with increasing population, e.g. infrastructure needs). The initial literature review is finding evidence to support a focus on 'critical systems', e.g., transport, waste, stormwater and infrastructure. The study will also develop a taxonomy of settlement form.
- 'Liveability, settlement form and environmental performance': the connections between liveability and settlement form. Includes how to measure liveability qualitatively and quantitatively, and how notions of liveability vary across social groupings. The project team is conducting a survey (n=2000) and qualitative inquiry (focus groups) to investigate New Zealanders' understandings of neighbourhoods, suburbs, communities, liveability, sustainability and environmental performance. Preliminary findings should be available before the end of 2004.
- 'Adaptation and community responses': limits of settlements to adapt looking at international tools and measures, plus four case studies: Auckland City (intensification); Bay of Plenty/Opotiki (weekenders); Kapiti (satellite); Nelson-Tasman (unitary authority, rapid growth).

**Results:**

The research is intended to assist communities to improve the environmental performance of settlements by contributing to the knowledge necessary to assess the sustainability of settlements, identify appropriate spatial models for the future development, and establish tools for the on-going sustainable management of settlement form. The results will enable generation of sustainable practices among the key stakeholders and participants who determine the shape of the city and other settlements.

**Summary:**

It is too early to draw conclusions about the sustainability impacts of this research. However, the programme is clearly closely aligned with Beacon's interest in developing a neighbourhood sustainability framework, and should be considered in the development of the NBH project.

## 6.4 Auckland Regional Growth Strategy

**Introduction:**

The Auckland Regional Growth Strategy sets a vision for sustainably managing the Auckland region's growth to the year 2050. The strategy was developed jointly by the eight local authorities in the Auckland Region, and is being implemented through their planning and strategic processes. It sets out principles and desired outcomes for the region, and establishes a 'growth concept' based on intensification around town centres and major passenger transport routes.

The key contact person for the ARGS is Noel Reardon, Manager: Regional Development, Auckland Regional Council.

Information about this case study has been sourced from the Auckland Regional Growth Forum (Nov, 1999). *Auckland Regional Growth Strategy: 2050.* Auckland: Auckland Regional Growth Forum and www.arc.govt.nz

**Process elements:**

A Regional Growth Forum was established in 1996 to review the options for managing the future population growth of the Auckland region, and its effects on environment, infrastructure and communities. Population projections predicted a regional increase of approximately 20,000 people per annum, with a doubling of the population in 50 – 60 years.[13] Combined with changing family structures and a trend towards smaller household sizes, this signalled potentially significant impacts on the environment and on physical and social infrastructure provision.

The Forum consists of ten elected representatives (mayors and councillors) from the Auckland Regional Council and the territorial local authorities of the Auckland region, and is supported by council officers. The process of establishing the Forum was ground-breaking in bringing the different local authorities together to develop a coherent region-wide strategy.

Through workshops, technical studies, modelling and public consultation, the Forum developed the Auckland Regional Growth Strategy, released in November 1999. The Strategy

[13] Note that population growth for the Auckland region for the year to June 2003 was actually 40,000 people, the largest rate of growth since the 1950s. This figure is still consistent with projections, although at the upper end. (Auckland Region's Population Growth, Nov. 2003 http://www.arc.govt.nz/arc/library/s12142_2.pdf accessed 17 Sept 2004)

splits the region into three sectors – Northern & Western, Central, and Southern. Each sector has been allocated a share of growth to accommodate. All Councils have adopted the Strategy, and have developed more detailed implementation plans as part of their 'sector agreements.'

The value of the Regional Growth Strategy's integrated approach to transport and land use has now been recognised in the Local Government (Auckland) Amendment Act 2004, which requires…Auckland local authorities to prepare and notify changes to the policy statement and plans under the Resource Management Act 1991 to provide for integrated land transport and land use provisions that are consistent with the Auckland Regional Growth Strategy (section 6(d)). Similar growth strategies are now under development in Wellington and Christchurch.

**Content elements:**

The ARGS sets a vision that:

The diversity and well-being of people and communities living in the Auckland region will continue to prosper in a sustainable manner which:

- promotes strong, supportive communities
- ensures a high-quality living environment
- creates a region that is easy to get around and
- protects our coast and surrounding natural environment

The Strategy identifies desired regional outcomes in some detail, and groups them into three priority rankings:

| Critical Outcomes | Very Important Outcomes | Important Outcomes |
|---|---|---|
| access and transport efficiency | business opportunity | cultural identity |
| water quality | urban amenity | rural amenity |
| coastal environment | safe, healthy communities | cultural heritage |
| air quality | housing choice/affordability | habitat |
| sustainable use of resources (land/infrastructure/energy) | employment choice | |
| open space | | |
| social and physical infrastructure | | |

Key issues being addressed as part of the Strategy's implementation include:

- urban form
- housing
- transport
- public spaces
- business and economy
- employment location
- environment
- growth
- management

Based on analysis of available land in the Auckland region, the Strategy estimates that 70% of new residential development to 2050 can be accommodated within existing metropolitan urban limits, and that the remaining 30% will need to be provided for through new greenfields expansion.

A Growth Concept is outlined, based on intensification around town centres and major passenger transport routes. Areas identified for growth have been selected in light of the Growth Strategy's principles, and avoid urbanisation of highly sensitive environments and landscapes (e.g., coastal environments, open spaces, rural land and bush).

**Results:**
The Growth Strategy establishes a clear plan for addressing the development pressures of the Auckland region. It supports the intensification and revitalisation of existing centres and neighbourhoods, and resists further sprawl development into rural landscapes. Collaboration between the local authorities has enabled a unified strategy for the region, across multiple (at times competing) jurisdictions. The latest move to ensure regional policies and District Plans are aligned with the Growth Strategy will support more effective implementation.

Whilst opening the door for more intensive development of town centres, the Growth Strategy has not successfully ensured an adequate quality of development – at the level of the dwelling and the neighbourhood. Some efforts to intensify neighbourhoods identified in the Growth Concept have been met with resident backlash at the threat of changing the nature of their neighbourhoods (for example the Panmure town centre and the Grey Lynn area).

Implementation of the Strategy is challenging, especially given the piecemeal nature of neighbourhood and town centre development. Various barriers to coherent development have been encountered, such as the difficulty of amalgamating brown-field blocks for

redevelopment.

Further, whilst all sectors have undertaken to accommodate their share of growth, they have not undertaken to ensure diversity within their share, particularly with regard to housing affordability. As the market continues to rise in the Auckland region, securing affordable housing continues to be a significant challenge.

**Summary:**

| **The Natural Step Guiding Principles (System Conditions)** | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space* | | | *Intensification, medium density housing, apartments* | *Provide for 320,000 new homes by 2050* |
| Non-residential space | | | Goal: 70% of future growth will happen within the existing urban area | Ensuring proximity / access to employment locations<br>Auckland Regional Economic Development Strategy |
| Non-built space | | | Regional Open Space Strategy | Ensuring proximity/ access to open space/ recreation opportunities |
| Infrastructure | Emphasis on public transport, walking, cycling | | Stormwater management systems | Emphasis on transport choice: public transport, walking, cycling |

## 6.5 BedZed Urban Housing Project, Peabody Trust, UK

**Introduction:**

The Beddington Zero (fossil) Energy Development (BedZed) project is located in Beddington, UK. The developer was Peabody Trust, one of the largest housing associations in London, and the architect was Bill Dunster (private practice). The housing project consists of 83 dwellings plus workspaces on a site area of 1.65 Ha. Information about this case study was sourced from www.bedzed.org.uk and Twinn C (2003) "BedZed" *The Arup Journal* 1/2003.

**Process elements:**

The purpose of the project was to build an urban housing and work community that would allow people to live in a way that encouraged sharing of resources and social interaction and minimised environmental damage.

In 1999, the Peabody Trust won the bid to develop the site in Beddington. The bid, although not the highest, was judged with its sustainability provisions as offering the best value by Sutton Borough Council. The Trust then appointed Arup as part of the design team for the project, and alongside architect Bill Dunster, had many debates and discussions about fully harnessing renewable energy sources, achieving closed-loop material use, site resource economy, social involvement, and how all of these could respond to ever-increasing lifestyle expectations. Most of the design team had high environmental aspirations, which was key driver for the inclusion of many of the sustainability features.

A planning submission was submitted in February 1999, with full approval gained in November 1999. Construction started on site in May 2000 with phased occupancy from 2002. Peabody Trust is now overseeing an intense programme pf post-occupancy monitoring.

**Content elements:**

BedZed is a new-build development on a brownfield site of 83 mixed tenure homes, plus some 3000$m^2$ of live/work, workspaces, retail, and leisure uses. It employs comprehensive passive solar design techniques – thermal mass and high levels of insulation, orientation south and use of sunspaces. Energy efficient lights and appliances have been installed such as compact fluorescent lamps and EU A-Grade appliances. Hot water supply is provided from waste heat from a wood-fired CHP plant.

Passive ventilation techniques include innovative stack ventilation with heat recovery, and openable windows. The energy supply is all renewable via wood fired generation using tree surgery wastes. There is also some photovoltaic supply used to charge the electric cars on site. There is conventional sewage connection, with dual flush toilets flushed using rainwater. Rainwater is collected off roofs and stored in an underground tank. Drinking water is provided by mains connection with demand reduced by A-rated appliances and flow restrictors in the pipework.

Stormwater is returned to the environment. It is collected from the roofs and there is porous paving of hard surfaces and swales to treat the remaining run-off. Building materials are simple and were designed for long life. The type of finishes is unknown. Planted roof areas improve the biodiversity on site. In terms of transport, the site is close to Hackbridge railway station (20 mins from London) and is close to the local tramway network. There is a car-sharing scheme to reduce the need for car ownership and there is solar energy provision on the buildings to charge 40 electric cars. There has been increased community awareness of food issues related to sustainability and all organic waste is composted on-site. All other waste production has reduced and there are waste segregation bins in all dwellings.

**Results:**
The development is popular with occupants and the market – in fact, demand for BedZed homes has been described as exceptional. It is UK's first large scale 'zero-emissions' development and it contains many synergies from combining many issues in one project. One potential weakness is that electricity and hot water generation using tree surgery wastes as fuel is not very replicable in urban areas.

The first period of monitoring revealed that hot water hearting is about 45% less that current UK benchmarks, electricity for lighting, cooking and all appliances is 55% less, and water consumption is about 60% less. Further lesson learned include:

"During construction a constant challenge was to achieve a consistently high build quality. The results are considerably better than current UK benchmarks, and demonstrate that general industry improvement is achievable. They highlighted that specific effort is needed in certain areas, notably site supervision and training for the many smaller sub-contractors upon which the industry depends. The nature and structure of the industry means that explaining the thinking behind innovation is difficult to pass down the supply chain.

The need to achieve high levels of building envelope airtightness is a particularly important

example of this. The implications of potential remedial works costs and supplementary energy use far exceed the small effort needed to get it right at the appropriate stage of the construction process. It is interesting that since BedZED, the UK Building Regulations have been revised in an attempt to start to address this airtightness issue for first time.

The availability of skilled site staff for construction, and particularly housing, is another wider issue for the UK industry. There has been low take-up of local labour training initiatives; perceptions of construction are at odds with the aspirations of our younger generations. Much of this points towards a future of off-site manufacturing where skills and training, materials and waste handling, and efficiency can be better provided" (Twinn, 2003).

**Summary:**

| **The Natural Step Guiding Principles (System Conditions)** | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space* | *Energy efficient appliances and lighting*<br>*Passive solar design (thermal mass, solar orientation)*<br>*Bio-fuelled hot water heating and energy supply (100% renewable energy use)*<br>*Wind powered ventilation systems* | *Simple materials (low embodied energy):*<br>*-recycled timber*<br>*- re-used structural steel* | *High density*<br>*Roof gardens*<br>*Water conservation (low flow tapware, dual flush toilets)*<br>*Rainwater collection and use (toilets)* | *Mixed tenure, home type and occupiers*<br>*Sunlight and daylight amenity*<br>*Good air quality and comfort*<br>*Affordable* |
| Non-residential space | Energy efficient appliances and lighting<br>Passive solar design (solar orientation)<br>Bio-fuelled hot water heating | Simple materials | Water conservation<br>Rainwater collection and use | Live / workspaces, retail and leisure<br>Community led management<br>Community internet connection available |
| Non-built space | | | Brownfield site: improved site ecological value<br>Rainwater collection and onsite ecological water treatment | |
| Infrastructure | Electric cars, powered by photovoltaics<br>Bike facilities | | Porous paving<br>Recycling facilities | Car sharing<br>Proximity to wider community facilities |

## 6.6 Quartier Vauban, City of Freiberg, Germany

**Introduction:**

Quartier Vauban is a 38 Ha urban development providing for 5,000 inhabitants (around 1,500 housing units) and 600 workplaces. It is due to be completed by 2006. It is characterised by a comprehensive sustainability approach with a co-operative planning process and intensive community participation. It was presented with a 'Best Practice' award at the UN Conference HABITAT II Conference in 1996. The project was funded by the European Commission between 1997 and 1999. The aim of the project is to encourage innovation in terms of energy, transportation and building. Information on this case study has been adapted from the following sources:
http://europa.eu.int/comm/urban/casestudies/c169_en.htm
http://wwwistp.murdoch.edu.au/publications/e_public/Euro_Field_Trip/field%20trip%20chapter%207.pdf

A key contact person is Carsten Sperling, Forum Vauban e.V., Freiburg
Forum.Vauban@t-online.de
http://www.forum-vauban.de

**Process elements:**

Vauban is a former French military site, which was abandoned by the French army in 1992. As the owner of the Vauban area, the City of Freiburg is responsible for its planning and development. From the beginning, the City aimed at strengthening social and ecological aspects and made them part of the development plan:

- a compulsory low-energy standard for new buildings
- a tram connection by the year 2006
- infiltration of rainwater into the ground
- a social balance of residents
- a preferential allocation of property to private builders and co-operative building projects

One of the City's important strategies was to allow an intense process of citizen participation. This led to many suggestions by the future residents for a more ecological and social district, including:

- car-reduced residential areas
- low energy houses and passive energy houses
- intensive use of ecological building materials
- co-operative building projects
- a neighbourhood centre

**Content elements:**

Large parts of the residential area are defined as "parking-free": cars have to be parked in a community car park located at the periphery of the residential area. A pilot project for car-free living has been initiated. Households that neither own a car nor use one regularly are exempted from having to buy one of the expensive parking spaces in the community car park. Almost 50% of the households have chosen to make use of this offer and live in Vauban without a private car.

In co-operation with the Forum Vauban (one of the partners in the development), the car sharing organisation also developed a special "mobility package" in which households participating in Vauban's car sharing receive a one-year free pass for all public transportation within Freiburg as well as a one-year 50% reduction on every train ticket in form of the "Bahncard". More than 70 of the 300 households living in Vauban have made use of this package so far.

Vauban is well connected to public transport and public bicycle trails. Schools, shopping facilities and recreation are accessible on foot. Further activities focused on optimising the connection to the local bus lines, enhancing the quality of the bicycle trails, developing a delivery system as well as redesigning the residential streets. Vauban is located about 3kms from the central railway station and city centre.

A new district heating grid is powered by an efficient co-generation plant that is run on woodchips and forest waste. Energy solutions are a feature of the development as whole and with the help of a number of funding schemes, many private households have also been enticed to use solar energy and energy-efficient household appliances in their buildings.

The first 40 housing units were built in an especially energy-efficient form (called 'passive houses') or produced more energy than what is required for use in the house, with the excess energy fed back into the grid (called 'plus energy' houses). Because of the success of these houses, 'passive' and 'plus energy' houses are and will be built in the second and third stages of development. The development also has a large solar settlement in the eastern part of Vauban (210 units).

A further 36 units showcase enhanced social features (called ‘model houses’). These houses combine environmental and social measures: improved low energy standard by using triple-glass windows and improved insulation, a large solar energy installation for hot water, use of rainwater cisterns, greening of roofs, floors made of domestic wood and PVC- and FCH-free construction. It will become Vauban’s largest social component of the whole development, with apartments for rent (one third of all properties in the development will be for rent), extensive participation of the future tenants, barrier-free access including lifts and access galleries, flexible basic plans as well as the shared use of guest rooms, wash room and drying room, communal houses and gardens.

In terms of water and waste management, the development allows a specialised infiltration system to return rainwater into the ground (this system covers 80% of the residential area). A new ecological sewage system is being trialled within one pilot project: solid wastes are transported through vacuum pipes into a biogas plant were they ferment anaerobically together with organic household waste, thus generating biogas, which is used for powering ovens and cookers. Remaining waste water (grey-water) is cleaned in biofilm plants and returned to the water cycle. For more information see:
http://www.vauban.de/info/abstract.html

**Results:**
The projects results (to date) are as follows:

- the project's structure integrates legal, political, social and economical actors from grassroot-level up to the city administration
- all houses are built at least with improved low energy standard (65 kWh/m2a, calculated similar to the Swiss SIA 380/1 standard) plus at least 100 units with "passive house" (15 kWh/m2a) or "plus energy" standard (houses which produce more energy than they need, another 100 plus energy houses are planned)
- a highly efficient go-generation plant (CHP) operating on wood-chips operating since 2002 and connected to the district's heating grid
- solar collectors (about 450 m2 until 2000) and photovoltaics (about 1200 m2 until 2000) will be common "ornaments" on the district's roofs
- an ecological traffic / mobility concept is implemented with a reduced number of private cars to be parked in the periphery (about 50% of the households agreed to live without an own car), good public transport, a convenient car sharing system and a higher quality of living
- streets and other public spaces are playground for kids and places for social interaction

The project also has a programme of research examining its ecological and economic effects. One of the analytical approaches is life-cycle and regional material-flow analysis using the GEMIS-software. This is the first time that a complete urban neighbourhood has been analysed with respect to buildings, infrastructure, electricity supply, heat supply, water and waste, traffic and private consumption with a full life-cycle perspective, and using regional data. Through this, the following impacts were found out (all figures are provisional):

- energy savings per year: 28 GJ (calculated as "CER", cumulative energy requirements)
- reduction of CO2-equivalents per year: 2100 t
- reduction of sulphur-dioxide (SO2-) equivalents per year: 4 t
- saving of mineral resources per year: 1600 t

**Summary:**

| **The Natural Step Guiding Principles (System Conditions)** | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space* | *Energy efficiency maximised*<br>*Passive solar design maximised*<br>*Solar energy and / or wood fired CHP* | *Green roofs, timber materials, no PVC or FCH* | *Car parking space free*<br>*High density* | *Public participation in design*<br>*Mixed tenure (ownership / rent / student accommodation)* |
| Non-residential space | | | | Public participation<br>Mixed use |
| Non-built space | | | Rainwater infiltration | Public spaces and playgrounds |
| Infrastructure | Car-free, public transport option promoted / preferred | Reduction of cars / improved local air quality | On-site wastewater treatment | Close to rail and town centre<br>Pedestrian- friendly<br>Car-sharing system<br>Redesign of streets for ease of access |

## 6.7 East Perth, East Perth Redevelopment Authority, Australia

**Introduction:**

The East Perth Redevelopment Authority (EPRA) was established under the East Perth Redevelopment Act 1991, to undertake, promote and coordinate the redevelopment of 146 hectares of inner city land in East Perth. A key contact person is Karl White, Sustainability Manager, EPRA. Information about the case study was sourced from www.epra.wa.gov.au

**Process elements:**

In the 1980s the Western Australian Government decided to rejuvenate and transform East Perth, redeveloping it to become a fully integrated urban village to cater for contemporary lifestyles and a trend toward inner city living. In 1992, the East Perth Redevelopment Act was established and EPRA was given responsibility for the planning and redevelopment of the East Perth Redevelopment Area.

The East Perth Redevelopment Authority was established in order to:

- rejuvenate the area
- rehabilitate the environment
- attract investment and expand the economic base
- demonstrate advanced forms of urban development

In order to complete this work, EPRA was given 'planning authority'. In other words, planning approvals for development were required from EPRA rather than The City of Perth. EPRA was therefore appointed with the responsibility to plan and undertake the redevelopment of the area, with a view to handing it back to the City of Perth at the completion of the project.

This whole process was made possible by the Western Australia Government mandate to improve the area and because the City of Perth were unable to complete this role at the time. It also meant that EPRA could impose certain planning requirements that the City of Perth would have had difficulty in doing so (at least in the short-term), e.g., comprehensive 'traditional' and sustainable development principles.

In February 2002, 75% of the East Perth redevelopment area was "normalised". Normalisation involves handing the planning responsibilities for the area back to the City of

Perth and 'normal' authority status. The success of the East Perth project has meant that EPRA has been given responsibility for further projects (Northbridge, the Gateway, and Power Plant projects), following the same process as above.

**Content elements:**
The following elements have been included in this brownfield development:

- The undergrounding of powerlines
- Streetscaping with co-ordinated paving and verge treatments
- New street tree planting
- Improvements to vehicle parking
- Integration of the streetscape with local parks and reserves
- Mix of single residences, home/offices, duplexes and medium density sites
- Embodiment of the same style and elegance illustrated at the established Constitution Hill precinct, with tree-lined streets and easily accessible facilities.
- Inclusion of public art
- Residents have many conveniences on hand and can walk to work or live and work in the same building
- Buildings are linked by walkways to ensure that all places are accessible to pedestrians
- Diversity of accommodation
- Proviso for affordable housing
- Emphasis on density (160 dwellings per Ha)
- Buildings are energy rated
- Building orientation and shading conform to passive solar design principles
- Water sensitive design

**Results:**
East Perth was a run-down inner city suburb. Now it is characterised as a model urban village with a consistent architectural approach promoting environmental, social and economic objectives.

Further Redevelopment Authority's have been established based on the success of EPRA, for example, the Subiaco Redevelopment Authority in 1994 (http://www.sra.wa.gov.au), Midland Redevelopment Authority (http://www.mra.wa.gov.au/) and Armadale Redevelopment Authority.

**Summary:**

| The Natural Step Guiding Principles (System Conditions) | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space* | *Energy rated*<br>*Passive solar design* | | *Water efficiency*<br>*Increased density* | *Diversity of accommodation*<br>*Proportion of affordable options* |
| Non-residential space | | | Increased density<br>Improved streetscapes | Mixed use development<br>Public participation<br>Heritage values retained<br>Public art / visual amenity |
| Non-built space | | | Waterfront rehabilitation | Public open space retention and provision |
| Infrastructure | Public transport supported | | Use of existing infrastructure | Movement and access emphasised |

## 6.8 METRIX, Department of Infrastructure, Planning and Natural Resources (DIPNR), NSW, Australia

The Department of Infrastructure, Planning and Natural Resources (DIPNR) are currently working on 'Neighbourhood BASIX' (unofficially known as 'METRIX'). As the project title indicates the concept is premised on the expansion and extension of BASIX to the neighbourhood scale or as a 'Metropolitan Sustainability Index'. That is, BASIX currently implements the NSW Government's 25% reduction target for greenhouse emissions and 40% reduction target for potable water consumption for new residential developments. The vision is for the METRIX model to also encompass, for example, socially sustainable measures, accessibility, housing mix, etc.

The METRIX project it is still in a very early scoping phase and as such, there is no published information that can be referred to as yet. DIPNR anticipate delivering a framework at the end of this year (G. Benitez, Pers. Comm., 27/9/04).

The project team mention it here for a number of reasons:

- We feel it is important for Beacon to be aware of its existence (albeit preliminary)
- It has been referred to as 'leading work' in this field, and Beacon should therefore keep an eye on its development
- It may potentially be useful as a tool for further stages of the NBH programme

Note also that a similar project is being undertaken in New Zealand. 'Tools for Urban Sustainability Code of Practice' [TUSC] is a Sustainable Management Fund project being developed by Waitakere City Council. Phase one is developing a web-based interface for assessing lot-level sustainability. Phase two will be extending the tool to address subdivision and catchment-level sustainability issues.

## 6.9 Community Visions Programme, City of Vancouver, Canada

**Introduction:**

Vancouver's 'CityPlan' is the city-wide plan (adopted in 1995), which provides a framework for deciding City programmes, priorities, and actions over the next 20 years. In 1997, the Community Visions programme was launched to bring the CityPlan to the neighbourhood level.

**Process elements:**

In 1995, City Council adopted CityPlan, a city-wide plan that provides a framework for deciding City programmes, priorities, and actions over the next 20 years. CityPlan includes directions on a range of topics, from transportation to arts, housing to community services. In 1997, the Community Visions Programme was launched to bring CityPlan to the neighbourhood level. This programme entails communities working with City staff over a two year period to create their visions for the future, based on CityPlan directions and community needs and aspirations.

Dunbar and Kensington-Cedar Cottage were the first two communities to try this new approach to local planning, beginning in 1997. The Dunbar and Kensington-Cedar Cottage Community Visions were approved by City Council in 1998. Victoria-Fraserview/Killarney and Sunset were the third and fourth communities to participate in the Community Visions Programme, from 2000 to 2001. Their Visions were approved by Council in 2002. City staff are currently working with the Hastings-Sunrise and Renfrew-Collingwood communities to complete their Community Visions, and beginning the Visions Programme in Arbutus Ridge/Kerrisdale/Shaughnessy (ARKS) and Riley Park/South Cambie (RPSC).

More information about the Vision programme can be found at:
http://www.city.vancouver.bc.ca/commsvcs/planning/cityplan/Visions/index.htm

**Content elements:**

Purpose

The purpose of the programme is to have communities, assisted by staff, develop Visions that incorporate a wide range of community interests and describe common ground for moving in CityPlan directions. The Programme asks each community to implement CityPlan directions in a way and at a scale and pace that suits the community.

Ground rules

A set of principles underlie the Programme which require that each Community Vision address CityPlan directions and that the process involve the broad community.

Product

Each Vision is a document which uses words, drawings, pictures, and maps to show how the community proposes to meet its needs and move forward on CityPlan directions over the coming decades. A vision identifies what people value and want to protect as well as those things that will change.

Process

The Community Vision process is a 15 month, four-step process that includes extensive outreach; the identification of community needs, ideas, issues, and opportunities on all the CityPlan topics; the creation of Vision options and directions; broad community voting on preferred options and directions; and Council endorsement of the final Vision. Subsequently, the community works on setting priorities for Vision implementation.

Each step provides a variety of ways for people in the community to be involved in creating, reviewing, and deciding on their Vision - including meetings, workshops and discussion groups, community events and festivals, brochures and surveys. The process also provides for an on-going Community Liaison Group [CLG] made up of people from the community. Within the general framework of the four steps, a communications and outreach strategy is tailored for each community.

Two communities prepare Visions simultaneously. A concurrent city-wide process helps link the communities with each other and with city-wide interests, as well as maintain city-wide awareness of CityPlan and the Community Vision Programme.

Roles

The community, which includes residents, property owners, workers, business owners, and community organizations within the community, generates the ideas, issues, and solutions that create the Vision options and directions. They also select preferred Vision directions.

CityPlan staff organise and facilitate the community process, undertake outreach and communications, help explore Vision possibilities, and document and illustrate material generated by the process. They provide information on community, city, and regional needs and CityPlan directions, ensure that proposed Vision options and directions move in CityPlan directions, and advise on the relationship between Vision options and directions and CityPlan.

The Community Liaison Group, with representatives from a wide-range of community interests, brings continuity and a "watch-dog" perspective to the process and provides a core group of participants and contacts. This group may also take on priority-setting, monitoring, and action roles after completion of the Vision.

The City Perspectives Panel are a small group of respected and knowledgeable individuals drawn from across the city who comment on how far each proposed Vision option or direction moves toward achieving CityPlan directions, and on their consequences. Their review is a part of each community Vision process and it is incorporated into the community's consideration of the Vision options and directions. City Council approves the resources required to undertake the Vision programme, endorses the Visions, and approves City initiatives to implement the Visions. Examples of what a vision would include:

Transit, Walking, and Biking as a Priority

- indicate ways to make it easier, safer, and more interesting for pedestrians and cyclists to get around including traffic calming and development of community greenways
- identify traffic issues and solutions
- identify ways to improve transit service

Accessible, Community-based Services

- identify particular community service needs in the neighbourhood and barriers that prevent people from obtaining services they need
- suggest ways to better provide community services, including ways to make them more accessible
- identify actions to improve neighbourhood safety

Neighbourhood Centres

- locate the neighbourhood centre(s) (but not necessarily the centre's exact size and boundaries)
- identify the kinds of community shopping, service, and job needs the centre could fulfil, and ways to make these happen
- identify types of housing to be included in the centre, to meet what needs
- generate ideas for streetscape, open space, and character for the centre
- describe the differences between centres, if there is more than one centre in the neighbourhood

New and More Diverse Public Places

- identify park needs of current and future residents
- suggest a variety of types, character, design, uses, and locations, of parks, streets and sidewalks, and other public places
- provide ideas for how to obtain park land where needed, and priorities

Housing Variety and Cost

- identify the housing needs of neighbourhood residents now and as they age
- identify ways to increase housing in the neighbourhood to meet these needs; include types, character, scale, and general locations of new housing (can include both agreed-on housing ideas for the short term, and a range of future possibilities where there is not full agreement now)
- define under what conditions rezonings could be considered for this housing
- identify requirements for affordable housing

Distinctive Neighbourhood Character

- identify aspects and areas of neighbourhood character to be retained, including heritage, landscapes, and other important elements of neighbourhood character
- suggest ways to preserve important elements of neighbourhood character
- identify the desired character of new development and how to make sure it is neighbourly
- identify the desired character of the neighbourhood centre(s) and how to make centre development fit well with the neighbourhood

**Results:**

Work has started on making the approved Community Visions a reality: dealing with traffic issues around schools; community clean-ups; reviewing zoning in shopping areas; addressing traffic issues on major roads; and developing better ways for residents to communicate with each other and with City Hall.

While the direct results of this work have been unable to be sourced, it would appear from the preceding documentation that the programme shows an explicit commitment to public participation and covers a variety of sustainability components. Interesting to note is the absence of any reference to ‘sustainability’ in any of the programme documentation. As a method of involving the community in the CityPlan process, it has been very successful.

The programme could perhaps benefit from a stronger environmental perspective. At present, the programme is highly social and dominated by a strong physical planning direction.

In saying this, the City of Vancouver have also launched a large 'environmental' neighbourhood project, called Southeast False Creek (SEFC), which will be developed as a residential community that incorporates principles of energy efficient design in its area plan. It is envisioned that SEFC will be used as a model "sustainable community." For more information see:
http://www.city.vancouver.bc.ca/commsvcs/southeast/index.htm

**Summary:**

| **The Natural Step Guiding Principles (System Conditions)** | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| *Residential space* | | | | *Affordable housing*<br>*Adaptable/needs met* |
| Non-residential space | | | Protecting greenways<br>Streetscape design | Character and heritage retention / neighbourhood character<br>Accessible community services<br>Town centre revival / zoning changes<br>Improved safety<br>Strong public participation / communication with City staff |
| Non-built space | | | Park retention and development | Park needs met<br>Community clean ups |
| Infrastructure | Addressing traffic issues (major roads and schools) | | | Transit, walking and biking a priority<br>Traffic calming around schools |

# 7. DISCUSSION

## 7.1 Lessons to be drawn from the initiatives

The inventory of initiatives and detailed profiles of key examples demonstrate the extensive range of work being undertaken, especially internationally, in the field of neighbourhood sustainability. Whilst the initiatives profiled here are wide-ranging in their approach, a number of common themes and issues have become apparent:

**Features and objectives:** Neighbourhood sustainability tends to focus on a number of common features and objectives. The primary issues appear to be based on choice/accessibility/provision of:

- transport
- housing
- mixed use
- public participation
- open space
- water
- energy

Secondary issues appear to be:

- health and safety
- waste
- air quality
- heritage conservation
- food production
- broader habitat protection
- noise

Relating this back to the four system conditions of The Natural Step, principle 4 (human needs) is most rigorously met (not surprisingly as neighbourhoods are fundamentally about people). This is followed by principles 3 (increasing degradation by physical means) and 1 (substances extracted from the Earth's crust). Very little attention is paid to principle 2 (increasing concentration of substances produced by society). The implications are further considered in section 7.2.

**Addressing neighbourhood-scale sustainability:** In most of the initiatives, more detail was available on the individual dwelling sustainability features than those relating to the

neighbourhood. This proved a significant challenge to the preparation of profiles in this report, and is likely to continue to be a challenge for Beacon's neighbourhood sustainability programme. The emphasis on dwelling features is perhaps because they are easier to identify, and their impacts are easier to measure. However, as pointed out in section two, the comprehensive benefits of neighbourhood sustainability make it critical to continue to address neighbourhood-level initiatives. The recommendations below suggest some steps to quantify (and hopefully simplify) neighbourhood sustainability impacts.

**Trading depth and breadth:** Some initiatives focus on the sustainability of specific neighbourhoods (new or retrofitted), whilst others seek to establish national or regional policies and guidelines to affect a wider number of neighbourhoods at once. At first analysis, there appears to be a trade-off between depth and breadth – specific neighbourhoods appear to achieve more significant results for that site, yet achieve little impact beyond their boundaries. Policy initiatives appear to be less 'strong' in their sustainability direction, yet potentially affect a greater proportion of development. Both policy and practical development are likely to be important to Beacon's neighbourhood sustainability programme; exactly where the balance falls needs to be carefully considered.

**Measuring results:** Gaining access to measurable results is a key challenge for neighbourhood sustainability assessment. Whilst most initiatives clearly define their objectives, results were less frequently disclosed. Many of the case study profiles, with the exception of Vauban, mention none (or very few) measurable results (whether quantitative or qualitative) other than in subjective terms, e.g., 'social cohesion was improved'. As a consequence, it difficult to assess the relative merits of one initiative over another, especially as they all sound so great on paper.

**Learning from international experience:** International initiatives offer a host of replicable elements for Beacon. The international profiles that are likely to be of most value to the Beacon programme are the City of Vancouver's work (in terms of whole neighbourhoods) and the BedZed development (in terms of residential clusters). They are exemplar initiatives and we recommend that the Beacon programme aim as high as they have done to show strong leadership in this area.

**Advancing practice in New Zealand:** In terms of current practice, New Zealand is lagging behind somewhat, with few built examples of sustainable neighbourhoods. On the policy and research front, three emerging work streams are of interest: central government's Sustainable Cities work programme as part of the Sustainable Development Programme of Action (e.g., the regional programme in Auckland, and the Draft Urban Design Protocol), the FRST funded

Sustainable Cities and Settlements work, and the Auckland Regional Growth Strategy.

**Moving beyond tokenism:** Finally, whilst there is a lot going on in the field of neighbourhood sustainability, not much of it could be described as seriously or comprehensively sustainable. This assessment is further limited by the absence of reported measures – a significant factor in neighbourhood sustainability being such a 'fuzzy' topic. The project team see this as a point of difference that the Beacon NBH programme could make progress in.

### 7.2 Developing a Neighbourhood Sustainability Framework

Developing a neighbourhood sustainability framework [NSF] forms the next phase of the Beacon NBH project, and is beyond the scope of this report. The report has, however, addressed the initial question of what 'success' in neighbourhood sustainability might look like. We have seen that there are many indicators available to us to measure progress by. Indeed, it is not a case of there not being enough measures (perhaps there are too many), rather they do not seem to be utilised as effectively as they could (if they are utilised at all).

Recalling section 4, we recommended that neighbourhood sustainability features may be best represented as a matrix (framed by the Natural Step and HQE$^2$R's four neighbourhood elements) with a series of goals and relevant indicators to measure progress by – the 'goal/indicator' model.

Using the system conditions of TNS for the neighbourhood sustainability framework would align with the recommendations made in the SF1.1 report, and reduce any duplication of effort. However, some members of the project team have concerns that the initial attempt at the matrix, as applied to the profiles in this report, does not draw out neighbourhood sustainability initiatives as meaningfully as it could. Some initiatives easily fit under multiple conditions, whilst others do not appear to fit at all. This may be partly due to the limitations of source material for the profiles, but practical experience suggests that some of the system conditions were not considered in the initiatives.

Bearing in mind the need for an easily applicable model to be adopted by the various stakeholders in neighbourhood development, the system conditions appear too far removed from neighbourhood decisions.

There are two possible conclusions that can be drawn here:

- that neighbourhood sustainability initiatives, in failing to address all four system

conditions, fall short of being truly sustainable

- that some elements of sustainability as defined by The Natural Step are better addressed at neighbourhood level than others

The question becomes what to do with these conclusions. Can neighbourhoods address all four system conditions? Is it meaningful to place equal emphasis on each of the conditions, as is implied in the matrix? Does some intermediary level of neighbourhood-relevant analysis need to be interposed in the matrix, retaining the system conditions of TNS as high-level principles and ensuring adequate feedback loops?

These are questions that will need to be addressed in the next phase of the Beacon NBH programme. As a starting point, we include one possible illustration of the goal/indicator matrix, based on the Natural Step/HQE$^2$R fields used in this report (see Table 4).

| **The Natural Step Guiding Principles** | | | | |
|---|---|---|---|---|
| **Neighbourhood element** | **Principle 1** | **Principle 2** | **Principle 3** | **Principle 4** |
| **Residential space**[1] | *See SF1.1* | *See SF1.1* | *See SF1.1* | *See SF1.1* |
| **Non-residential space** buildings AND spaces hosting public and private sector facilities, services and activities | Same as for SF1.1 (buildings)<br>Air quality of spaces maintained by passive means<br>Design enables movement between and around public spaces by 'carbon-free' means | Same as for SF1.1 (buildings)<br>Spaces require no chemical treatment before or after use<br>Environmental management techniques for organisations controlling non residential spaces (esp in planning, construction and maintenance) | Same as for SF1.1 (buildings)<br>Design favours mixed use development<br>Design favours redevelopment of existing sites and buildings before building new ones (land and materials conservation)<br>Design favours water efficiency and conservation<br>Provides for communal solutions to sustainable water, waste and | Same as for SF1.1 (buildings)<br>Provides for schools, shops, churches etc<br>Encourages employment opportunities<br>Protects heritage and cultural values<br>Design favours cultural diversity<br>Provides for eco-industrial development |

1 In terms of 'residential space', 'non-residential buildings' and 'non-built space', the stated goals should be the same as for housing as determined in project SF1.1 (see Appendix 1). They can either be restated here (unnecessary duplication?), or 'ignored' for the purposes of measuring neighbourhood sustainability (the risk with this option is that they are not picked up by the SF1.1 process). This issue will need to be resolved in the next phase of the programme.

| | | | | |
|---|---|---|---|---|
| | | | stormwater needs<br>Eliminate use of non-sustainable renewable resources | Includes participatory neighbourhood planning and decision-making |
| **Non-built space**<br>all parts of the neighbourhood which are not built, even if they are not really natural | Same as 'habitat' provisions in SF1.1<br>Meets peoples recreational needs within walking distance<br>Design favours use of organic agriculture techniques<br>Design limits land required for roads/car parks | Same as 'habitat' provisions in SF1.1<br>Landscaping uses alternatives to chemical pesticides and herbicides | Same as 'habitat' provisions in SF1.1<br>Preserve open space, forest, habitat and land forms<br>Improve indigenous biodiversity<br>Provide for sustainable stormwater and wastewater management | Design for locally based food production (community gardens)<br>Reduces opportunities for crimes and violence<br>Provide for active and passive recreational needs |
| **Infrastructure**<br>roads, streets, pavements, networks | Design favours transit and pedestrian-oriented development<br>Provide well designed street pattern and section orientation<br>Favour car sharing /alternative fuelled fleets<br>Promote use of public transit | Eliminate use of toxic substances | Design provides for black and greywater recycling at the community level<br>Use waste as a resource<br>Minimise impervious surfaces<br>Provide for sustainable stormwater management | Promotes convenience of movement (of people and goods)<br>Infrastructure is safe to install, use and decommission |

**Table 4: Proposed goals for neighbourhood sustainability**

From here each goal would be assigned a measure (indicator), a target, current status and previous results (as they become available). As a hypothetical example (see Figure 9):

| |
|---|
| **Goal**: neighbourhood X will protect heritage and cultural values |
| **Measure**: heritage appreciation |
| **Description of measure**:<br>a) percentage of visitors (or residents) satisfied overall with their experience at neighbourhood historic sites, museums, visitor centres, etc.<br>b) percentage of visitors (or residents) satisfied overall with their experience at neighbourhood parks and recreation areas. |
| **Targets**:<br>a) 99%<br>b) to be established |
| **Current results**:<br>a) 95%<br>b) 87% |
| **Previous result**:<br>a) 92%<br>b) no data |

**Figure 9: Example of neighbourhood goal and indicators**

As Table 4 is currently drafted, 32 are goals listed (not including those from the SF1.1 framework). Assuming each goal had 2 or 3 indicators, we are looking at around 100 indicators for assessing neighbourhood sustainability (remembering, however, that the same indicator may measure multiple goals). Bearing in mind the broad range of user-groups this work is likely to apply to, these numbers would seem appropriate for the Beacon programme (and could be tailored for each group in any case).

The development of a tool such as this for New Zealand neighbourhoods (as part of the NBH framework development) is seen by the project team as a critical and unique feature of this programme.

# 8 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this report has been to **identify existing national and international initiatives that address sustainability issues at the neighbourhood level**, with the broader aim of developing a model strategy for designing or redesigning neighbourhoods to accelerate the opportunity to enhance sustainability in the residential built environment.

In identifying these initiatives, the project team also considered the following issues:

- the theoretical basis of what is meant by neighbourhood, especially in the New Zealand context
- the differences and/or similarities in achieving sustainability at the level of houses (residential dwellings) vs. neighbourhoods and the role of neighbourhoods in achieving sustainability at the city level
- what a sustainable neighbourhood might look like

As a result, this report provides:

- a discussion around neighbourhoods and neighbourhood sustainability
- an inventory of existing initiatives for achieving sustainability in New Zealand neighbourhoods, and an inventory of similar international examples
- a critical assessment of a selection of these initiatives drawing out replicable elements and lessons for future initiatives especially with regard to Beacon's goals (what 'success looks like')
- recommendations regarding how the proposed Neighbourhoods programme should proceed, with emphasis on how to achieve the same results in shorter time

The project team recommend that Beacon:

1. **Recognise the significance of neighbourhood form and development to the sustainability of the residential built environment.**

*Explanation:* Neighbourhood form is perhaps the most influential and irreversible influence on sustainability in the residential built environment. Once developed and vested in fragmented ownership, it is difficult to modify the street patterns, site orientations, lot sizes, and infrastructure systems that frame the potential sustainability of individual dwellings.

Whilst acknowledging the difficulties of changing neighbourhood form, successful modifications can generate substantial sustainability improvements. For example, promoting

greenfield development (or the regeneration of brownfields sites) near transport nodes can dramatically affect the transport, energy and greenhouse gas impacts of residents. Affecting neighbourhood form could allow Beacon to leverage greater sustainability impacts across a greater number of dwellings than interventions on a dwelling-by-dwelling basis.

*Recommended action:*

- Ensure Beacon dedicates a substantial part of the research and implementation phase of the NBH programme on the sustainability features beyond the building envelope.

**2. Investigate and where necessary develop measures to better quantify the sustainability impacts of New Zealand neighbourhoods**

*Explanation:* The research literature surrounding neighbourhood sustainability is unevenly developed, and limited in its quantification of actual sustainability impacts. Whilst we can make assumptions that certain development forms and techniques will be more likely to encourage sustainability, Beacon will gain more traction with regulators, developers and communities if it can rigorously prove those benefits.

*Recommended actions:*

- Investigate and quantify the impact of neighbourhood form on specific sustainability issues (e.g. water quality, greenhouse gases, biodiversity, community cohesion etc.).
- Develop a taxonomy of different neighbourhood forms (e.g., conventional low-density suburbs, infill developments, medium density housing, mixed use town centres etc.) and compare the impacts of those forms.
- Compare the potential for improvement in new development and retrofit situations (e.g., does achieving density through infill have equivalent transport and GHG impacts as a comprehensively planned dense development).
- If it is not being done in another part of the Beacon programme, quantify the substantial sustainability gains that can apparently be made with terraced housing forms in comparison with detached housing.
- Identify the location and number of planned or potential new neighbourhoods in New Zealand (within a fixed horizon, say by 2014), with a view to quantifying the potential sustainability impacts of wide uptake of the Beacon programme.

**3. Develop a simple yet meaningful framework to guide the sustainable development and redevelopment of New Zealand neighbourhoods**

*Explanation:* A framework that is appropriate to the New Zealand context could aid design and construction practices in ensuring more liveable and sustainable neighbourhoods.

Depending on the level of detail and supporting materials that are developed, the project team regard this framework as a potentially 'marketable' feature of the neighbourhoods programme.

It would appear to make sense to utilise the model of the SF1.1 framework as the basis for the neighbourhood framework, so as to would avoid at least three months of duplicated effort and show consistency between the programmes.

However, initial attempts to directly apply the four system conditions as part of a neighbourhood-focussed matrix have been less than satisfactory. The conditions do not readily draw out the elements of neighbourhood initiatives. Whilst some initiatives easily fit under multiple conditions, others do not appear to fit at all. At the same time, some of the system conditions, particularly number two, are scarcely addressed by neighbourhood-scale initiatives. This may be something that the Beacon programme needs to address.

A more targeted matrix (potentially based on a matrix of elements and impacts) would be more useful. The exact details of the framework and matrix will need to be informed by the quantification undertaken in response to recommendation two. It could be possible to retain the TNS system conditions as high-level principles, and to ensure that the matrix, however it is developed, references back to those principles.

*Recommended actions:*

- Retain the four system conditions of The Natural Step as high-level guiding principles for a neighbourhood sustainability framework.
- Further explore whether and how neighbourhood level sustainability initiatives address all four system conditions – and if they don't, whether and how they might.
- Determine the appropriate level, approach and point of application of the framework. For example, the framework could constitute a set of high-level principles, more detailed indicators or design specification guidelines; it could be applied as part of the brief for initial designs, or as a set of assessment criteria in the development approval process.
- Develop a robust goal/indicator matrix for measuring success, including identified desired performance standards or targets in each of the impact areas. (Alternatively, consider the weighting of different elements within an aggregated index.)

**4. Ensure wide application of the framework through both practical and procedural efforts.**

*Explanation:* Beacon's research will only achieve value if it is applied. The programme needs

to address how a neighbourhood sustainability framework would be implemented, and by whom. It needs to demonstrate the benefits of neighbourhood sustainability in practice, for example, through pilot studies. Identifying appropriate areas for pilots will be complicated, for example needing to take into account long development times and a risk-averse industry.

Further, to ensure widespread uptake of a neighbourhood sustainability framework, Beacon will need to address the procedural and systemic barriers to change.

*Recommended actions:*

- Pilot studies
    - Demonstrate the quadruple bottom-line benefits of application (economic, environmental, social and cultural) to the diverse range of stakeholders that will influence uptake (e.g., developers, regulators, consumers, etc.)
    - Identify potential neighbourhood (re)developments and partners in the development and local authority sectors, including the Northern Strategic Growth Area in Waitakere City.

- Address procedural barriers
    - Partner with 'progressive' New Zealand government agencies (the programme will be reliant on planning and building regulations to effect change).
    - Explore the potential to 'upgrade' NZS HB44:2001 into a Standard, and the potential to revise territorial authorities' District Plans and codes of practice to reflect this (as appropriate).
    - Investigate the barriers to sustainable neighbourhood development through analysis of the drivers of development (economic, regulatory and otherwise), examination of recent 'conventional' projects, and interviews with key stakeholders.

To support the achievement of these recommendations, it is further recommended that Beacon:

**5. Establish links with relevant national and international programmes.**

*Explanation:* Given the amount of work on neighbourhood sustainability already underway, Beacon would benefit from establishing links with other programmes, to ensure alignment of work programmes and rapid uptake of findings as they emerge. In-depth study trips may be useful, should the budget allow. (Note: issues of sharing information and ownership of IP will need to be addressed)

*Recommended connections:*

- Opus Consultants – Sustainable Cities and Settlements programme and Reducing $CO_2$ Emissions project
- Eco-Water, Waitakere City Council – Tools for Urban Sustainability Code of Practice (TUSC)
- Landcare Research – Low Impact Urban Design and Development (LIUDD)
- Auckland Regional Growth Forum
- Auckland Sustainable Cities Programme
- City of Vancouver – Community Visions Programme
- NSW Department of Infrastructure, Planning and Natural Resources - METRIX

**6. Be transparent and regularly report on progress (even if it only shows small steps).**

**7. Identify the appropriate mix of research and practical skills necessary to deliver the programme.**

In terms of recommending ways of achieving the results in a faster time, it is helpful to review the overall programme's goals and milestones (as below):

Outcome Statement:
Through working through a test community, develop an implementation strategy to enhance sustainability of the residential built environment at a neighbourhood level. Improvements in at least one neighbourhood and an implementation strategy for others will be available by June 2009.

Objective Statement:
Develop a model strategy for designing or redesigning neighbourhoods to accelerate the opportunity to enhance sustainability of the residential built environment.

Milestones:
06/05 Prototype Neighbourhood Sustainability Framework (NSF) developed
06/06 Prototype NSF validated (including identification and testing of key interventions that could enhance sustainability) through development of a case study
12/06 Completion of the NSF, customised for use by TLA's, including a methodology to test long-term effectiveness of the framework and a strategy for implementation
06/07 Refined framework based on application to three test sites
06/08 Refined framework based on application to three test sites
06/09 Refined framework based on application to three test sites

The process outlined by Beacon for the NBH programme is considered appropriate, if too broad-brush. The development of case studies will be the time consuming section of the programme – largely because this must contend with the real-world delays and uncertainties of the development process.

As mentioned above, a critical element for moving this programme forward will be effective partnering with a 'progressive' territorial local authority, in particular the urban design, planning, and resource and building consents staff / units. It would be useful for stage 2 to also identify and analyse the primary tools that local authorities use to influence the design of neighbourhoods, e.g., district plan rules and codes, and the codes of practice that apply to the design and construction of public infrastructure.

As world leaders, the City of Vancouver work (and the METRIX programme once formally underway) warrant further investigation. This should provide valuable lessons on how to progress quicker, as in the Canadian case, they have been undertaking this work for the past 10 years or so.

Because of the limited amount of focussed/specific neighbourhood sustainability work being undertaken in New Zealand both currently and in the past (although this is now moving forward reasonably quickly), Beacon is an ideal position to make significant changes and show leadership in this field. The neighbourhoods work stream has the potential to offer people the opportunity to live and work in a way that significantly improves lifestyles, makes this choice attractive and cost-effective, and is appropriate to the New Zealand context. This report provides the first step in making this a reality.

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# APPENDIX 1

| The Natural Step Guiding Principles | | | | |
|---|---|---|---|---|
| **Housing element** | **Principle 1**<br>*eliminates fossil fuel, metal and mineral use* | **Principle 2**<br>*eliminates use of toxic and synthetic substances* | **Principle 3**<br>*eliminates encroachment upon nature* | **Principle 4**<br>*meets human needs fairly and efficiently* |
| Materials and Design | Material selection and design favour deconstruction, reuse, and durability appropriate to the service life of the structure | All materials are non-persistent, non-toxic and procured either from reused, recycled, renewable, or abundant (in nature) sources | Solid waste is eliminated by being as efficient as possible, or<br>a) Where waste does occur, reuses are found for it on-site, or<br>b) For what is left, reuses are found off-site.<br>c) Any solid waste that cannot be reused is recycled or composted | Source materials and labour locally and where appropriate support local economies<br><br>Material selection and design meets social and cultural needs<br><br>House is affordable for a diversity of residents |
| Energy | All energy sources used are 100% renewable and are: | a) created without rare metals or persistent or toxic materials, e.g., photovoltaics<br>b) not systematically degrading the water table nor releasing toxic substances, e.g., geothermal | c) "fish friendly" hydro (fish flows are not systematically degraded)<br>d) "bird friendly" wind (bird migration patterns are not systematically degraded) | Design favours excellent levels of thermal comfort (minimise the amount of purchased energy required) |
| Water | Pumping systems powered by 100% renewable energy | The quality, temperature and rate of flow of the water both on-site and leaving the site have no damaging impact on the natural systems of the watershed (i.e., does not need chemical treatment before release) | The water budget does not exceed the water that falls on or flows through the site: (stormwater control methods, greywater / blackwater systems, etc). | House design favours source control for run-off and allows for community based waste water treatment systems |
| Air | Indoor air quality maintained by passive means | The purity of ambient air surrounding and flowing off-site is as pure as or purer than the air flowing into the site. This means that air is not a waste sink for harmful particulates or gasses that may contain heavy metals, fossil fuel by-products, or hazardous or persistent compounds | Changes to airflow or air temperature do not systematically degrade natural systems | Indoor air quality maintains or improves health of occupants |
| Transport | Transportation | Transportation energy | If changes to the | Existing infrastructure |

| | | | | |
|---|---|---|---|---|
| | energy sources (related to construction, operation and demolition of the house) are renewable | sources have no synthetic or toxic additives<br><br>Transportation infrastructure uses no synthetic or toxic substances | infrastructure occur, any degradation of natural systems resulting from paving land and increased driving is repaired or restored | is used wherever possible by selecting building sites that fit within the current transportation infrastructure |
| Habitat | No requirement for petrochemical based fertilisers | No requirement for synthetic pesticides or herbicides | Restore enough of the same habitat within the local area to replace the natural systems that have been disrupted by the construction of the building and its site.<br><br>Whatever disruption does occur does not extend beyond the boundary of the construction-site development. This means that wetlands, soil or stream habitat downstream of the site are not disturbed.<br><br>Any vegetation used is compatible with the local natural systems. | Design for on site or community-based food production |
| | | | | |

**Table 5: Proposed actions for the Sustainability Framework for Houses (SF1.1)**

Note: Table 5 is provisional until acceptance by the Beacon Board.