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NOW HOME PROTOCOLS:

A TOOLKIT DOCUMENTING THE BEACON APPROACH TO SUSTAINABLE RESIDENTIAL DESIGN

A REPORT PREPARED FOR
BEACON PATHWAY LIMITED

WRITTEN BY Karen Bayne, Roman Jaques, Annika Lane, Katja Lietz and Robin Allison

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AUTHORS

Karen Bayne, Roman Jaques, Annika Lane, Katja Lietz and Robin Allison

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1. EXECUTIVE SUMMARY

First and foremost, the NOW Home is a research experiment designed to test how an innovative design and construction concept delivers nine fundamental objectives of a sustainable home. It is not an 'eco housing' project, nor is it a 'social housing' project. The NOW Home is different because it aims to be affordable, appealing to the mass market, as well as environmentally sustainable. In effect, the NOW Home demonstrates design and construction concepts that can be reproduced in any new home, anywhere in New Zealand.

Through the construction of the NOW Home at New Lynn in Waitakere City, Beacon Pathway is hoping:

- To create a sense of excitement and expectation among the public about a better way of living that is within their grasp – and to create a demand for this
- To encourage the general public and the construction industry to consider – and use – sustainable methods and materials when building new homes
- To demonstrate that sustainable homes can be built using designs and materials available now

Future NOW Homes are not expected to be all alike. However, they will all seek to address the same nine fundamental objectives of a sustainable home.

The NOW Home protocols are a resource document which aims to assist Beacon Pathway and its future collaborative partners to design these future NOW Homes.

At this stage, the NOW Home protocols are an internal Beacon Pathway document. It is envisaged that Beacon Pathway team members will use parts and portions of the protocols, as appropriate, as they engage and work with partner organisations. With sufficient end-user feedback, it may be possible to create a revised set of protocols that are made available for wider use.

The NOW Home protocols consist of:

- A generic NOW Home design process
- A design process flowchart
- A list of architects (designers) with experience in sustainable design
- A set of sustainable design considerations and features
- Information about the NOW Home monitoring programme
- A list of technical tools for sustainable design
- A directory of specialist relevant to sustainable design
- A filtering framework to assist with product selection
- Case study documents relating to the first Beacon NOW Home built in New Lynn, Waitakere City

2. INTRODUCTION: THE NOW HOME CONCEPT

First and foremost, the NOW Home is a research experiment designed to test how an innovative design and construction concept delivers nine fundamental objectives of a sustainable home. Appealing to the mass market, the NOW Home balances affordability, desirability, family health, investment value, resource use, energy efficiency, water and waste management, future proofing, landscaping, measurable performance and community needs (Figure 1).

The NOW Home is not an 'eco housing' project where concern for environmental materials and resource use dominate. Nor is it a 'social housing' project where affordability is the highest priority. The NOW Home is different because it aims to be affordable, appealing to the mass market, as well as environmentally sustainable.

Beacon Pathway's vision for the NOW Home is: *An environmentally friendly home which people want to, and can afford to live in*.

Importantly, the NOW Home demonstrates design and construction concepts that can be reproduced in any new home, anywhere in New Zealand.

For more information about the NOW Home, visit www.nowhome.co.nz

FIGURE 1: The fundamental objectives of a sustainable home according to Beacon Pathway.

3. THE GENERIC NOW HOME DESIGN PROCESS

The NOW Home located at New Lynn in Waitakere City is just one expression of the Beacon Pathway approach to sustainable design. Through this project, Beacon Pathway is hoping:

- To create a sense of excitement and expectation among the public about a better way of living that is within their grasp – and to create a demand for this
- To encourage the general public and the construction industry to consider – and use – sustainable methods and materials when building new homes
- To demonstrate that sustainable homes can be built using designs and materials available now

As such, it is expected that further NOW Homes will be constructed which will demonstrate the Beacon Pathway approach to sustainable design in other locations and situations. Future NOW Homes are not expected to be all alike. However, they will all seek to address the fundamental objectives of a sustainable home described in Figure 1.

The NOW Home protocols are a resource document which aims to assist Beacon Pathway and its future collaborative partners to design future NOW homes.

The generic NOW Home design process has twelve elements:

1. **Create a team**

   The core team should consist of:
   - A single client: someone with a clear understanding of what they want built and who has access to the chequebook. This person needs to be from ONE entity and have the final signoff on all decisions.
   - A project manager: someone who takes responsibility for the project and who is accountable to the client. This person needs to have a good understanding of modern building practices. However, they also need to be sympathetic to the needs of researchers.
   - A bridge: someone who has taken part in an earlier NOW Home project. This person should ensure that learning and experience from earlier projects are captured. They should also act as a technical advisor and coordinate the involvement of technical experts.
   - A scribe: someone who can take good notes and keep a record of team activities

   Additionally, the core team will consult with:
   - A single architect: the architect must be prepared to work closely with the core team. They may even become part of the team.
   - Outside technical experts/ advisors: these people are consulted as required. Ideally, they will be found within the shareholder or stakeholder organisations. On some occasions it may be necessary to contract specialists.
   - A builder and/or architect to be included in the peer review process

2. **Cast a vision**

   All Now Homes share a common vision: An environmentally friendly home that people can afford to, and desire to, live in. However, this vision needs to be interpreted by the team in the context of the specific NOW Home being proposed. A compelling vision is a powerful and unifying influence.

3. **Select a site**
Firstly, the choice of site should take into account the particular NOW Home project aims (housing market segmentation, unique community factors, etc). In addition, factors such as orientation, size, slope and boundary features must also be considered as these will limit the design possibilities and the opportunities to achieve sustainability outcomes.

4. **Select an architect who will embrace the vision**
The choice of an architect should be a team decision. Of overall importance is that the architect must be well aligned with the project goals and vision. Refer to Section 5 (Architects with experience in sustainable design) for further advice on how to choose an appropriate architect.

5. **Develop a detailed project specification**
The project specification should take into account the desire to balance the fundamental objectives of a sustainable home (Figure 1). However it also needs to clearly articulate the features and benefits which are a priority in order to achieve the vision the team has for the project. It will be necessary to take into consideration such things as the likely occupant, local community demographics, local median house prices and site-related factors. The project specification must be signed off by the client.

6. **Create a building design**
It is expected that the architect will present layout designs to the team in an iterative fashion until a final layout is agreed.

7. **Create a landscape design**
The landscape design should proceed in parallel with the building design. This will require the architect and landscape designer to work consultatively.

8. **Select appropriate materials, systems and technologies**
It is expected that the architect will choose the materials in consultation with the technical experts and by making reference to the resources in this document.

   Where necessary, technical tools may need to be consulted (e.g. LCA, LCC, ALF energy modelling, acoustic performance modelling). However, the cost of using these tools needs to be considered.

   At this stage, the team will also need to make decisions about the sorts of research monitoring equipment that will go into the home. The necessary monitoring systems and devices will need to be obtained (Refer to Section 7: The NOW Home monitoring programme).

9. **Peer review**
Once the design is finalised, at least one peer review meeting should be held with the core team, architect, builder and an external architect. It may be necessary to have more than one peer review (e.g. at concept *and* detailed design stage). The final design needs to be signed-off by the client prior to the detailed drawings being prepared.

10. **Select a builder who will collaborate with the team**

In selecting a builder, the team needs to consider the builder's familiarity with sustainable building technologies and their willingness to do things differently. Naturally, the selected builder should be someone who takes pride in their work and has a track record of quality building work. It is also important that the builder is someone who gets on well with the architect. It is the Project Manager's responsibility to arrange the contract with the builder and to handle consenting issues on behalf of the client.

11. Procure the materials

As with any demonstration project, it is possible to obtain in-kind contributions. If there is going to be donations of building materials, it is best if this is coordinated through a single point person.

Also, for the project to have integrity, donations of materials must not be considered until after the materials selection process is complete.

12. Build…and turn the vision into reality!

It is expected that the architect will visit the site regularly in order to check the quality of the building work and to assist the builder in their understanding of sustainable design and correct installation. The architect will also need to certify the quality of the building work for the client so that payments to the builder can be made as necessary.

One of the team members should take responsibility for organising a record of the construction process and coordinate any research related components.

4. DESIGN PROCESS FLOWCHART

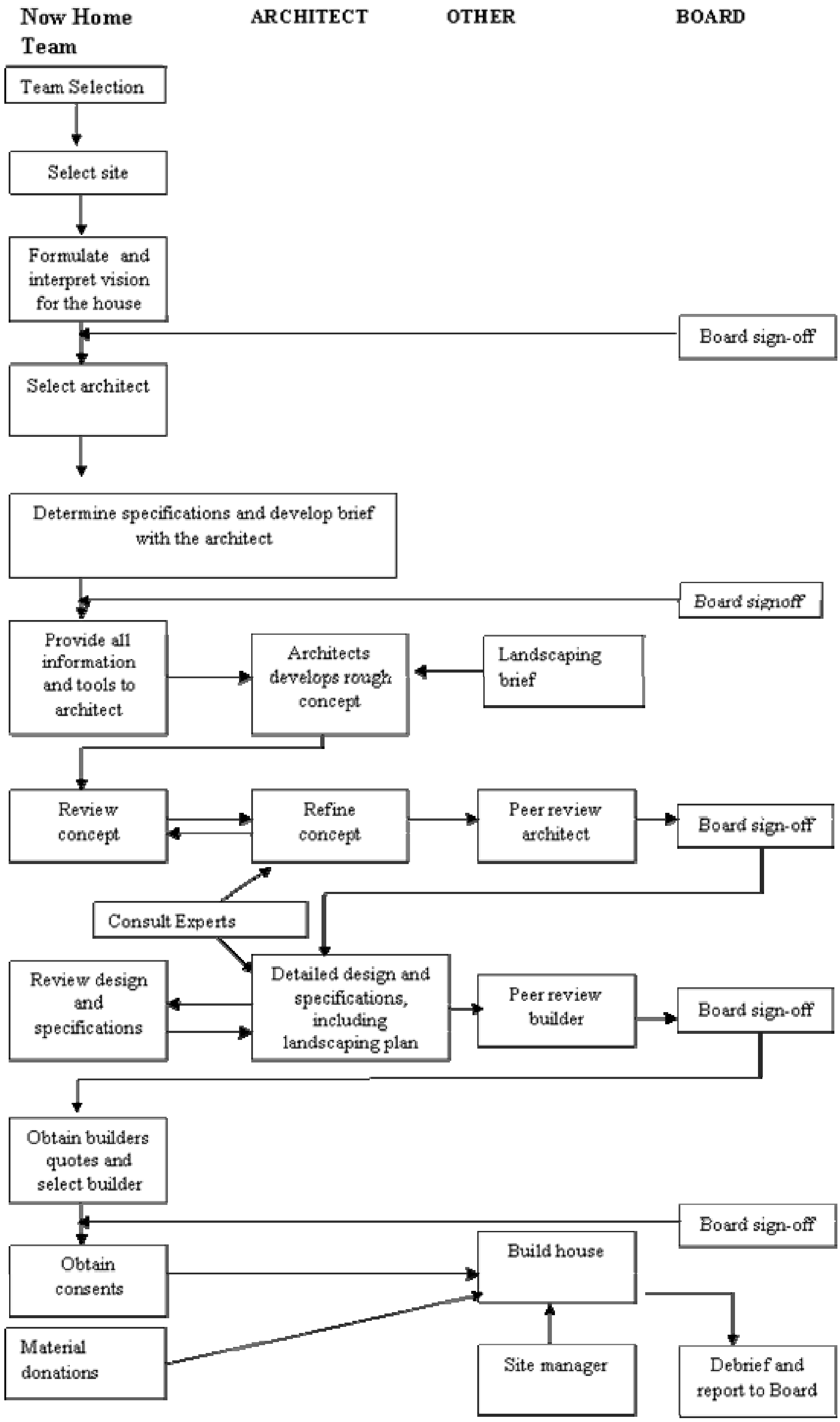

FIGURE 2: The design process flow chart.

5. ARCHITECTS (DESIGNERS) WITH EXPERIENCE IN SUSTAINABLE DESIGN

Fundamental to the success of a NOW Home project is the selection of an appropriate architect or designer. Some of the important questions to ask before making a selection include:

- Does the architect (designer) have a track record in designing well-performing sustainable homes in a similar price range to the intended project?
- Has the team inspected at least one recently completed project by the architect (designer)?
- Have any projects by the architect (designer) been subject to a formal environmental rating (e.g. BRANZ Green Home Scheme)?

It is also critical that the team is confident that they can work well with the architect (designer) and that the architect (designer) will work well with the intended construction team.

What follows is a list of architects (designers) with experience in sustainable design (Table 1).

Note however, that this listing is not comprehensive, and in creating this list, Beacon Pathway Ltd does not recommend any particular designer, nor is it liable for their work.

TABLE 1: Architects (designers) with experience in sustainable design.

Architects and Designers	
Robin Allison	PO Box 70001 Ranui Auckland 09-8334409
Johann Bernhardt	11-5 Millais St Grey Lynn Auckland ph/fax 09 - 376 6767 e-mail: jobern@ihug.co.nz
Greg Burn	Structure Ltd 0274-736164 structure@ihug.co.nz
	Boon Goldsmith Bhaskar Team Architecture 131 Cortenay Street New Plymouth 06-757 3200 admin@bgb-ta.co.nz http://bgb-ta.co.nz
Roger Buck	47 Hereford St Christchurch 03-36 6888
John D'Anvers	PO Box 31362 Miford Auckland 4894896
Peter Diprose	PO Box 82 Whitford Auckland 1750 09-530 9065 peter@diprose.co.nz
Graeme Finlay	Warren and Mahoney PO Box 25086 Christchurch 03-961 5926 Graeme.finlay@wam.co.nz www.wam.co.nz
Brian Halstead	131 A Ngapuhi Rd Auckland 5 5240938
Paul Heather	Green Design 2/25 Awatea Road Auckland 1 fax: 3023639 025-545133
Bo Hermans	Peter Hollenstein Assoc. PO Box 34242 Birkenhead North Shore ph/fax: 3767151
Gerry Hodgson	DHT Architects PO Box 106 Tauranga 07-5785199 www.dht.co.nz
Don Jamieson	Ph: 04 386-3012 Fax: 04 3863019 don@donjamieson.co.nz www.donjamieson.co.nz

Architects and Designers	
Robert Jaunay	Robert Jaunay, 51 Ballarat Street Ellerslie Auckland Ph (09) 579 8573
Paul Jurasovich	JASMAX Limited Email: pdj@jasmax.com Tel: 64 9 366 9626 Fax: 64 9 366 9629
Rick Lambourne	Lambourne Architects 47 Ponsonby Road Auckland 09-361 2030 021 608 268
Graeme North	49 Matthew Road, RD1, Warkworth, New Zealand 1241 Ph/fax +64 (0)9 4259305 email ecodesign@xtra.co.nz www.ecodesign.co.nz
Architects Patterson	PO Box 8778 Symond Street 09-303 4004
Pat de Pont	Strachan Group PO Box 26-038 Epson Auckland 09-638 6302
Bryan Pooley	Ph 09 623 2038 Cell 021 1309412 Bryan.Pooley@clear.net.nz
Alan Poor	Alan Poor Architects 28 Laurie Ave Parnell Auckland City ph: 3767350 fax: 3765822
Trevor Pyle	Eco Places PO Box 107 Red Beach, Orewa
Carolyn Savage	DU BOIS & SAUVIGNON Architectural & Building Services PO Box 409, Waiuku Ph: (09) 235 9091 Fx: (09) 235 9061 Mobil: 021 1179 261 Email: cisavage@xtra.co.nz
Chris Scott	PO Box 78032 Grey Lynn Auckland City ph: 3767350 fax: 3765822
Hugh Tennant	Hugh Tennant Architects Wellington
Matthew ter Borg	BOX 30904 Lower Hutt 04 565 1119
Philip Toms	220 Princess Street Otahuhu Auckland 6 2766338

6. DESIGN CONSIDERATIONS AND FEATURES

Future NOW Homes are not all expected to be alike. However, they will all seek to address the same fundamental objectives of a sustainable home described in Figure 1. There is a common set of design considerations, or aims, which will apply in every case. These include:

- The aim of selecting a site which takes into consideration Beacon's community (or neighbourhood) goals
- The aim of maximising the potential of the site through the orientation of the house
- The aim of creating a home in which the occupants feel safe
- The aim of balancing affordability with appeal to the mainstream market
- The aim of designing the home with accessibility, flexibility and durability in mind
- The aim of reducing resource use and waste generation throughout the lifecycle of the building
- The aim of controlling moisture to reduce health impacts and damage to the building
- The aim of optimising the thermal performance of the house
- The aim of minimising energy use during the building's lifetime
- The aim of ensuring that the home allows the occupants to perform every-day tasks comfortably
- The aim of achieving acoustic comfort for the occupants
- The aim of providing a healthy home
- The aim of minimising the home's impact on the natural environment
- The aim of ensuring that the home appeals to the target audience

Table 2 elaborates upon these aims, not for the purpose of prescribing answers, but as a primer for discussion. As is the case in any design process where there are multiple objectives, it will be necessary to make trade-offs and compromises. Not every objective will be able to be simultaneously optimised.

This table attempts to capture key learnings from the design process for the Beacon NOW Home located at New Lynn in Waitakere City. Naturally, it is assumed that the design will comply with all relevant legislative requirements - such items are not covered here.

At this point, the team may also find it helpful to consult Section 8 (Technical Tools) and Section 9 (Directory of Specialists).

TABLE 2: Suggested design considerations and features for NOW Homes

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of selecting a site which takes into consideration Beacon's community (or neighbourhood) goals.		Consider the location of the site with regard to: • Proximity to public transport • Proximity to local shops and facilities • Proximity to schools • Proximity to recreational facilities	The site is located within comfortable walking distance of many local facilities. Single car garage, or no garage at all.	Private car use is a leading cause of air and noise pollution, non-renewable resource use and congestion. Encourages stronger relationships within local community. Doesn't disadvantage families without cars, but sends the signal that only one car is required because of proximity to transport and facilities.
		Consider slope and orientation, and existing vegetation.	The site has a good northern aspect.	Passive solar design reduces energy use and increases comfort for little extra short-term cost while having savings long-term.
		Consider topography, ground stability and overland flow paths in order to minimize earthworks and foundation requirements.	The site is on stable land with good bearing capacity.	Minimises disturbance to soil and ground water systems.

TABLE 2: (cont)

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of maximising the potential of the site through the orientation of the house.		Consider the local climatic and other conditions including likely future changes • solar access • views • average temperatures • daily variations • seasonal wind directions • wind velocity and frequencies	The house is sited to maximise solar exposure of living areas. Outdoor living areas that are sunny and sheltered from prevailing winds. Maximized views from main living areas and decks.	Designing for local climate conditions maximises thermal performance. Siting determines wind, water, sun, UV etc. loading, which may influence cladding choice eave size, protective coatings, etc.
		Ensure resident and neighbour privacy by creating a balance between private and public spaces.	Private rear or side garden. Open, more public front yard that allows for interaction with people on the street.	For personal and surrounding privacy.

TABLE 2: (cont)

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of creating a home in which the occupants feel safe.		A passive approach to security through design.	A well-defined main entrance, this should be clearly visible from the road, but should not be in direct sight line with the living area. No visually impermeable fences. Outdoor security lighting with motion sensors or solar garden lights. WCC publication *Crime Prevention through Environmental Design* can provide guidance.	Good design can result in increased security without the need for active security systems.
			Security vents, screens, passive ventilation for windows.	This ensures that ventilation can be achieved without compromising security.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
		Fire safety.	Two exit routes in case of fire from each space. Use materials which limit fire spread where possible. Working smoke alarms positioned in key areas. A fire blanket and/or fire extinguisher in the kitchen or garage. Emergency supplies/protection of important records cupboard or safe.	To reduce the risk of fire and to reduce the harm to people and property if a fire does occur.

TABLE 2: (cont)

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of balancing affordability with appeal to the mainstream market.		House to be built to a similar budget to surrounding houses.	Simple design. Smaller home to allow for extra features.	Reflects the local demographics and market. Gives potential occupants in the area a realistic idea of what is attainable.
		Aim for lower running costs than the average home.	Energy efficiency. Water efficiency. Low maintenance.	An intrinsic part of a sustainable approach.

TABLE 2: (cont)

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of designing the home with accessibility, flexibility and durability in mind.		Design a house that is barrier free and safe for all members of society.	The following guidelines and Standards can be referred to: • BRANZ. (2001) *Homes Without Barriers.* • Royal New Zealand Foundation for the Blind. Design guide information: http://www.rnzfb.org.nz/Environmental/domestic_design.html • Standard NZS 4102: (1996) Safer House Design (Guidelines to reduce injury at home). Independent checks by accredited auditors or ergonomists also may be helpful.	A barrier free home ensures that all members of society can use the home. It also ensures future flexibility as the circumstances of the occupant change over time (such as temporary or permanent loss of mobility or the arrival of a baby). Designing a home that is safe for the very old and the very young generally means that it is safe for those in between.
		Ensure that the design reflects the ethnic and cultural mix of New Zealand and is able to cater for different and changing family circumstances.	Usable, covered outdoor areas. Multipurpose rooms that allow for a variety of sleeping arrangements. Food preparation area that can cater for larger families. Adequate corridor and door space available for moving furniture in/out and around the home. Explore the possibility of internal walls being non-load bearing to maximise open plan living space.	In-built flexibility will reduce the need for costly alterations or for the occupants to move when their circumstances change.
		Durability and maintenance requirements.	Use appropriately durable materials and systems; and future-proof for easy maintenance.	As people's lives become busier they will have less time to maintain their homes.
			Allow provision of a maintenance record log book.	Record keeping helps to ensure that maintenance is undertaken on a regular basis by present and future owners.
		A wired house that allows for future technological needs.	Broadband internet access. Easy access for piping and electrical services.	Minimises installation costs in the future.

TABLE 2: (cont)

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of reducing resource use and waste generation throughout the lifecycle of the building.		Aim for a house that is spatially flexible, deconstructable and built using recyclable materials.	Preference for demountable, non-composite, screwed-in, high quality materials and components.	Making a building easier to deconstruct increases the chance of it being recycled.
		Reduce construction off-cuts and allow for ease of reuse and recycling during construction.	Rooms based on standard sheet sizes. Separating of construction wastes for collection. Prefabrication and modular design of core elements.	Increases resource efficiency.
		Use recycled materials and materials with a recycled content where possible, provided performance and other factors are not compromised.	• Recycled concrete for base-course. • Recycled bricks for landscaping. • Recycled whiteware (basins etc). • Composite wood products made from recycled timber. • Insulation from recycled materials.	Reduces construction waste destined to landfill.
		Design the house so that the occupants can manage waste responsibly.	Provide space in kitchen for organic collection. Provide space for non-organic recycling bins (to fit in with local collection system). The design should NOT incorporate an in-sink waste disposal unit. Provide space in garden of at least 1 m^3 for composting of organics.	Encouraging recycling and composting by providing appropriate facilities will reduce waste to landfill and encourage resource conscious behaviour.
		Efficient water use and the reduction of waste water generation.	Provide for rainwater collection for toilets and garden use (and possibly other uses). Incorporate dual flush toilets and low flow showers and taps (fewer than 9 litres per minute). Water efficient appliances. Consider grey water reuse for garden and toilet uses (this is generally not cost effective).	Reducing town supply water use by using rainwater will lessen the strain on local water infrastructure and the environment. Using less water will lessen the load on the sewage system and local receiving environments.

TABLE 2: (cont)

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of controlling moisture to reduce health impacts and damage to the building.		Design the house to control and manage moisture passively as much as possible.	Manage moisture with appropriate heating, ventilation and insulation, and avoid high tech HVAC systems. Have background vents built into windows if possible.	Moisture and the resulting mould growth have occupant health implications and impact on materials durability. Background ventilation in tighter homes is necessary for pollutant reduction.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of optimising the thermal performance of the house.		Sustainable solar design and passive temperature control.	Use of thermal mass, insulation and appropriate glazing. Passive heating of internal environment as much as possible. Passive heating may need to be supplemented by artificial heating in colder climates. Layout of rooms and windows in context of living patterns throughout the day. Incorporate shading through fixed overhangs, movable awnings and vegetation to prevent overheating. Planting to complement the climate control of the house.	Reduction of GHG emissions and reduced dependency on depletable fuels.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of optimising the thermal performance of the house (cont).		Insulation.	Meet at least the BETTER Practice options in *NZS PAS 4244* for light timber framed construction OR CCA's *Designing Comfortable Homes* for heavy construction.	High levels of insulation will provide better comfort, reduce energy use and improve health year round.
		Thermal mass.	Insulated slab on ground floor, which in solar exposed areas is tiled or polished i.e. NOT covered in carpet. Calculate ALF for thermal simulation Ensure BPI is not greater than 0.044 $kWh/m^2/DD$.	Thermal mass will absorb warmth from the sun and ambient warmth and release this warmth slowly, resulting in a more stable indoor temperature.
		Heating.	In warm climate zones (Climate Zone 1), the home does not require in-built heating. In cool climate zones (Climate Zones 2 and 3) options include: • Heat-pumps: with coefficient of performances of at least 2.5 • Solid fuel heating: using Ministry for the Environment approved burners only, potential wetback combination. • Under floor heating utilising solar hot water system. The capacity of the heater should be the minimum that will maintain comfort levels.	The type of heating used influences energy consumption. Different energy sources have different levels of greenhouse gas emissions.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
		Shading.	Appropriate shading of façade to avoid overheating during summer while still allowing winter sun to heat house. Avoid excessive West facing windows; apply overhangs for North facing windows.	Overheating is becoming an increasing issue with climate change and is easily solved.
		Minimize thermal bridging.	Few or no recessed light cans in insulated ceilings unless they are insulation contact rated. Consider joinery with thermal brakes when using aluminium joinery (timber joinery performs better thermally).	Small weak points in the insulation envelope can result in significant heat losses.
Aim	**Vision Elements**	**Design Consideration**	**Suggested Features**	**Rationale**
The aim of minimising energy use during the building's lifetime.		An energy efficient hot water system.	Solar Hot water heating. Install HW cylinder close to uses (to minimise pipe runs) and inside the house (to utilise heat losses for space heating). Insulate vent pipe and frequently used hot water pipes. Consider hot water heat recovery systems. Consider heat pump hot water systems.	Water heating is generally the biggest home energy use.
		Energy efficient lighting.	Light fittings that are suitable for compact fluorescent light bulbs.	Energy efficient, longer-lasting.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
			Utilise natural lighting where possible • Ensure every room has access to natural light. • Rooms should not require artificial lighting during 9am-4pm year-round.	Natural lighting is better for health, energy efficiency and productivity. However, overcast days in winter may require additional light sources.
		Energy efficient appliances.	Appliances with 4 or more stars. Provision for laundry to be dried outside in a sunny but sheltered (and private) area. Provision of indoor drying rack or line for wet days.	Increased energy efficiency. Drying laundry in the sun reduces bacteria and dust mites.

TABLE 2: (cont)

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of ensuring that the home allows the occupants to perform every-day tasks comfortably.		Lighting.	Differentiate between task and general lighting. Provide good visual performance (e.g. contrast, luminance, and colour rendering).	Different activities need different lighting conditions. Soft/passive lighting suits most areas; however, some tasks require more concentrated (usually artificial) lighting.
			Provide suitable shading controls for westerly windows (especially for kitchen/living and study areas) to control for glare/overheating.	Areas used for demanding visual work and living areas need to be glare-controlled. Preventing overheating and damage to fittings and furniture from UV.
Aim	**Vision Elements**	**Design Consideration**	**Suggested Features**	**Rationale**
The aim of achieving acoustic comfort for the occupants.		External noise.	Site house and use landscaping to reduce external noise penetration into living areas of house even when windows/doors are open to outside living areas. Provide ventilation systems which allow adequate ventilation without severe acoustic compromises.	We can't control the noise being made outside the home in the same way we can control internal noise sources if needed. The external envelope is critical to achieving an acceptable level of peace and quiet that is beneficial to the health of the home's occupants. There should also be a liveable area of the house, which can have its windows open without undue noise intrusion.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
		Internal noise.	Arrange rooms so that quiet areas are separated from noisy areas. Provide internal wall systems to reduce noise transmission from living areas into bedrooms and other quiet areas such as a study. Identify noise sources and the most noise sensitive living areas. Plan the layout to optimise acoustic separation and minimise impact of road noise. Avoid plumbing noise. Provide a mid-floor system in 2 level homes.	Large families, especially those with young children, require quiet areas at all times even when various other activities are taking place throughout the home. Many health problems are being associated with disruption of sleep.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
The aim of providing a healthy home.		Indoor air quality.	Low toxicity products and materials, especially considering VOC content (such as in flooring material, wood based furniture, paints, glues, sealants and carpets). Minimise irritants such as dust and pollen. Garage detached from house or cross-vented.	Indoor air quality is known to be linked to occupant health.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
		Electro magnetic fields (EMFs).	Ensure that switchboard is not within a 4 metre direct line of where people are for prolonged periods (e.g. bed)	EMFs are perceived/believed to cause negative health impacts, from mild headaches to cancer. However there is no scientific consensus on their risk.
Aim	**Vision Elements**	**Design Consideration**	**Suggested Features**	**Rationale**
The aim of minimising the home's impact on the natural environment.		Storm water management.	Minimise impermeable areas (strip driveway, permeable paths, intensive landscaping). Consider a storm water detention tank (a rainwater tank can double as a detention tank by locating the overflow some distance from the top of the tank). Consider achieving hydrological neutrality (no storm water discharge from the site).	Impermeable surfaces increase the amount and speed of storm water runoff. They contribute to flooding and water contamination. By limiting and slowing the runoff from the site, flooding and contamination of local waterways is reduced.
		Landscaping.	Minimise site works needed and work within bounds of site – incorporate and utilise existing trees and streams etc. as well as existing buildings as site features within the overall design.	Ground disturbance upsets natural ecology. Mature amenities can increase value, and provide shade/beautification etc.
			Plants native to the area. Edible landscape and vegetable garden. No plants should be used that could become weeds.	Acknowledging natural heritage of the area. Providing habitats for native species. Providing food for occupants.
			No in-built irrigation system.	Reduces water use during dry times, when town supply tends to be stretched.

Aim	Vision Elements	Design Consideration	Suggested Features	Rationale
			Limit lawn area.	Increased permeability through intensive planting. Less energy use, air and storm water pollution through lawn mowing.
			Provision for outdoor entertainment area.	Cultural requirement for Kiwi home. Accommodates more people without need for large indoor living space.
		Material selection.	Refer to the ‘Filtering Framework’.	
Aim	**Vision Elements**	**Design Consideration**	**Suggested Features**	**Rationale**
The aim of ensuring that the home appeals to the target audience.		Style.	Consistent with current design trends.	To be effective the home needs to appeal to the target audience.

7. THE NOW HOME MONITORING PROGRAMME

The first Beacon NOW Home located at New Lynn in Waitakere City has been equipped with special research equipment in order to monitor the performance of the home. Over two years, Beacon Pathway will monitor the NOW Home while a family lives in it to assess its success in achieving its aims. Measures are being applied to the health, comfort and general well-being of occupants, to energy and water consumption and to the durability and functionality of the materials and design (Table 3). Some or all of these monitoring operations may be considered in future NOW Homes.

6.1 Monitoring programme objectives

- Demonstration of the key performance advantages of the NOW Home over conventional houses
- Provision of comparative data between NOW Homes
- Provision of benchmarking information for new technologies

6.2 Management of the monitoring programme

For each NOW Home, it is recommended that a single technician/scientist be responsible for setting up, running and reporting on the monitoring programme. This person will ensure that schematics are available in a timely manner to those who are involved in the construction process. They will also schedule the installation of monitoring equipment so that the construction process is not delayed or unnecessarily interfered with.

6.3 Additional monitoring and assessment possibilities

- Post occupancy evaluation (POE): This is designed to assess issues which are more social in nature, including such things as:
  - Use of local transport facilities
  - Use of local amenities
  - Use of food from the local landscape
  - Occupant mould risk behaviours
- Construction process monitoring: This consists of a written and/or photographic log of the construction process. Its purpose is to reveal construction related issues and decision making processes.
- Environmental rating and assessment such as the BRANZ Green Home Scheme.

TABLE 3: Sustainability objectives, design considerations and potential measurement points.

ELEMENT	DESIGN CONSIDERATIONS	MEASUREMENT
Personal Health	Warmth	Internal Temperatures and Humidity
	Privacy and Security	Initial assessment
	Ventilation	Derived from ALF
	Noise reduction	Internal and External
	Air quality (e.g. dust and VOC emissions from materials)	Quarterly POE, which includes mould risk behaviour.
Desirability	Quality of life	Quarterly POE
	No behavioural compromises	Quarterly POE
	Aesthetically pleasing decor	Not measured
	Mass market appeal	Not measured
Affordability	Fits mainstream budget for capital costs	Initial Cost
	Location specific	Measured indirectly
	First Cost	Measured
	Reduced operating costs	Ongoing service costs
	Low maintenance costs	Not measured
Resource Use	Reduction in purchased energy	Utility bills
	Low embodied energy materials, and renewable materials	Life Cycle Costing
	Reduced purchased water supply	Measured usage, rainwater collection as a proportion of total water use, outdoor water use. Proportion of hot water from solar, standing losses from storage.
	Storm water utilised	Estimated based on impermeable surfaces
	Reduction in waste materials to landfill (construction and use)	Materials used and wastes generated
Community	Impact on neighbourhood	Not measured
	Road noise and emissions	Measured.
	Aesthetics – fits into surrounding environment	Not measured.
	Distance to amenities	Measured as the crow flies.
	Distance to recreational facilities	Measured as the crow flies.
	Links with public transport networks	Measured as the crow flies.
Landscape	Solar and road noise	Measured
	Water harvesting	Measured (see Resource use)
	Surface runoff	Estimated from permeable surfaces (see Resource Use)
	Aesthetics	Not measured
	Privacy	Quarterly POE
Investment Potential	Convenient access	Not measured
	Proven technologically	Not measured
	Reliable utilities	Not measured
	Favourable climatic exposure	Not measured
	Layout and space provision in design	Not measured
Future Proof	Prepared for what homeowners will face in the future	Not measured
	Telecommunication -enabled	Not measured
	Anticipates future societal requirements	Not measured
	Imaginative	Not measured
Performance	Improved building envelope	Measured directly through thermal performance of envelope and indirectly through LCC
	Improved sound insulation	Measured internal and external
	Lower operating costs	Measured through utility bills
	Appliances and lighting	Measured through utility bills and efficiency of appliances. Social aspects measured thru POE.
	Drying space	Not measured
	Durability and weather tightness	Measured indirectly through life cycle costing

8. TECHNICAL TOOLS

Table 4 provides information about technical tools that may be helpful during the design process. These tools concern:

- Water use efficiency
- Energy use efficiency
- Construction materials waste
- Whole building sustainability assessment
- Construction materials choice

TABLE 4: Technical tools

TOOL	OVERVIEW	COVERS	SOURCE / MEDIA	APPLICABILITY
		WATER USE EFFICIENCY		
National Water Conservation and Rating Scheme	Provides verifiable listing of rated water products for the home.	Shower heads Dishwashers Clothes-washing machines Taps and tap outlets Toilet suites or matching- Flow regulators	Web site and downloadable hardcopy	Very relevant (although an Australian web site). www.wsaa.asn.au
		ENERGY USE EFFICIENCY		
BRANZ ALF 3	Thermal design assessment tool which comprehensively models whole house reflecting actual use patterns.	Thermal design, space heating sizing, NZBC issues, economic cost benefit	BRANZ Ltd Hardcopy and electronic	Very relevant (apart from EIFS systems), demo version free from www.branz.co.nz . Contact Albrecht Stoecklein at 04 471 1170.
Design Guidelines: Passive Solar in New Zealand	Fairly comprehensive overview of good passive design strategies. Has accompanying Construction Issues publication.	Site design, collection, storage, distribution, dissipation, etc. issues.	Ministry of Commerce	Very relevant. Contact Allan Davidson at EECA. 04 472 000 Cost $30.
WERS – window efficiency rating scheme	Rates the effectiveness of winter heating, winter cooling and reduction of fading for a variety of window and frame types.	All window frame and glazing types. R and U values given.	Hardcopy only.	Very applicable. Cost: free. Contact local window merchant.
		CONSTRUCTION MATERIALS WASTE		
REBRI – resource efficiency in the building and related industries	One-stop NZ-based guidance for reducing construction material waste.	Recycling and diversion databases, case studies, guidance documents and tips sheets for whole life cycle	Web site and downloadable hardcopy	Relevant. Updated regularly. Link here www.rebri.org.nz Contact Roman Jaques at

				BRANZ

TABLE 4: (Cont)

TOOL	OVERVIEW	COVERS	SOURCE / MEDIA	APPLICABILITY
WHOLE BUILDING SUSTAINABILITY ASSESSMENT				
WCC's Sustainable Home Guidelines	**A fairly comprehensive NZ overview for healthier and more sustainable residential building, renovating and living.**	**Energy, water, materials, IAQ, site issues, waste, etc.**	**Waitakere City Council** **Hardcopy or electronic.**	**Very relevant, Printed in 1998. Download from:http://www.waitakere.govt.nz/AbtCit/ec/bldsus/shsummary.asp**
Green Home Scheme	**Sustainable building assessment tool and design assistance tool**	**Energy, water, material, IAQ, waste, fire, transport etc issues**	**BRANZ Ltd** **Hardcopy and electronic.**	**Very relevant, Printed 2005, Cost $100 per assessment. Contact: RomanJaques@branz.co.zn**
Your Home Technical Manual	**Fairly comprehensive examination of eco-specification and design issues**	**Energy, water, materials siting, etc.**	**NSW government** **Hardcopy, electronic, CD ROM DVD.**	**Free for Internet and CD ROM access, $40 for DVD version. Contact: www.yourhome.gov.au**
BBE's Eco Products and Services List	**National eco-sourcing data which is updated regularly.**	**Fairly comprehensive regional-based materials and products listing.** **Note: no selection criteria.**	**Building Biology and Ecology Group** **Hardcopy and electronic.**	**Very relevant, Printed 2005, Cost $10. Contact: www.ecoprojects.co.nz phone 0800 223 272.**

TABLE 4: (Cont)

TOOL	OVERVIEW	COVERS	SOURCE / MEDIA	APPLICABILITY
CONSTRUCTION MATERIALS CHOICE				
GABI- Life Cycle Assessment	Extremely comprehensive, computer-based life cycle tool, using mainly overseas databases.	Effects on fossil fuel availability, change to habitats, concentrations of ozone depletion, greenhouse gases etc	Scion Electronic copy (for expert user only)	Relevant, but requires experienced user. Updated frequently. Contact Barbara.Nebel@scionresearch.com
Environmental Choice NZ	Limited selection of environmentally-preferable building materials, but based on sound life cycle methodology.	Carpets, resistive type thermal insulation and paints. Plaster board probably added soon. Specs can be downloaded.	Enviro-Choice. Listing available www.enviro-choice.org.nz	Relevant, ongoing (but not updated frequently enough (e.g. paints). Cost: free
Easy Material Specification and Enviro-comparison	A simple but effective web based portal for comparing building materials. Provides specification support also.	Most building materials and systems (e.g. windows, roofs, wall paints, composite boards etc.	Web only on www.greenspec.co.uk	Very relevant (although some UK-only issues).
NZIA's Materials Comparison Charts	Mainly qualitative, reasonably comprehensive life cycle-based assessment sheets of building elements	Structure, roof and wall cladding, interior flooring, floor coverings, ceiling and internal wall linings, interstitial elements, ground bearing elements	New Zealand Institute of Architects Hardcopy only.	Very relevant, Printed 1996, Cost $125. Contact NZIA Auckland office at 09 623 6080
Life cycle costing	Limited comparative assessment of life cycle related issues for external WALL claddings. May include ROOF claddings late 2005.	Production, in-use and disposal related embodied energy, embodied CO_2 and financial costs.	BRANZ Ltd. Electronic on BRANZ web site only	Very relevant. Published 2005. Contact Ian Page at BRANZ 04 471 1170.

9. DIRECTORY OF SPECIALISTS

Table 6 is a directory of specialists that may be helpful to a NOW Home team. This listing is not meant to be comprehensive and Beacon Pathways Ltd does not make any recommendation or take any responsibility for their work.

TABLE 6: Directory of specialists

Generic Area	Specialist Area	Name	Organisation	Contact (email)	Phone
Acoustics	Acoustics; Acoustics modelling and testing	Grant Emms	Scion	grant.emms@scionresearch.com	07 343 5569
	Acoustic design	Robert Hallows	Winstone Wallboards	Robh@GIB.CO.NZ	
Sustainable Design	Sustainable home design	Robin Allison	Earth Song Eco-Neighbourhood	robin.allison@earthsong.org.nz	09 833 4409
	Sustainable home design	Robert Vale	Landcare Research	ValeR@landcareresearch.co.nz	
	Sustainable home design	Richard Lambourne	Lambourne Architects		09 361 2030
	Sustainable home design	Peter Diprose	Peter Diprose Architects	peter@diprose.co.nz	09 530 9065
	Sustainable home design	Matthew ter Borg	Matthew ter borg Architect		04 560 3759
	Sustainable home design	Greg Burn	Structure	structure.@ihug.co.nz	
	Sustainable home design	Andrew Stephenson	Dimensions	Andrew.S@dimensions.co.nz	07 579 2555
	Sustainable home design	Graeme North	Warkworth Architects		09 425 8216
	Sustainable home design	Tony Winter	Dwell	dwell@cear.net.nz	09 834 5206
	Sustainable home design	Antanas Procuta	Antanus Procuta Architects	Antanas@APArchitects.co.nz	
	Sustainable home design	Claire Chambers	Claire Chambers Architect	clairetaylor@clear.net.nz	09 379 3733
	Sustainable home design	Alex Greig	BBE	www.ecoprojects.co.nz/	
	Sustainable home design	John Storey	Victoria Uni	John.Storey@vuw.ac.nz	04 463 6200
	Sustainable home design	Carolyn Savage	Du Bois & Sauvignon	cisavage@xtra.co.nz	09 235 9091
	Sustainable home design	Graeme Finlay	Warren and Mahoney	graeme.finlay@wam.co.nz	03 961 5926
	Green Building Design issues	Katja Lietz	Waitakere City Council	katja.lietz@waitakere.govt.nz	09 8118957
	Green Building Assessment	Roman Jaques	BRANZ Ltd	RomanJaques@branz.co.nz	07 839 5360
Material Waste	Collection, site monitoring, landfill diversion	Pene Burns	Sinklair Knight Merz	PBurns@skm.co.nz	03 3632921
Energy	Thermal and energy analysis, modelling	Albrecht Stoecklein	BRANZ Ltd	AlbrechtStoecklein@branz.co.nz	04 23810383
	Energy monitoring, auditing, analysis	Andrew Pollard	BRANZ Ltd	andrewpollard@branz.co.nz	04 471 1170
	Energy monitoring, auditing, analysis	Mike Donn	Victoria University	Michael.Donn@vuw.ac.nz	
	PV and Solar Hot water systems	Carl Emerson	Freepower	moreinfo@freepwer.co.nz	09 476 4669
	Modelling, auditing, post occupancy analysis	Quentin Jackson	Building Workshop	quentin@buildingworkshop.co.nz	0274 926 245
	Modelling, auditing, post occupancy analysis	Barbara Joubert	Building Workshop	barabara@building workshop.co.nz	2740926245
Material Usage	LCA data; LCA modelling	Barbara Nebel	Scion	barbara.nebel@scionresearch.com	07 343 5637
	LCA modelling, embodied energy analysis	Roman Jaques	BRANZ Ltd	romanjaques@branz.co.nz	07 8395360
	Durability of materials	Chris Kane	BRANZ Ltd	ChrisKane@branz.co.nz	04 2381370
	Life cycle costing	Ian Page	BRANZ Ltd	IanPage@branz.co.nz	04 2381392
	Timber treatment and durability issues	Dave Page	Scion	dave.page@ensisjv.com	07 343 5782
Builders	Eco-building techniques, materials specification.	Alan Drayton	Alan Drayton Builders	drayton@ihug.co.nz	09 817 7177
Neighbourhood Design	Sustainable Urban Design, development	James Lunday	Common Ground	james.lunday@common-ground.co.nz	09 445 4020
	Community Design	Megan Howell	Waitakere City Council	Megan.Howell@waitakere.govt.nz	
Water Efficiency	Black and grey water systems	Dave Kay	Vortech		09 422 7984
	Water efficiency standards at a national level	Richard Taylor	EcoWater, Waitakere City Counci	Richard.Taylor@waitakere.govt.nz	09 835 0290
	Healthy water, water collection	Ian Gunn	Auckland Uni	i.gunn@auckland.ac.nz	09 579 2327
	Water efficiency, grey water	Katja Lietz	Waitakere City Council	katja.lietz@waitakere.govt.nz	09 8118957
	Water efficiency	David Kettle			
Other	Barrier-free design; Ergonomics	Dave Moore	Scion	Dave.moore@cohfe.co.nz	09 415 9026
	Accessibility	Vivien Naylor	CCS	info@no.ccs.org.nz	04 8010854
	Climate Change mitigation	Rachel Hargreaves	BRANZ Ltd	RachelHargreaves@branz.co.nz	09 524 0008
	Crime and Safety by Design	Mike Mills	Waitakere City Council	michael.mills@waitakere.govt/nz	09 836 8000
	Personal Health	Malcolm Cunningham	BRANZ Ltd	malcolmcunningham@branz.co.nz	04 237 1170
	Future proof	Duncan Stewart	Scion	Duncan.Stewart@scioresearch.com	07 343 5899
	Future proof	Susan Bates	Scion	Susan.Bates@scionresearch.com	07 343 5899
	Post occupancy evaluation	Chris Watson		Chris.Watson@PostOccupancyEvaluation.com	021 158 7874

10. FILTERING FRAMEWORK TO ASSIST WITH PRODUCT SELECTION

This filtering framework is intended to assist with the selection of products and systems for a Now Home. While not a scientific analysis tool it will be useful to qualitatively assess the merits of one product versus another. The filtering framework is based around the nine fundamental objectives of a sustainable home as defined by Beacon Pathway (Figure 1).

Personal Wellbeing

Definition
The effect the component or system has on the personal wellbeing, health and safety of the occupants of the home.

Considerations:

- Injury prevention
- Indoor pollution (including but not limited to: dust, moulds, VOCs, toxins, fibre irritants, allergens, EMFs)
- Moisture
- Protection from crime
- Temperature
- Quality of light
- Noise
- Air exchange/ventilation
- Protection from fire
- Accessibility
- Humidity

- **Scoring Scale**

L This product has significant negative effects on the wellbeing of the occupants.
M This product has no discernable effect on personal wellbeing compared with a recently constructed conventional dwelling built locally.
H This product has significant beneficial effects on the wellbeing of the occupants.

Community Wellbeing

Definition
The effect the component or system has on the health or wellbeing of the community. This includes the home's interaction with the local community, but also considers the effect of the manufacture, installation or disposal of the item(s) on the wellbeing of the communities involved in those processes.

Considerations:

- Urban design
- Private vs. public space
- Effect on the transport network
- Creation of local employment
- Wellbeing of manufacturing and construction staff
- Character of the neighbourhood
- Effect on neighbours

- **Scoring Scale**

L This product has significant negative effects on the wellbeing of the community.
M This product has no discernable effect on community wellbeing compared with a recently constructed conventional dwelling built locally.
H This product has significant beneficial effects on the wellbeing of the community.

Environmental Wellbeing

Definition
The effect the component or system has on the natural environment. This includes the effect on the immediate environment as well as the wider environment through all stages of the product's life cycle.

Considerations:

- Environmental practices of manufacturer
- Global warming
- Acidification
- Eutrophication
- Fossil Fuel Depletion
- Indoor Air Quality
- Habitat Alteration
- Water Intake
- Criteria Air Pollutants
- Smog
- Ecological Toxicity
- Ozone Depletion
- Human Health

- **Scoring Scale**

L This product has significant negative effects on the wellbeing of the environment.
M This product has no discernable effect on the environment compared with a recently constructed conventional dwelling built locally.
H This product has significant beneficial effects on the wellbeing of the environment.

Performance

Definition
The performance of the component or system for its intended function

Considerations

- Durability
- Quality
- Maintenance
- Moisture
- Structural performance
- Thermal performance
- Fire
- Noise
- Moisture
- Ability to meet Future Needs

- **Scoring Scale**

L This product or system, when installed in accordance with the manufacturer's instructions, fails to achieve its stated design function, either by direct failure or by failure to provide support to other items which have complementary or other functions.

M This product or system makes no discernible functional difference compared with a recently constructed conventional dwelling built locally.

H This product or system provides exemplary performance when installed in accordance with the manufacturer's instructions and in some cases will exceed the claimed performance, either in direct functionality or in support of complementary or other functions.

Desirability

Definition
The appeal of the component or system to the target audience. It is acknowledged that this criterion is highly subjective.

Considerations:

- Aesthetics
- Functionality
- Saleability
- Marketability

- **Scoring Scale**

L This product detracts from the desirability of the house when installed.
M This product is neither desirable nor undesirable compared with a recently constructed conventional dwelling built locally.
H This product enhances the desirability of the house when installed.

Affordability

Definition
The product or component is within the means of the target audience. The initial (i.e. upfront) monetary cost as well as the ongoing cost (i.e. any maintenance or replacement costs) should be taken into consideration. It is proposed that the total cost (i.e. initial plus maintenance and replacement) of the major elements should be calculated over at least 100 years.

Considerations:

- Capital cost
- Energy costs over the item's lifetime
- Water (and waste water) cost
- Other running costs
- Maintenance costs

- **Scoring Scale**

L This product or system's total cost over 100 years is very high, when compared to a similar product or system which has the same function.
M This product or system's total cost over 100 years is average.
H This product or system's total cost over 100 years is modest.

Energy Resource Management

Definition
The effect the product or system has on greenhouse gas emissions caused by the operating energy demand of the home. (Embodied energy is included in *Environmental Wellbeing*)

Considerations
- Grid supplied energy use of the home
- Type of energy used (renewable vs. non renewable)

- **Scoring Scale**

L This product or system is extremely fossil fuel intensive – uses non-renewable energy resources in areas where others will suffice.
M This product or system is on par with fossil-primary fuel consumption compared with a recently constructed conventional dwelling built locally.
H This product or system allows for very low fossil fuel consumption during occupancy phases.

Water Resource Management

Definition
The effect the product or system has on the sustainable management of water: storm water, waste water and potable water.

Considerations
- Amount of town supply water used
- Amount and quality of waste water produced
- Amount and quality of storm water discharged
- Waste water treatment
- Sensitivity of the environment discharged into

- **Scoring Scale**

L This product has a negative impact on water management.
M This product represents standard practice, i.e. compared to a recently constructed conventional dwelling built locally.
H This product significantly contributes to the sustainable management of water.

Solid Waste Resource Management

Definition
The product or system does not result in unnecessary solid waste generation during its whole life cycle.

Considerations

- Amount of waste generated
- Type and toxicity of waste generated
- Recyclability of materials and waste
- Use of recycled products
- Home composting
- Construction waste

- **Scoring Scale**

L This product is extremely material resource intensive with no provision for deconstructability or materials reuse.
M This product generates an average amount of solid waste during its life cycle.
H This product generates very little solid waste during construction and/or operation, or has excellent provision for deconstructability or material reuse.

APPENDICES

CASE STUDY DOCUMENTS RELATING TO THE FIRST BEACON NOW HOME BUILT IN NEW LYNN, WAITAKERE CITY

APPENDIX 1
LIST OF MATERIALS AND RATIONALE FOR SELECTION

System	Material Used	Brand	Dimensions	Supplier	Comments
Barge boards	Radiata H 3.1		150 x 25	Placemakers	
Bath		Sorrento	1675 long	Plumbing World	
Bathroom hand basins	Acrylic vanity top and bowl	Athena Eclipse	900mm wide to ensuite, 1000mm wide to bathroom	Placemakers	Bathroom is designed for accessibility, therefore has wall-hung vanity.
Bracing	angle brace strap and gib	Lumberlock strap, Gib		Placemakers, Winstone Wallboards	
Building wrap	Breathable plastic	Frameguard 2		Gib	Design Team and/or builder choice
Built in shelving	Plastic-coated wire			Wardrobes Direct	
Ceiling finish	Paint	Resene		Resene	
Ceiling insulation	Fibreglass	Pink Batts	R 5.0 batts	Tasman Insulation	
Ceiling lining	13mm standard Gib®	Winstone Wallboards		Winstone Wallboards	Similar cost to other alternatives, but lower embodied energy, better for internal lighting than wood, able to be recycled, non-combustible, non-toxic and low waste in production (e.g. water) and installation (material). NZ Kraft paper is generally sourced from radiata pine plantations - an abundant renewable source. Dust made when sanding plaster board may cause eye and respiratory irritation. One of the major problems associated with the use of plasterboard is the amount of waste generated and the lack of recycling in NZ. Large amounts of plasterboard are wasted during the construction process usually due to a mismatch between sheet and room sizes. Careful design and accurate quantity surveying can minimise waste.
Curtains	100% cotton	Kresta Blinds		Kresta Blinds	Lined with thermal lining. Curtain rail mounted close to wall to minimise convective heat loss
Dishwasher		Fisher and Paykel DW 691ED	860 h x 597w x 596d	Fisher and Paykel	
Door handles	Brushed stainless steel	Legge Diva		Placemakers	Lever for easy use
Down pipes	Polypropelene	Valsir		Waterware	To avoid PVC
Drainage	PVC			Norman Drainage	
Driveway	Solid concrete along wheel tracks, exposed aggregate with shell chip		150mm thick x 1 strip 1m wide, other strip 900mm wide.	Murray Douglas	The one nearest the front door to be one metre wide for disabled access; for this reason a loose surface is unsuitable. Driveway areas outside and inside car tracks is compacted gravel with shell chip.
Electrical switchboard				M.O.S. Electrical	
Electrical wiring				M.O.S. Electrical	
Entrance porch					Roof, soffit etc as for house
Exterior Cladding system	Radiata H3.1 bevel back weatherboard		200 x 25mm	Placemakers	Scores better on sustainability than other cladding materials
Exterior Door - garage	Coloursteel sectional overhead, Ironsand colour	Futura Sectional door	2120 x 2865	Pioneer Garage Doors	
Exterior Doors	Aluminium	Vistalite		Vistalite West	Double glazed

- bifold				Auckland	
Exterior Doors - entrance	Painted pine in aluminium frame	Saad Fig. 5	2138 x 860mm	Saad Joinery	
Exterior Finish	Paint	Resene		Resene	
Exterior taps	brass				
Fascia and gutters	Coloursteel fascia gutter system. Ironsand colour.	Triline Old Gothic	135mm fascia with 125mm spouting	Triline Spouting Systems	Insufficient impact on objectives to require input from remainder of team. Choice made by GJ Gardiner
Fridge		Fisher and Paykel E411T	1695h x 635w x 708d	Fisher and Paykel	
Foundation insulation	25mm polystyrene insulation to foundation edge with Hardiflex protection	EPS sheets 'S' grade	2.5m x 1.2m x 25mm	Styrobeck Plastics	In essence, the slab must be isolated from the heat sinks around it (in the form of the earth and air) to perform properly as a thermal store, which is its role in a passive solar house. Because we don't plan to heat the house and there is no floor covering, we have to avoid too much thermal mass in the floor – which would be the case if it is uninsulated or only the perimeter is insulated. In that case the energy losses may still be rather small but the floor surface would become uncomfortably cold. Therefore the thermal mass must be within the thermal envelope. (For a discussion of insulation and sustainability, see http://www.enviro-choice.org.nz/ and look at the resistive insulants document.)
Foundations and floor slab	Concrete slab and footings with 25mm polystyrene between the hard fill and the DPC. Dricon colour mixed into concrete		100mm thick concrete slab	Podflor Systems	Provides thermal mass when exposed to sunlight
Framing	Radiata H1.2		100 x 50	Carters and Placemakers	Enables house to be relocatable and a solid timber wall system does not achieve the R value
Garage door	see above No. 19				
Garden shed	Colorsteel	Kiwi garden shed	2.5 x 1.7m	Placemakers	
Hob		Fisher and Paykel CT560C	578w x 511 d	Fisher and Paykel	
Hot water cylinder	see solar heating system No.63				
Interior doors	Paint finish flush hollow core unclashed		1960 x 810mm	Placemakers	Design team choice
Interior doors - cavity sliders	Paint finish flush hollow core unclashed	Cavity slider Spacemaker CS	1980 x 860mm	Cavity Sliders Ltd	
Interior finish	Paint - breathable and low toxicity	Resene		Resene	EnviroChoice paint
Interior flooring - bedrooms	Carpet with rubber waffle underlay	Feltex Condor			
Interior flooring - garage	Concrete, sealed, uncoloured				
Interior flooring - wet areas	Polished coloured concrete				Easy to finish and low cost.
Interior flooring- living area	100% wool carpet with rubber waffle underlay	Norman Ellison Boston Moleskin		Commercial Carpet Services	

Interior lining - walls	10mm standard Gib®, Gib® Aqualine (wet areas) and Gib® Braceline (as required).	Gibraltar board		Winstone Wallboards and installed by Andrews Enterprises	Similar cost to other alternatives, but lower embodied energy, better for internal lighting than wood, able to be recycled, non-combustible, non-toxic and low waste in production (e.g. water) and installation (material).*
Kitchen bench top	Laminate	Formica "Concrete"		Pro-Tech (NZ)	
Kitchen cabinetry	Melamine	Bestwood Melteca Oyster		Pro-Tech (NZ)	
Kitchen appliances (oven, hob, dishwasher, fridge and range hood)		see individual items			
Laundry tub	Stainless steel	Robinhood Supertub		Placemakers	
Letterbox	Painted pine ply	Lodge Alpine		Bunnings Ltd	
Light fittings	20 light fittings including 4 pendant fittings to raking ceilings;	Various	20 watt and 15 watt Ecobulbs	EnergyMad	
Mouldings	Finger jointed radiata			Placemakers	
No of smoke alarms	5 x smoke alarms (wired-in non-ionising);				
No. of light switches					
No. of power sockets	15 double power points (400mm above FFL and some at 1000mm for accessibility); 1 x computer outlet 2 x telephone points and 2 x TV outlets; External sensor light; wiring and outlets as required for monitoring equipment.				
Oven		Fisher and Paykel BI 602C	595h x 595w x 562d	Fisher and Paykel	
Pergola	Radiata H 3.2			Placemakers	
Pergola roof	Clear polypropylene	Suntuf		Placemakers	
Plumbing pipes	Polypropylene	Fusiotherm		JDF Plumbing	
Plumbing tap ware	Chrome tap ware with flow and temperature limiters	Aquatica Smarte		Plumbing World	Ecowater specified
Rangehood		Fisher and Paykel RH 600 CRC	985h x 597w x 500d	Fisher and Paykel	
Roof cladding	Concrete tiles	Ross Hacienda		Ross Roofing	Preferred over clay tiles due to use of local materials and savings in transport energy
Roof Framing	Radiata H1.2			Carters	
Roof lining paper	Breathable paper			Ross Roofing	
Roofing battens	Radiata H1.2		50 x 50mm	Ross Roofing	
Roofing insulation	see No. 8 ceiling insulation				
Shower	Chrome	Aquatica		Plumbing World	With flow reducer to 9 litres/min

hardware (taps/rose)		Smarte mixer with Methven rainfall slide			
Shower box to ensuite	Showerwell combo shower tray and lining with aluminium pivot door and safety glass in ensuite	Showerwell	900 x 900mm	Showerwell Home Products	
Site works				Pro-Floors Ltd Civil	
Sliding wardrobe doors	see below				
Soffits	Fibre cement sheet	Hardiflex	4.5mm	Placemakers	
Solar heating system		Solahart Streamline Electric	340 litre, 1.7h x 650mm diameter	Solahart Industries Pty Ltd	Panels on the roof, hot water cylinder in cupboard, pumped system
Solar light tube over kitchen bench	Solar tube	Solatube	400 mm dia.	HomeTech	Improves natural light
Splashback to kitchen bench	Ceramic tiles	Copenhagen	150 x 150mm	Midas Interiors	
Tiles to bathroom floor	Ceramic tiles	TCM Ragione White	300 x 300	Midas Interiors	
Tiles to bathroom walls including shower	Ceramic tiles	Lily	200 x 200	Midas Interiors	Tiled shower with level access and sufficient space to enable wheeled access (e.g. wheelchair, walking frame) in main bathroom
Toilet bowls & Cistern	Ceramic bowl	Caroma Sovereign 2000 WC pan		Plumbing World	Caroma Care push button option on the cistern to the bathroom WC only
Vanity for bathrooms	see No.3 bathroom basins				
Wall Framing	Radiata H1.2			Carters	
Wall Insulation	Fibreglass batts	Ultra Batts R3.0			
Wardrobe doors	Painted Gib board in aluminium frame	Wardrobes Direct		Wardrobes Direct	
Washing line	Plastic line with steel posts	Hills Extendaline	3.5m long	Installation Contractors	
Water tank	Polypropylene	Bailey	13,500 litre, 2.8 diameter x 2.5 high	Bailey Tanks	
Water tank - TankVac		TankVac		Connovation	Syphons dirty water from the bottom of the tank when tank overflows, rather than the clean water from the top.
Window frames	Double glazed aluminium with powder-coated finish and passive-vented opening	Vistalite		Fletcher Aluminium	Cheaper than timber options by approx $6000
Window glass	Plain glass - double glazed		IGUs with 4mm glass and 12mm spacer	Pilkington glass	Sustainability framework scores suggest preference for double glazed vs single glazed and timber vs aluminium.

* Additional notes re interior wall linings: Visy's effective recovery rate that is the amount of paper packaging recovered as a percentage of paper produced is 98.3% and they recover 138% of the paper products they sell through Visy Board and Visy Specialties. Gypsum plaster is a non-renewable but abundant resource. Mining can cause habitat loss, soil erosion & water pollution unless carefully controlled. CO2 emissions from limestone processing. Paper lining from sustainable forests in NZ. Additives can include starch, lime, chemical accelerators, glass fibres, vermiculite (fire resistance), paraffin wax (water resistance). 10% of GIB products discarded due to inability to reuse off-cuts if not full sheet size. There was a product available to do this previously, named Dozlock clip, for joining off-cuts, but did not gain BRANZ Appraisal certificate as Gib did not certify it for use with their product range. FR has been unsuccessful in locating the inventor of the Doz lock clip system this year. Lowest Total system cost focus. GIB(r) Toughzone produced to enhance lifecycle cost and reduce maintenance. Dust from sanding may cause eye and respiratory irritation; mask and goggles advised. GIB(r) as a company has a large commitment to both smart growth and beacon initiatives (investing back into the community). Likewise the Chairman of Visy Industries Richard

Pratt AC, together with Jeanne Pratt AC, established the Pratt foundation in 1978 with a vision to provide support to charities throughout Australia and the world. Plasterboard manufactures in particular GIB(r) support the building industry and the individual smaller NZ building companies through various sponsorships with organisations such as MBA, CB, Property Council, etc. There is an on-going commitment from Plasterboard Manufacturers and distributors to keep the installers of their product trained in "Best Practice" to eliminate call back to jobs from various faults, minimise wastage on site and enable them to improve their business. High market share due to smooth finish and low-cost; Plasterboard lined houses tend to be demolished rather than deconstructed, due to difficulty in taking off the plasterboard, and lack of secondary market for plasterboard except as a soil conditioner. Plasterboard is the preferred Internal wall lining for 99% of New Zealand Homes confirming its desirability as a wall lining. GIB(r) living Solutions Program and joint development with industry partners and builders. Ease of renovation, decoration, and installation. Plasterboard is a wall lining developed product only. Plasterboard has a very low embodied energy rating compared to other lining material. On top of this Tight construction can be achieved - the lining acts as the control mechanism for air pressure gradient across the wall, improving insulation performance and reducing internal leakage and drafts from within the home. Plasterboard also helps to reflect light making the most of natural light. Greenhouse Gas emissions from Visy Pulp and Paper operations. Greenhouse efficiency improved from 1.25tCO2-eq per tonne of production in 1996/7 to 1.19tCO2-eq per tonne in 2001/2 making emissions in 2001/2 20,000 tonnes lower than they would have otherwise been. Paper lining of GIB(r) is made from 100% recycled paper (with the exception of GIB(r) Ultraline where a superior finish is required.). VISY Industries the suppliers to Winstone Wallboards Ltd of all their paper lining products has a strict Environmental Management Plan to achieve and maintain compliance with all relevant environmental laws, regulations and standards as well as the company's voluntary public commitments. To Identify and manage environmental risks and set and achieve targets for improving their performance the Plan is based on and has to conform to ISO 14001 - The International Standard for environmental management. Minimal maintenance for lifetime of building if kept dry and protected from impact. Simple to repair. Requires applied finish needing periodic replacement. Gypsum not a renewable resource, and shipped from Australia?; Bracing properties good, but evidence of punch through and indentations, especially in rental properties, due to lower toughness and lower hardness of material; For retrofitting, due to poor screw holding, and tendency to stop, it is difficult to remove panels easily and reuse them; Needs rawl plugs to install most hanging items, so that no tear out occurs; Smooth finish, and ability to have seamless walls, due to stopping process. Plasterboard is a specifically manufactured product for internal wall and ceiling linings. Development has allowed the introduction of specialist additives and products to deal with moisture issue in a wet areas, extra strength in areas suffering from high levels of impact, bracing, noise control and superior smooth finishes for feature areas in a home for a fraction of the total building cost. Soft body impact tests undertaken by BRANZ in accordance with ISO 7892:1998 during March 1997 show that GIB(r) Toughline 12mm failed at an impact of 247-271J compared other products including Fibrocement. Only 6mm MDF and 9mm Plywood out performed it. Under the reduction of waste management strategy by the Queensland Governments "Rockhampton House" Wider hallways (part of smart housing program from xxx) with a min width of 1200mm were provided as part of the design brief along with 13mm reinforced plasterboard (equivalent to GIB Toughline) in these high traffic areas. GIB(r) Site guide for hanging stuff. Non-toxic, inert, non-combustible. Emissions only from additives to finish materials. Moderately high chemical sink potential for unsealed plaster. Air permeable, permits diffusion to outside air unless non-permeable coating used. Healthy Home Solution is a GIB(r) system to control internal moisture including weather tight solutions to control mould and mildew. Fire Safety Solutions, Noise Control Solutions for peaceful living and no harmful emissions from products. Waste used for compost or land filled. Sheet lengths are designed to reduce waste and Plasterboard is a wall lining specific developed product. Gypsum is a recognised soil conditioner; there is large potential for waste recycling in the future. Paper production uses large volumes of water and produces potentially serious water pollution unless carefully controlled. Minimal waste water input from production, benign water effluent. Visy's efforts in water conservation and in-mill recycling resulted in water use per tonne of production falling by 11% in 2001/2 averaging 5.48 KL/tonne of production across Visy's paper mills. This is well below the Australian paper industry average of 40.2 KL/tonne.

APPENDIX 2
DESIGN BRIEF FOR BEACON NOW HOME LOCATED AT NEW LYNN IN WAITAKERE CITY

FR Project # N58201NOW House

Detailed Brief for Olympic Place NOW Home

Dave Moore
Karen Bayne
Katja Lietz
Albrecht Stoecklein
Roman Jaques

Mike Collins
Jo Duggan
Grant Emms
Russell Burton
Chris Kane
Louw van Wyk

May 2003

Approved for Release:

____________________________	____________________________	________________________
Russell Burton	**Harry O'Rourke**	**Wayne Sharman**
Manager, Science Futures	**Chief Executive**	**Executive Manager**
FOREST RESEARCH	**WAITAKERE CITY COUNCIL**	**BRANZ LTD**
Date:	**Date:**	**Date:**

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CONTACT LIST

Name	Organisation	Phone	Mobile	Email
Russell Burton	Forest Research	07 343 5519	0274 737 575	Russell.Burton@forestresearch.co.nz
Karen Bayne	Forest Research	07 343 5372		Karen.Bayne@forestresearch.co.nz
Mike Collins	Forest Research	07 343 5762		Mike.Collins@forestresearch.co.nz
Bryan Walford	Forest Research	07 343 5761		Bryan.Walford@forestresearch.co.nz
Louw van Wyk	Forest Research	07 343 5546		Louw.vanwyk@forestresearch.co.nz
Grant Emms	Forest Research	07 343 5569		Grant.Emms@forestresearch.co.nz
Charles McIntosh	Forest Research	07 343 5397		Charles.McIntosh@forestresearch.co.nz
Dave Moore	Forest Research	09 415 9026	025 290 6954	Dave.Moore@forestresearch.co.nz D.J.Moore@massey.ac.nz
Chris Kane	BRANZ	04 238 1372		ChrisKane@branz.co.nz
Roman Jaques	BRANZ	04 238 1367		RomanJaques@branz.co.nz
Albrecht Stoecklein	BRANZ	04 238 1383		AlbrechtStoecklein@branz.co.nz
Wayne Sharman	BRANZ	04 237 1170		WayneSharman@branz.co.nz
Jo Duggan	GIB	09 633 0188	027 2751131	Joanned@gib.co.nz
Kevin Golding	WWB	09 633 0105	025 424 255	Keving@gib.co.nz
Greg Burn	Structure		0274 736 164	Structure@ihug.co.nz
Kimball Fink-Jensen	QWANT		021 654 357	Kimball.fink-jensen@qwant.com
Barbara Joubert	EECA	04 470 2200		Latitudes@paradise.net.nz Barbara.joubert@eeca.govt.nz
Katja Lietz	WCC	09 836 8000 (8365)		Katja.lietz@waitakere.govt.nz
Annika Lane	WCC	09 836 8000		Annika.lane@waitakere.govt.nz
Alan Duxfield	WCC	09 836 8000		Alan.duxfield@waitakere.govt.nz
Robin Allison	Co-Housing NZ	09 833 4409		Ecohousing@xtra.co.nz
John Sutherland	University of Auckland	09 373 7999		
Robert Vale	University of Auckland	09 373 7599		r.vale@auckland.ac.nz

Detailed Brief for Olympic Place NOW Home

Overview

The NOW House research project is about **building houses for the post-Kyoto environment** (2012-2015), but constrained in that it can **only utilise NOW materials/ technologies** (those currently available or able to be achieved today).

The work is being conducted by Forest Research in collaboration with BRANZ, EECA, WCC, and WWB. Forest Research holds ownership of the project, which is being funded through the Foundation of Research Science and Technology under 2 contracts [contract number CO4X0215 being Research for Industry funding, Objective 2: Concept House; and FR Contract 'Value through Design' being NSOF funding projects N58201 & N58301].

It forms part of a larger piece of work on Sustainable Cities and the Built Environment being proposed by the Beacon Consortia over the following six years.

Project Aims

1. The NOW House project aims to research and encapsulate what we know today about best practice in meeting the needs of the next decade – the 'post-Kyoto'[1] society. Identified should be: preferred design processes, design ideas and also identifiable gaps in the knowledge.
2. The project aims also to demonstrate this via one possible built solution on a given site.
3. The built demonstration house will not be a show home, but is rather an attempt to physically represent best practice, in order to assess gaps in meeting the needs and therefore set research priorities for future housing projects.
4. While recognising the limitations of studying a single house in isolation, the project will also install adequate provision for energy, thermal, water and moisture metering (wired-house) for evaluative purposes; and study waste streams and labour processes during the construction process.
5. All system decisions will be the most appropriate for the situation with regard to the following filter elements (as described in Appendix A: Filter Elements):
   - Affordability (capital and running costs)
   - Resource use (labour, land, transportation, sustainable and renewable materials)
   - Energy efficiency (operating and embodied)
   - Desirability (heritage, fashion, comfort and aspiration)

[1] 'post-Kyoto' refers to the time period after the 2012 reporting period under the terms of the ratified Kyoto protocol. It indicates a time period 10-15 years hence, whereby certain societal changes have been anticipated due to lifestyle and demographic trends and indicators, as well as the Government regulatory environment which will affect both consumers and industry players.

- ♦ Performance (durability, seismic, fire, wind-loading) also Future-proof (functional needs, flexible design, maintenance needs)
- ♦ Water and Waste management (minimised city-supply water usage, reusability and/or recyclability)
- ♦ Personal Health (physiological, safety and security, peace/relaxing(mental))
- ♦ Community Health – (social cohesion, neighbourhood etc)

6. None of the above filter elements is to be regarded as any more or any less important than any other filter element.
7. The project will reflect the Vision throughout: be inspiring & affordable (appeal), healthy and resource efficient (sustainable), smart, innovative and marketable (education) and fit for purpose for the needs of future 'post-Kyoto' society (performance).
8. House design will need to provide a 'meaningful' house to reflect NZ character and values.
9. The house is being designed with the average New Zealand family in mind. The costing is therefore something which is within reach for most (with a 10-20% deposit), but for which they will still need to save and work quite hard towards obtaining.
10. The completed construction will be finished with interior chattels such as that of a vacant possession sale, with modest exterior landscaping. Appliances to be included in chattels include an oven, a dishwasher.
11. The Now House is about building a home requiring whole house considerations in terms of Function, Light, Indoor Air Quality, Safety and Security, Cost, Warmth, Acoustics, Aesthetics, Energy Use, and Environmental friendliness. The benefits of this house will be a home that is: of higher quality, more comfortable, safer, quieter, requiring less maintenance and is more durable incurring lower monthly operating costs to support a state of complete physical mental and social well-being for its occupants.
12. Aim to use the least environmentally-damaging and resource-intensive materials.

Values:

- Setting a benchmark for best practice.
- The performance requirements are better than Code minimum.
- Make the best decisions possible given appropriate and reasonable analysis. (Remember the 80:20 rule).
- Describe your goal, how will you measure success and how will you confirm success.
- Behind every decision is a story – ensure your story is in the log.
- Making a mistake is forgivable, not trying is not forgivable.
- The best personal ethics – we do not accept personal gifts – any gifts to the project are officially notified and recorded, and included in the budget.
- All material and system decisions to be run through the decision filter.
- Unless there are strong reasons why not we use New Zealand-based biologically-derived sustainable and renewable resources.
- It is difficult that's why we have the best team.
- You CAN be SMART and INNOVATIVE within a NOW framework.

Success is?

Success	Performance indicators.
A HOUSE that sets a new "benchmark" for understanding sustainability in the framework of affordable and desirable.	▪ Detailed performance criteria with at least 90% of these criteria met. ▪ We break the mould – eco and sustainable are affordable and desirable ▪ National interest in the house is very high ▪ We achieve innovation within a NOW Framework.
A HOUSE that requires significantly less water, energy, resource to operate than a "typical" house.	▪ We achieve 60% of "typical" resource demands.
We will have created a decision framework that we can build into a powerful future tool.	▪ We have developed a baseline decision filter system. ▪ We will have developed a sustainable framework of real and meaningful value.
We will have exposed knowledge gaps.	▪ Created a log of key issues relating to buildings that are otherwise not dealt with.
Created opportunities for the future.	▪ A list of great ideas ready to be tested in retrofit or new build solutions.
We know why we have made ALL decisions.	▪ Every decision and issues affecting those decisions are documented.
We have created a platform that will set precedents for House design.	▪ Developed a system for House design ▪ Set protocols for design focussed on sustainability.
We have captured the attention of the Nation.	▪ Media exposure ▪ Web hits ▪ Demand for information.
We will achieve significant and sustained change in the thoughts, behaviour and uptake of ideas of all people affected throughout the residential value chain.	▪ Code changes and bylaws reflect project aims and outcomes ▪ People come to us as the source of best practice in residential building

SUMMARY SHEET OF PERFORMANCE SPECIFICATIONS, TARGETS AND MEASURES OF SUCCESS

NB: WE MUST INDICATE TARGET VALUES – (Recognising that many may be highly estimated)

Home Value	Component	Success determined by achievement of following 'A' grade performance specs:	Measurement method	Target	Justification for target (references)	Score*
Affordability	Capital cost	1.1; 1.2; 1.4; 2.1; 3.6	Total cost of construction.	$150,000 (+15,000 for operating benefits)	Based on market demographics	
	Operating (energy and general maintenance) costs	1.3; 3.12; 4.4; 6.2; 6.6; 7.2; 11.1; 13.7	Energy: sum monthly energy bills Maintenance: sum maintenance diary expenses for year.	Energy bills: ≤ $550/yr Maintenance: ≤ $600/yr for first 15 yrs.	EECA national average figures (halved); Ian Page.	
Desirability	Ergonomics	2.3; 2.4; 2.5; 2.6; 10.1	Adherence to Standards	'Good' rating, POE review*	Arbitrary	
	Aesthetics	1.3; 9.1; 13.5; 14.1; 14.2; 14.3	Post Occupancy review of occupier	'Good' rating, POE review*	Arbitrary	
	Saleability (Resale)	2.6; 9.1; 13.5; 14.1; 14.2	Resale value/ Valuation	N/A	Not likely to be on-sold.	
	Useability (Functionality)	2.3; 2.6; 2.10; 3.12; 3.13; 8.1; 13.3	Post Occupancy review of occupier	'Good' rating, POE review*	Arbitrary	

Home Value	Component	Success determined by achievement of following 'A' grade performance specs:	Measurement method	Target	Justification for target (references)	Score
Performance	Structural *Earthquake, wind, loads*	3.1; 3.6	N/A	N/A	NZBC compliance	
	Fire	10.1; 10.3; 10.4	N/A	N/A	NZBC compliance	
	Thermal	6.2; 6.6; 6.8	Calculated performance using ALF to find BPI and monitoring of thermocouples (with meter-board loggers).	Indoor temp. between 18 and 25°C for all but 10 days/year.	Various (inter)national sources[2]	
	Indoor Air Quality	1.10; 5.2; 5.3; 11.1; 11.4; 11.7; 13.2	None- pollutants levels cannot be compared to normal houses, as too user/situation dependant.	No sensible targets could be established.	Various (inter)national sources[3]	
	Noise (Internal)	9.2; 9.3; 9.4	Sensor in lounge and bedroom	Quiet areas ≤ 27 dB(A). No plumbing noise.	Various international sources[2]	
	Noise (External)	9.1	Acoustic sound testing results	N/A	Uncontrollable.	
	Future proof - *Flexibility and services provision.*	2.3; 2.6; 2.10; 3,12; 3.13	(Needs to be assessed well after NOW House built)	'Good' rating at POE review*	Arbitrary	
	Light	7.7; 8.1; 8.2	Post Occupancy review of occupier	'Good' rating at POE review*	Occupant-dependent.	
	Durability	5.1; 5.2; 6.8; 8.4;	Maintenance and bio-deterioration - POE	'Good' rating at POE review*	Arbitrary	
	Moisture	5.1; 5.2; 5.3;11.4	In-wall MC monitoring results. No targets for room ambient air RH, as too dependant on occupier.	mc in wet-area framing to be similar to general framing mc, at between 10-14% MC.	BRANZ studies[2].	

** POE – We will be developing our own specific format based on common approaches from literature. Dave M has undertaken to develop this, as although we have the advantage of a far more detailed brief to use as the starting point for our environmental monitoring, the functionality is invariably a lot more vague right now as we are producing a spec building for a very generally described population, rather than for an individual client which is more usual and easier to set qualitative targets around..*

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[2] See associated Multi-Criteria Decision Matrix for details
[3] See associated Multi-Criteria Decision Matrix for details

Home Value	Component	Success determined by achievement of following 'A' grade performance specs:	Measurement method	Target	Justification for target (references)	Score*
Personal and Community Health	Health & Safety	2.4; 5.3; 8.1; 9.1; 10.1; 10.3; 10.4; 11.4; 11.6; 11.7; 13.3	N/A	N/A	Impossible to measure.	
	Privacy	1.6; 9.1; 1.10	Post-occupancy review	'Good' rating at POE review*	Arbitrary	
	Security	1.10;	Post- occupancy review	'Good' rating at POE review*	Arbitrary	
	Comfort	1.3; 1.10; 6.2; 6.6; 6.8; 8.4; 9.1; 9.3; 11.1; 11.4; 11.6; 13.2; 14.3;	Post- occupancy review	'Good' rating at POE review*	Arbitrary	
Resource use	Water consumption	4.6; 4.8; 4.9; 7.6; 13.8; 4.10	Monitoring of public supplied (i.e. reticulated) and toilet only	Total: ≤ 90 l/person daily.	WCC (Katja Lietz)	
	Energy consumption	7.2; 7.7; 8.1; 11.1; 13.3	Monitoring of meter box.	Less than 5070kWh/yr	BRANZ HEEP data, halved.	
	Embodied energy	3.12;	Calculated/estimated from final design	890 MJ/m^2 for floor/walls/roof only (for light construction)	N. Mithraratne (2001) and Andrew Alcorn (2003).	
	Land use (impact)	1.3; 13.2; 13.5; 13.7; 13.8; 13.9;	Area disturbed by development, and volume of land resources used in construction and landscaping	N/A	Targets very site-specific.	
	Water production (*grey and storm*)	4.8; 13.6	None – as too difficult to measure accurately.	N/A		
	CO_2 emissions		Derived (converted) from bought power	≤ 2650 kg CO_2/yr gas/electric mix; or ≤ 3250 kg CO_2/yr all elect. system)	Based on predicted energy use and marginal electricity CO_2 emission of 0.64kg/kWh.	
	Materials (*sustainable, renewable, non-toxic, healthy*)	3.6; 3.12;	TBA	TBA.	TBA.	
	Waste	4.4; 4.6; 13.1	Monitoring during construction phase; Volumes produced during occupancy recorded	≤ 4 m^3 in total; ≤ 5 kg/ HH/wk	REBRI, BRANZ and WasteMINZ studies[2].	

Note that in assessment of success measures, we will endeavour to score the **completed** NOW house using internationally recognised scoring systems such as (Barbara's system) and/or the Green Home Scheme, to enable suitable comparisons to be made.

This Brief

This document provides the link between the extensive research and consultative process feeding information into the design, and the final solutions developed for the specific site in Olympic Place. A generic brief for the NOW House concept will be produced separately.

- The Performance Specification column sets out what the designer should aim to achieve, it does not state how. The bullet points indicate how success will be measured, by whom, and when.
- These individual Performance Specification are prioritised to assist the designer in making the best overall trade-offs as the design is knocked into shape.
- The next column provides the reasoning behind the Performance Specification and possibly links to further information to assist design.
- The Designers Log column within the brief is included to ensure that we capture the processes behind the design decisions made. This project is unique in its team composition and approach, and so the design process including: expert input, specific resources used and rationales for final decisions, will be of great interest to the architectural and related professions. The Log is also intended to provide a mechanism for internal communication amongst the team which being large and widely spread may otherwise have inadequate understanding of the thinking behind the finished building

Notes: It has also been discussed that a check column or columns should be added to make it faster to identify at what stage the item will be checked in the design, and by whom.

For example: WCC.

Check 1 Developed design.

Check 2. POE [Post Occupancy Evaluation].

This version of the brief may be in spreadsheet form as part of a larger database.

DESIGN CONSTRAINTS

These are uncompromiseable 'Givens' that the design must adhere to:

CONSTRAINT	**REASON** *(these should all be referenced if at all possible!)*	**DESIGNER SIGN-OFF WHEN CRITERIA MET.**
Site to be that offered by WCC at Olympic Place, New Lynn. • Site specified in design and resource/building consents	Site chosen	________________ Date __________
House design must enable relocation after 2 years • Ability to relocate	Site and ownership restriction	________________ Date __________
5 m max height • Design compliance to this height restriction	Site requirement	________________ Date __________
To be designed to meet local body requirements. • WCC resource and building consent gained	The house should not get 'special treatment' from WCC.	________________ Date __________
House to be built to an NZ$150,000 budget, excluding: GST, land purchase, professional fees. • Budget estimates to be generated at concept, developed and contract document stages • Quantity Surveyors report on completion [hand over].	Reflects the local demographic data and market (from StatsNZ 2001 Census figures, collated by Strategic Group, WCC). Gives potential occupants in the area a realistic idea of what is attainable.	________________ Date __________
Adequate provision for operational monitoring as per Project Aim 4 •	Project requirement	________________ Date __________
Comply to all legal requirements and implement at least minimum standards as outlined in NZBC • Code of compliance certificate	Legal requirement	________________ Date __________
Wired house – ability to connect to services later, even if not yet provided. (Internet and Sky a must, things like security, Jetstream, other 'new and emerging' technologies need to have provision for hooking in later). • Ability to upgrade house with technology change.	Project Requirement. Need for technology enabled homes, and future provision of services. Minimise installation costs for the future. MOVE TO SITE/LOCATION?	________________ Date __________

CONSTRAINT	REASON *(these should all be referenced if at all possible!)*	DESIGNER SIGN-OFF WHEN CRITERIA MET.
Install smoke detectors in 2 areas of house, and install fire extinguisher and/or fire blanket in kitchen and garage • POE check	Fire Service recommendation	________________ Date __________
Install low-flow showerheads and taps (9 l/min or less) • POE check	Water conservation. (SAA MP 64-1995)	________________ Date __________
Incorporate ventilation methodology into design • Check final design	Innovation requirement	________________ Date __________
No use of deadlocks • Audit item at completion stage	Deadlocks are seen as an irritant and safety risk. [Ref?]	________________ Date __________
The design should NOT incorporate an in-sink waste disposal unit • Check with final plans	Sink disposal units use much water, discourage composting and overload the sewerage system (Ref?).	________________ Date __________
Provide space in kitchen for organic collection • Provide a space of 5 litres	Reduce green houses gases, reduces waste disposal to landfill and increase the amount of nutrients on-site (Ref?).	________________ Date __________
Provide space for non-organic recycling bins (at least 2) located near (or in) the kitchen • Bin to be a combined volume of 20 litres or more.	Reduce waste to landfill; Council likely to introduce organic collection;	________________ Date __________
Provide for rainwater collection and reuse. Reuse for toilets and garden rainwater use. • Detailed design to be checked with at least 80% reduction in average water use for toilets and garden.	Lowers town supply water use while using natural on-site resources	________________ Date __________
Energy Efficiency measures to be prioritised according to HEEP findings (eg. Hot water heating high priority)	Energy efficiency measures taken need to be shown to be in most effective areas	________________ Date __________
Weather tight (as far as practicable) but breathable envelope. • monitor moisture content of frames • incidence of leaks • incidence of mould growth	4D's document (Hazleden et al.) spells out the need for various aspects for weather tightness. Need to ensure if water gets in, it can get out again –hence breathable	________________ Date __________

CONSTRAINT	**REASON** *(these should all be referenced if at all possible!)*	**DESIGNER SIGN-OFF WHEN CRITERIA MET.**
Utilise solar water heating circulation system and thermal mass storage for under-floor or preliminary water-heating.	Innovation requirement	________________ Date __________
Passive solar-panel for pre-heating of hot water • Check building consent provision	Hot water accounts for major power use in homes (ref = HEEP..?)	________________ Date __________
Passive design for heating of internal environment. allowing an ambient temperature of between 18 and 25 degrees C, for all but 10 days of the year • Number of days below 18 or above 25 degrees C from temperature measurements • Number of days where occupant took active measures to control temperature to maintain thermal comfort	Energy efficiency and comfort (Ref = WHO)	________________ Date __________
Emphasise natural lighting where possible • Ensure every room has access to natural light • Room does not require artificial lighting during 9am-4pm year-round	Natural lighting better for health, energy efficiency and productivity(ref)	________________ Date __________
Emphasis on efficient lighting where practical • Monitor energy required to run lighting	Efficient lighting reduces energy used and excess heat generated. (ref=HEEP)	________________ Date __________
Appropriate shading and protection from wind, UV and water to reduce maintenance and deterioration of assets. • Maintenance required from maintenance log • overheating	Future-proof requirement, given high likelihood of intensified climatic conditions (ref).	________________ Date __________
Use of only naturally sustainable and renewable (bio-based) materials in core systems and products unless it is inappropriate to do so (i.e. does not meet core design brief criteria, or no bio-based products/systems currently available that meet performance needs). Use of materials with lowest toxicity and health impacts practicable, if known. • Volume of non-renewable materials used	From a range of comparative studies, biomaterials (especially wood) are recognised and well understood to be the materials of choice for sustainable buildings (esp. given they are New Zealand's only available sustainable and renewable building resource apart from wool) due to higher performance cf. other materials across a wide range of filter criteria, including: cost; seismic (Rainer, H.J. and E. Karacabeyli. 1999) and fire	

	performance (Sultan, M.A., V.R. Kodur, L.R., Richardson and R.A. McPhee 1997), structural loadings (Tiemann, H.D. 1951.), recreational facilities, labour (simplicity of tools and recognition of system), local material availability, ability to change and upgrade systems later, ability to access services, affective qualities of natural wood finishes (Ridoutt et al.2001; Broman 1995; and Sadalla & Sheets 1993) as well as the following environmental qualities (as outlined from ASMI comparative tests by Trusty and Meil 1999)which included ground disturbance, embodied energy, water and air toxicity, global warming potential, resource use and waste generation.	________________ Date __________
Use plant species compliant with WCC guidelines for area • Check with WCC Parks Dept for landscaping plant choices	WCC Parks and Ecomatters Trust requirement	________________ Date __________
Minimise impermeable areas. • % of impermeable area	Impermeable surfaces increase the amount and speed of stormwater runoff. They contribute to flooding and water contamination.	________________ Date __________
Product and material choices will be made in consultation with the appropriate expert(s) as highlighted in each section of the brief, through use of Filter in Appendix a. • Signoff of design choices relevant to each section by an appropriate named expert.	Process requirement.	________________ Date __________

Ranked Performance Specifications – A's

PS	Rank	Benefit Components	Sustainability factors	Designer's Log
1.1	A 10+	Capital Cost	Affordability	
3.1	A 10+	Structural	Performance	
6.6	A 10+	Thermal Operating Cost Comfort	Performance Affordability Personal & Community Health	
6.2	A 10+	Thermal Operating Cost Comfort	Performance Affordability Personal & Community health	
2.1	A 10+	Capital Cost	Affordability	
1.2	A 10+	Capital Cost	Affordability	
11.1	A 10	Air Quality Operating Cost Comfort Energy Consumption	Performance Affordability Personal & Community health Resource Use	
6.8	A 10	Comfort Durability Thermal Light	Personal & Community Health Performance Performance Performance	
13.3	A 10	Energy Consumption Health & Safety	Resource Use Personal & Community health	
13.9	A 10	Land use	Resource use	
13.8	A 9	Land use Water Consumption	Resource use	
4.8	A 9	Water Consumption Water Production	Resource Use Resource Use	
1.3	A 9	Land Use Ambience Comfort Operating Cost	Resource Use Desirability Personal & Community Health Affordability	
5.1	A 9	Moisture Health and Safety	Performance Personal & Community Health	

		Durability	Performance	
13.5	A 9	Land Use Ambience Saleability	Resource Use Desirability Desirability	
13.2	A 9	Land Use Comfort Air	Resource Use Desirability Performance	
5.2	A 9	Moisture Durability Air	Performance Performance Performance	
4.9	A 9	Water consumption	Resource Use	
1.4	A 9	Capital Cost	Affordability	
7.2	A 9	Energy Consumption Operating Cost	Resource Use Affordability	
13.7	A 8	Land use Operating Cost	Resource Use Affordability	
7.6	A 8	Water Consumption	Resource Use	
13.1	A 8	Waste	Resource Use	
9.1	A 8	Noise Comfort Health & Safety Privacy Ambience Saleability	Performance Personal & Community Health Personal & Community Health Personal & Community Health Desirability Desirability	
8.1	A 8	Light Health & Safety Useability Energy Consumption	Performance Personal & Community Health Desirability Resource Use	
10.1	A 8	Ergonomics Health & Safety Fire	Desirability Personal & Community Health Performance	
7.7	A 8	Light Energy Consumption	Performance Resource Use	
11.7	A 8	Health and Safety Air	Personal & Community Health Performance	

1.10	A 7	Privacy Air Comfort Security	Personal & Community Health Performance Personal & Community Health Personal & Community Health	
8.4	A 7	Comfort Light Durability	Personal & Community Health Performance Performance	
4.6	A 7	Water Consumption Waste	Resource Use Resource Use	
2.6	A 7	Saleability Useability Ergonomics Future proof	Desirability Desirability Desirability Performance	
13.6	A 6	Water Production	Resource Use	
9.3	A 6	Noise Comfort	Performance Desirability	
2.10	A 6	Future Proof Useability	Performance Desirability	
3.12	A 6	Useability Operating cost Future proof Materials Embodied Energy	Desirability Affordability Performance Resource use Resource use	
10.4	A 6	Fire Health & Safety	Performance Personal & Community Health	
11.6	A 6	Health and Safety Comfort	Personal & Community Health Personal & Community Health	
1.6	A 6	Privacy	Personal & Community Health	
14.3	A 5	Ambience Comfort	Desirability Personal & Community Health	
11.4	A 5	Air Moisture Health & Safety Comfort	Performance Performance Personal & Community Health Personal & Community Health	
3.6	A 5	Capital Cost	Affordability	

		Materials Structure	Resource Use Performance	
5.3	A 5	Health and Safety Moisture Air	Personal and Community Health Performance Performance	
4.4	A 5	Operating Cost Waste	Affordability Resource Use	
2.4	A 5	Ergonomics Health & Safety	Desirability Personal & Community Health	
14.2	A 4	Ambience Saleability	Desirability Desirability	
3.13	A 4	Useability Future proof	Desirability Performance	
4.5	A 3	Waste	Resource use	
10.3	A 3	Fire Health & Safety	Performance Personal & Community Health	
2.3	A 3	Ergonomics Usability Future proof	Desirability Desirability Performance	
14.1	A 2	Ambience Saleability	Desirability Desirability	
2.5	A 2	Ergonomics	Desirability	

TRADE-OFFS:

(NB – In deciding trade-offs, the ranking system is to be used in conjunction with the Summary of Performance Specifications sheet on pages 8&9. The goal of the design team is to incorporate ***all*** *benefit components, in major or minor ways. Some of the above specifications have multiple benefits, which means a trade-off can be made with another performance spec with just the one benefit, as it will still achieve the benefit in some way, so long as the relative ranking is also taken into account. - KMB)*

1. Site including security and privacy - Katja

Goals – *Provide a safe and secure area, with residential 'peace of mind', to keep safe most precious things – family and assets*
– Balancing exposure and seclusion to give both inter- and intra- house privacy.

	Performance Specifications and • **measures**	**Priority**	**Reasoning behind performance specifications** See Katja Lietz, WCC; Charles McIntosh and Karen Bayne, FR	**Designers Log**
1.1	Site to be that offered by WCC at Olympic Place, New Lynn.	A 10+		
1.2	To be designed to meet local body requirements.	A 10+	The house should not get 'special treatment' from WCC.	
1.3	Ensure optimal siting and design, through determining regional climate, site micro-climate, solar access, views, average temperatures, daily variations and seasonal wind directions, velocity and frequencies, for both today and likely future increases. • Site environmental presentation sheet for public display produced explaining how the above site characteristics influence design.	A 9	Siting determines wind, water, UV, etc. loadings, and the required claddings/ eaves, protective coatings. Designing for local climate conditions maximises thermal performance.	
1.4	5m height max	A 9	Waitakere City Council has a 5 m height restriction on the site. [This would incline us towards specifying a single storey house, or a single storey + basement -contingent on ground-site suitability]	
1.5	Section obtained to be sized similarly to similarly priced houses in that area	B	Must have face validity with local visitors. Should not have an unrealistic amount of space to spread out it.	
1.6	Ensure house is sited and designed so as not to compromise resident or neighbour privacy. • Balance between public, open areas and private, intimate areas • A well defined main entrance, this should be	A 6	For personal and surrounding privacy	

	clearly visible from the road, but should not be in direct sightline with the living area. • Access to toilet and kitchen is possible without passing through public areas.			
1.7	Provide a variety of spatial experiences • User trials using visualisation via 3D modelling	B	Using odd shaped areas and different ceiling heights can create different moods – intimate or public.	
	Security			
1.8	Emphasis on passive security through design Occupants feel safe • Street facing side of house is open and visible, without impinging on privacy • No solid fences	B	Good design can result in increased security without the need for active security systems.	
1.9	No use of deadlocks • Audit item at completion stage	B		
1.10	Use security vents, screens, passive ventilation for windows. • Audit item at completion stage	A 7		
1.11	Outdoor security lighting with motion sensors or solar garden lights should be utilised • Audit item at completion stage	B	Outside lighting when dark, simple security feature	

2. Accommodation - Dave

Goals - Meet needs, and key wants and expectations of target population.
- House should be designed from the outset with approachability, accessibility and usability in mind.

	Performance Specifications and • measures	Priority	Reasoning behind performance specifications See Susan Bates, FR and Annika Lane WCC - demographics, usage trends and needs Dave Moore, FR - safety and layout for good function	Designers Log
2.1	House to be built to an NZ$165,000 budget*, excluding: GST, land purchase, professional fees. • Budget estimates to be generated at concept, developed and contract document stages • Quantity Surveyors report on completion [hand over].	A 10+	Reflects the local demographic data and market. Gives potential occupants in the area a realistic idea of what is attainable.	
2.2	Total running costs including cleaning materials to be significantly better than the local average for affordability. • Provide occupants with a log for recording detailed costs and check annually against a control group within WCC.	B	An intrinsic part of a sustainable approach. Any comparable studies of this type already in progress or planned? Anyone know?	
2.3	The following guidelines and Standards to be adhered to: 1. BRANZ. (2001) Homes without Barriers. 2. Royal New Zealand Foundation for the Blind. Design guide information @ http://www.rnzfb.org.nz/Environmental/domestic_design.html Independent checks to be made by a Barrier Free Trust accredited auditor or agronomist: • At concept, developed design, working drawings and practical completion stages and • When relevant changes are made to the design	A 3	House should be designed from the word go with approachability, accessibility and usability in mind. It should permeate our thinking with regard to all the design features, not simply be add ons or afterthoughts. The design should draw upon available researched understanding to extend the useful life of the design for given occupants as their circumstances change. For example the arrival of children or age-related degeneration.	

	during the construction process.			
2.4	The following Standard to be adhered to: Standard NZS 4102: (1996) Safer house design (guidelines to reduce injury at home). Independent checks to be made by an injury prevention specialist (IPS) at: • Concept, developed design, working drawings and practical completion stages. • When relevant changes are made to the design during the construction process.	A 5	To incorporate knowledge about aetiology of domestic injuries, in particular slips/trips/falls into the design process.	
2.5	Public space and building surroundings to be designed in accordance with: 1. Standard NZS 4121(2001) Design for access and mobility: buildings and associated facilities. 3. Barrier Free (NZ) Trust (2002). Resource handbook for barrier-free environments. In order that human and goods accessibility is optimised. Independent checks to be made by a Barrier Free Trust accredited auditor or ergonomist: • At concept, developed design, working drawings and practical completion stages and • When relevant changes are made to the design during the construction process.	A 2	These documents cover non-domestic buildings and the spaces between. Design to at least NZS 4121 standard ensures compliance with Code. The BFT Resource handbook includes a useful checklist and background information. The guidelines also assist with ensuring that	
2.6	Target market to be people looking for a 3 bedroom house in the New Lynn area. Design to reflect local population of mixed ethnic and familial circumstances through provision of: a variety of possible sleeping arrangements as numbers expand and contract, and food preparation facilities that expand by utilising covered outdoor areas to cater for extended families and larger groupings if required. The house to demonstrate means of extending the useful life of the	A 7	The place is likely to be occupied by a WCC parks department employee and family for the first two years. Design flexibility is viewed as a core criterion for future housing. For a house built to a tight budget, the maximisation of the use of extensive outdoor space [decks are one-tenth the cost of internal space] is essential. In Auckland a well placed deck is probably	

	design for given occupants as their circumstances change, providing ddifferent uses of spaces over time with minimal retrofitting. To be checked against the following scenarios: • Family with active three children under five • Household with a member needing bed rest for several months • Christmas - with a trebling of people staying for three days • Blended family at a weekend with two adults and five children from three different relationships under the same roof • WCCs and ergonomist to check design at each iteration.		the most intensively used room in the house by children. WCC Demographics data see: Household Composition and Family Type.xls	
2.7	House to be suitable to fit in with the longer term WCC and Ecomatters Trust cluster plans for the area. Specifically, main living space to have capacity for expansion into covered, less covered and open areas. Decks, courtyards, drive etc. To provide facility for up to 35 people to be addressed from the house in good weather. • WCC to check and sign off at each iteration • (Dependent on Marketing Plan)	B	The building is likely to be hub of the educational function of the cluster. As a cluster of buildings and other project facilities with a common focus, there will be an increasing need for a gathering and focal point for visitors. This need not be entirely indoors, but would ideally have the facility for at least small groups to be catered for in poor weather. Contact Iris at WCC via Annika for more detail as cluster, and New Lynn redesign plans evolve.	
2.8	Personal security to be optimised in accordance with guidelines from WCC publication Crime Prevention through Environmental Design • Check by WCC at developed design completion.	C	Cheap deterrent ideas such as scrunchy gravel around path nearest house to track movement of visitors/intruders better than reliance solely on expensive active systems. Contact Annika Lane at WCC and Rachel Hargreaves at BRANZ.	
2.10	Wired house – ability to connect to services later, even if not yet provided. (Internet and Sky a must, things	A 6	Need for technology enabled homes, and future provision of services. Minimise	

	like security, Jetstream, other 'new and emerging' technologies need to have provision for hooking in later). • Ability to upgrade house with technology change.		installation costs for the future.	
2.11	Adequate corridor and door space available for moving furniture in/out and around the home. • POE check when tenant takes possession	B	Future-proofing requirement. Anecdotal evidences that older homes do not have adequate room for installing newer, larger items of furniture (esp. entertainment centres, queen-size beds and lounge suites) with ease. Expectations that people will continue to have shorter term tenancies.	

*** Within the $165,000 is a $15,000 margin for capital items and systems which give long-term operational benefits**

Structure and materials - *Louw*

Goals – *Preventing loss of value in the physical asset, and protecting people who live in it from natural elements.*
- Best structural integrity for LCA of manufactured components, time to construct and use of resources.

	Performance Specifications and • **measures**	**Priority**	**Reasoning behind performance specifications** See Mike Collins or Bryan Walford, FR	**Designers Log**
3.1	Structural performance specifications are spelt out in NZBC. • Adherence to letter and spirit of NZBC • Building consent and compliance certificate	A 10 +	NZBC compliance required	
3.2	Prefabrication and modular design of core elements and fixing systems is preferential to reduce construction time. • Ease of construction, construction time and tools required	B	Short construction time, ease of modification to system, and	
3.4	Explore the merits of alternative stud spacing/lining material combinations. Incorporate a redesigned timber framed wall of lower grade timber material. • 150x40mm studs, with 900mm centres will improve thermal efficiency. • Check Building Consent compliance	B	Ability to increase thermal and acoustic properties, and use lower grades of timber for similar structural performance. Ability to utilise New Zealand's largest biological building product to greater advantage. Thinner studs reduces thermal bridging	
3.5	Roof needs to be supported in such a way as to maximize open plan living space, and also allow all internal walls to be non-load bearing. • No. of load-bearing walls	B	Design flexibility for future layout.	
3.6	Design Roof truss support system to make best use of timber grades available from the forest resource. • Design incorporates optimised grade mix for loading requirements	A 5	Ability to use existing wood resource more effectively, and reduce building costs.	
3.7	Use of large solid beams or columns in the architectural design, which may be used as structural elements.	B	People want open plan space requiring beams or columns.	

	• Open plan space incorporated			
3.10	Flooring if sheet material used to be screwed to joist, and to incorporate I-Beams and double-sided tape to reduce squeaking.	B	Although gluing to joists eliminates squeaking, deconstruction in future means this makes it difficult to reuse floor elements. I-Beams have more consistent dimensions, and are stiffer, thus reducing deflection.	
3.11	Floors in sensitive acoustic zones to have shorter span joists to reduce deflections.	B	Short spans reduce sagging.	
3.12	Use lowest maintenance materials and systems; and future-proof for easy maintenance • Core maintenance time spent on house cf. average in area over time	A 6	People have less time available (and spend less money) to undertake maintenance and subsequently much maintenance is not being undertaken adequately.	
3.13	Provide easy access for piping and electrical services piping for upgrading / maintaining etc. through structural but non-permanent fixtures.	A 4	Need to keep design flexibility and future wiring upgrades in mind.	

4. Waste management - Roman

Goal - ***minimise liquid and material wastes from construction, habitation and demolition stages as much as possible.***

	Performance Specifications and • **measures**	**Priority**	**Reasoning behind performance specifications** See Katja Lietz, WCC and Roman Jaques, BRANZ	**Designers Log**
4.1	Ease reuse/recycling of the house by increasing the de-constructional potential. Preference for demountable, non-composite, screwed-in, high quality materials and components • Assess at detailed design stage	C	Making a building easier to deconstruct increases the chance of it being recycled.	
4.2	Reduce construction off-cuts and allow for ease of reuse and recycling, by having rooms based on standard sheet sizes, separating construction wastes for collection and should be 4 cubic metres or less uncompacted. • measure construction waste going to recycled (overall volume or weight)	B	Reduce environmental stress on planet by being more resource efficient. WCC in association with REBRI and BRANZ can do this.	
4.3	Use recycled materials where possible, provided performance and other factors are not compromised • Volume of recycled materials used catalogued,	B	Reducing construction waste destined to landfill.	
4.4	Provide space in kitchen for organic collection • Provide a space of 5 litres	A 5	Reduce green houses gases and increase the amount of nutrients on-site.	
4.5	Provide space for non-organic recycling bins (at least 2) located near (or in) the kitchen • Bin to be a combined volume of 20 litres or more.	A 3	Reduce waste to landfill; Council likely to introduce organic collection;	
4.6	The design should NOT incorporate an in-sink waste disposal unit • Check with final plans	A 7	Sink disposal units use much water, discourage composting and overload the sewerage system.	
4.7	The design should provide for grey water reuse for garden and flush-toilet uses.	C	Lower water usage from council supply, reduces waste water generation. However,	

	• Volumes re-used		this is practically difficult to do.	
4.8	Provide for rainwater collection and reuse. Reuse for toilets, hot water and garden rainwater use • Detailed design to be checked with at least 80% reduction in water use for toilets and garden.	A 9	Lowers town supply water use while using natural on-site resources	
4.9	Incorporate dual flush toilets with low water consumption	A 9	Water use reduction, and less treatment and pollution of water ways.	

5. Moisture control –Chris

Goal - *The provision of a home that excludes external moisture, and manages internal moisture to provide a healthy indoor environment.*

	Performance Specifications and • **measures**	**Priority**	**Reasoning behind performance specifications** See Chris Kane, BRANZ	**Designers Log**
5.1	Examining the building envelope: • monitor moisture content of frames • monitor incidence of leaks • monitor incidence of mould growth	A 9	Moisture ingress has implications for health and well-being of the occupants as well as the durability and structural integrity of the building materials.	
5.2	To control indoor moisture, give attention to: heating, ventilation, insulation and moisture release rate. Design must achieve this as passively and as energy efficiently as possible. • See Thermal section	A 9	Require minimal condensation to prevent mould growth and material degradation. See NZBC E3.	
5.3	Layout vents so that moisture-generating appliances addressed through passive ventilation.	A 5	To avoid condensation.	

6. Thermal – Albrecht

Goal - *Achieve comfortable ambient living conditions throughout the changing seasons through minimal non-passive means.*

	Performance Specifications and measures	**Priority**	**Reasoning behind performance specifications** See Albrecht, BRANZ and Mike Collins, FR	**Designers Log**
6.1	Sustainable solar design is based on three principles ranked in order of importance: - Insulation (incl. advanced glazing) - Solar gains through optimum window sizes and orientations - Thermal mass for heat storage and overheating protection Maximise use of passive solar heating and cooling. Layout of rooms and windows in context of living patterns throughout the day. Incorporate shading through fixed overhangs, movable awnings and vegetation to prevent overheating		Reduction of GHG emissions (Post Kyoto House!!!) and reduced dependency on depletable fuels.	
6.2	Passive design for heating of internal environment, allowing an ambient temperature of between 18 and 25°C for all but 10 days of the year. This is to be achieved through the use of thermal mass, insulation and glazing. • Number of days below 18 or above 25°C from temperature measurements • Number of days where occupant took active measures to control temperature to maintain thermal comfort Insulation (Recommended R-values are generic and may vary slightly with product choice):	A 10+	Energy efficiency. Improve comfort and health of occupants. Reduce energy bills.	

	Recommended R-Values: Walls: total installed R-value R3.4 Roof: total installed R-value R5.2 Floor: total installed R-value R4.4 (or equivalent BPI using ALF) **Thermal Mass:** Insulate slab on ground floor, which in solar exposed areas is tiled or polished i.e. NOT covered in carpet. Use thermal simulation to optimise design and ALF to confirm BPI for reference purposes.			
6.6	**Means of Heating:** In warm climate zones (i.e. Auckland), the home does not require in-built heating. In cool climate zones options include: - heat-pumps: COP of 2-3 but expensive and uses high-grade energy (electricity) - solid fuel heating: no net CO_2 emissions, potential wetback combination, renewable local fuel source - This sections refers to the type of heater used and is measured in CO_2 output generated by the heater.	A 10+ A 10+	Reduction of GHG emissions Comfort improvements	
6.7	**Heater capacity:** Minimise heater capacity required to maintain comfort levels. - This section refers to the SIZE of heater required and is measured by the CAPACITY of the heater	B	The objective is achieved by the same means as the heating energy reduction (insulation, solar gains and thermal mass), because good solar design results in smaller equipment requirements.	
6.8	**Shading:** Use appropriate shading of façade to avoid overheating during summer while still allowing winter sun to heat house. Avoid excessive East and West facing windows; apply overhangs for North facing windows. - This section refers to the COMFORT of the occupant	A 8	Achieve a naturally comfortable home, i.e. no equipment is necessary to provide a comfortable living environment. Part of general rules of passive design	

	and can be measured using comfort graphs			

7. Energy – Albrecht

Goal - *Energy efficiency is a major Post-Kyoto aim - reduce overall non-renewable energy consumption, while increasing the benefits from energy use for same units generated*

	Performance Specifications and • **measures**	**Priority**	**Reasoning behind performance specifications** See Albrecht Stoecklein, BRANZ and Mike Collins, FR	**Designers Log**
7.1	Preamble: Energy consumption in New Zealand houses is generally allocated to equal parts to • Space heating (climate dependent) • Hot water heating (of these on average 40% are standing losses) • Other (appliances, lighting, etc.)		*Albrecht's document spells out the main justifiable reasons for the energy requirements in this brief.*	
7.2	Specify solar hot water heating • This section refers to the AMOUNT of ENERGY used for heating hot water and is measured in kWh • The Solar Industries Assn. is currently developing a tender document template, which can be used in specifying the individual product.	A 9	Free energy for hot water heating	
7.3	Install HW cylinder close to uses to minimise pipe runs and inside the house to utilise heat losses for space heat. •	B	Hot water is one of main energy drain on households.	
7.4	Insulate vent pipe and frequently used hot water pipes •	B	Hot water is one of main energy drain on households.	
7.5	Consider hot water heat recovery systems such as GFX. The benefits will however have to be balanced with the increased building/plumbing complexity. • This section refers to the AMOUNT of heat recovered and is measured in Joules (?)	B	If heat is recovered from space or water heating, then less energy is required to get spaces and water to higher temperature	
7.6	Install low flow shower heads.	A 8	To reduce water consumption	

	• POE			
7.7	Specify use of compact fluorescent with energy efficient ballasts for all artificial lighting. • This section is concerned with the NUMBER of LUMINAIRES in a lighting design scheme with uses high efficiency lighting options and can be measured by the % of artificial lighting which uses these options	A 8	Energy efficient, longer-lasting	Scale: 10 = 100% CF with HE ballasts 4 = 50% CF with HE ballasts
7.8	Appliances should be chosen based on their energy label ratings as well as on their appropriateness. Choose only appliances with 4 ★ or more •	B	Using less energy to run for similar task	
7.9	Embodied energy of house designs to be calculated and life cycle costs of materials including 50 year energy use to be outlined. • This section refers to the AMOUNT of ENERY required to produce the materials that make up the building as well as the energy required to operate the house and can be measured in MJ.	C	The embodied energy of materials has a direct impact on the environment	

8. Light – Roman

Goal – *providing effective and efficient lighting to enable functions in specified areas*

	Performance Specifications and measures	**Priority**	**Reasoning behind performance specifications** See Roman Jaques, BRANZ	**Designers Log**
8.1	Emphasise natural lighting where possible • Ensure every room has access to natural light • Room should not require artificial lighting during 9am-4pm year-round • Measure number of days where artificial lighting used outside daylight hours.	A 8	Natural lighting better for health, energy efficiency and productivity, however, overcast days in winter may require additional light sources.	
8.3	Differentiate between task and general lighting and generally provide good visual performance (e.g. contrast, luminance, and colour rendering). • Plan checked at detailed design stage, examining all the critical living areas	B	Different activities need different lighting conditions. Soft/passive lighting suits most areas, however some tasks require more concentrated (usually artificial) lighting.	
8.4	Provide suitable shading controls for westerly windows (especially for kitchen/living and study areas) to control for glare/overheating • Plan checked at developed design stage as well as at POE. See *Thermal* and *Energy* sections.	A 7	Demanding visual work and living areas needs to be glare-controlled. Preventing overheating and fittings and furniture damage from UV in summer.	
8.5	Any compact fluorescent lamps (CFL's) provided need to be well colour rendered with electronic ballasts ♦ Check specs on lamp	B	Need to ensure that the desired colouring is achieved in a particular space.	
8.6	Few or no recessed light cans in insulated ceilings unless they are insulation contact rated. • Check plan	B	Need to ensure that thermal bridges are minimised.	

9. Acoustics – Jo

Goal - *Control noise levels in the home so that internal and external sounds do not impinge on activities*

	Performance Specifications and measures	Priority	Reasoning behind performance specifications See Grant Emms, FR	Designers Log
9.1	<u>**External Noise**</u> • Control intrusion of external noise into house by selection of appropriate external envelope systems including walls, windows, doors, and roof. (warning can be expensive i.e. double glazing/laminated glass) • Site house and use landscaping to reduce external noise penetration into living areas of house even when windows/doors open to outside living areas. (Bedrooms should still have level of quiet) • Provide landscaping (fences, vegetation, barriers) to reduce noise to outside living areas. • Provide ventilation systems which allow adequate ventilation without severe acoustic compromises <u>Measure</u> **Living Areas** – $L_{A,eq}$ over 24 hours should be less than 30dB(A) **Bedrooms**/**Study's -** $L_{A,eq}$ over 24 hours should be less than 27dB (A) **Wet Area's** (Bathrooms/ensuites/laundries) $L_{A,eq}$ over 24 hours should be less than 40dB(A) for both intermittent and continuous noises. **Outdoor Living/Living with Doors or Windows open-** should be less than 40 dB(A) at times they are likely to be used. **Ventilation** -A fully open bedroom ventilation system should not increase the noise levels in the room by	A 8	We can't control the noise being made outside the home in the same way we can control internal noise sources if needed. The external envelope is critical to achieving an acceptable level of peace and quiet that is beneficial to the health of the homes occupants. There should also be a liveable area of the house, which can have it's windows open without undue noise intrusion A passive venting system should not allow significant external noise penetration, but should be present so that occupants don't have to open windows to get enough air (especially when sleeping)	

	more than 1dB. (Strip vents in windows should achieve this). **Building Elements -** Use $R'_w+C_{tr,50\text{-}2500}$ ratings for building envelope elements (Walls, windows, doors). Monitoring – Plan for measuring Daytime Background noise levels prior to construction (Marshall Day??) Monitoring with sensors Daytime background noise level in living area once occupied(price to come). Hard to measure background levels once occupied, may be better to measure them unoccupied.			
9.2	**Internal Noise** • Arrange rooms so that quiet areas are separated from noisy areas. • Provide Internal Walls Systems to reduce noise transmission from living areas into Bedrooms and other quiet areas such as a study • Identify noise sources and the most noise sensitive living areas. Strategic layout of the plan to optimise acoustic separation and minimise impact of road noise. Measure Bedroom and quiet areas should remain at less than 27 dB(A) even when other activities are taking place in the home, wall structures to these rooms should have an acoustic rating of at least $R'_w = 45$ Monitoring Sensor measuring dB level in at least one bedroom adjoining/closest to living areas. (Can be incorporated with Plumbing Noise)	B	With large families especially with young children to allow for quiet areas and all times even when various other activities are taking place throughout the home. Many health problems are being associated with disruption of sleep Juxtaposition of noisy and noise sensitive areas on plan will increase building costs to achieve required levels - if levels are achievable at all.	
9.3	**Plumbing**	A 6	Plumbing Noise can be distracting and	

	No Audible plumbing Noise. Monitoring – Sensor Measure dB(A) level in adjoining room from source i.e. level in Master Bedroom from Ensuite/Toilet ($$ to come)		disturbing particularly at night and is easily solved.	
9.4	**Internal Impact Noise – 2 Level Homes** Provide a mid-floor system in the home so that noise levels are kept at required levels at times of impact. Measure Floor structure should have an acoustic rating of $L'_{n,w} + C_I < 50$ dB for both vertical and horizontal transmission into quiet areas.	B	Footfall noise is often a source of annoyance in any home. Reduce impact sound transmitted from trafficked areas into quiet habitable spaces.	
9.5	**Appliances.** Select low-noise level appliances in the home so as not to affect required levels stated previously. Locate appliances away from walls backing onto quiet zones.	B	Reduces the overall house noise levels	

10. Fire - *Chris*

Goal – *Prevent, minimise risk and contain fires where possible*

	Performance Specifications and measures	Priority	Reasoning behind performance specifications See Colleen Wade, or Chris Kane, BRANZ	Designers Log
10.1	Design the layout to provide two exit routes in case of fire from each space. Escape route plan in place, and drill confirms do-ability. Check at developed design	A 8	Need to get family including elderly members to safety.	
10.2	Use materials which limit fire spread where possible Volume (or %) of non-flammable materials used. Check at working drawing and completion audit stages.	B	Flammability risk, and preventing flame spread.	
10.3	A built-in sprinkler system be plumbed in as well as hard wired (and linked) smoke detector system which is properly positioned Working smoke alarms positioned in key areas checked at completion audit. Sprinkler system fitted checked at completion audit. • Explore payback period	A 3	Fire Service advocate of smoke alarms in every house. Sprinkler system cost now a safer and viable option for residential	
10.4	Install a fire blanket and/or fire extinguisher in the kitchen or garage Checked at completion audit	A 6	High risk of fire from cooking Kitchen and Garage recognised as two prime fire-start areas	
10.5	Provision for an emergency supplies/protection of important records cupboard or safe. Check at completion audit.	B	Civil Defence emergency risk, and protection of valuable/ irreplaceable items	

11. Air quality – Chris

Goals - Achieve desirable air change rates with minimal energy and pollutant in ambient air, in recognition that air quality is a vital aspect of good living conditions.

	Performance Specifications and • **measures**	**Priority**	**Reasoning behind performance specifications** See Chris Kane -BRANZ	**Designers Log**
11.1	No high-tech HVAC or ventilation heat recovery solutions. Simple, low-tech solutions such as passive vents, etc. • Percentage passive control of air circulation cf. active control	A 10	High-tech HVAC is not traditional in NZ houses, and also often energy intensive and intrusive. HVAC systems are occasionally unreliable and require occupant education, maintenance etc.	
11.2	Products used in the house should be chosen for low toxicity including VOCs, particularly from flooring material, wood based furniture, paints, glues and sealants, carpets and also products used for cleaning need to be addressed under occupant behaviour. • Reduce VOC emissions (see Paragon quote re monitoring)	B	VOCs are known to cause negative health effects.	
11.3	Limiting potential harm from EMFs. • Monitor EMF emissions levels on site prior to construction (as transmission towers nearby) • Ensure that switchboard is not within a 4 metre direct line of where people are for prolonged periods (e.g. bed)	C	EMF's are perceived/believed to cause negative health impacts, from mild headaches to cancer, with no scientific consensus view on their risk.	
11.4	Air should be kept at an appropriate RH level through passive means for comfort and to prevent bio-contaminant problems • Control RH and temperature of ambient air (see Thermal and Moisture sections). For living areas a comfortable range is between 40-60% RH, for bedrooms range is 40-70% RH. • Minimise mould growth/ spore presence	A 5	An important air quality problem in residential buildings is generally bio contaminants (mould, mildew, dust mites, bacteria). BRANZ are in the final stages of developing BRANZ Vent (it is undergoing a technical audit), this helps in identifying air change rates etc in conjunction with the changes to E3.	
11.6	Minimise irritants such as dust and pollen	A 6		

11.7	Any garage detached from house or vented	A 8		

12. Health – Jo

Goal –*enhancing general wellbeing, by providing positive conditions in which occupants thrive.*

	Performance Specifications and • **measures**	**Priority**	**Reasoning behind performance specifications** See Jo Duggan, WWB, - general. Roman Jaques, materials toxicity and air quality. Charles McIntosh, Composite boards and paint/glue VOCs.	**Designers Log**
11	**Indoor Air Quality** Performance covered under Air Quality and Moisture Control Sections		Indoor Air Quality is important to Human Health because we spend as much as 80% of our time indoors. The cost to the country in terms of Asthma alone are estimated to be at least $825 million a year and Asthma has a significant impact on sufferers quality if life. The causes of asthma has been linked to House dust Mites and the indoor living environment. The EPA states that 50% of illness is either caused or aggravated by indoor air pollution.	
6	**Thermal** Performance covered under Thermal Section		New Zealand Houses are frequently below 14 degrees Celsius and occasionally below 10 degrees which is well below the WHO recommendation of 16 degrees c. New Zealand has a higher winter mortality rate than other western nations with much harsher winters such as Sweden.	
11 & 5	**Moisture Control & Ventilation** Performance covered under Air Quality and Moisture Control Sections		There are a number of articles showing the toxicity and unhealthy levels of current homes due to the presence of	

			moulds, use of cleaners, and lack of appropriate layout for safety, and moisture control and ventilation. Require adequate fresh air changes. HVAC systems suspected (known?) to increase risk of airborne viral colds/ flu.	
9	**Acoustics** Performance covered under Acoustics section		Noise can affect people physically, psychologically and socially. Noise affects everyone and has an impact on the environment equal to other forms of pollution.	
1 & 2	**Safety and Security** Performance covered under Site and Accommodation sections		Reduce accidents in the home	

13. Landscaping – Katja

Goal – *Provide aesthetic and functional qualities to house design, which improve the value and living ability of the outdoor environment*

	Performance Specifications and • **measures**	**Priority**	**Reasoning behind performance specifications** See Katja Lietz, WCC	**Designers Log**
13.1	Provide space in garden of at least 1 m^3 for composting of organics	A 8	Encourages and allows composting, as tenants are collecting organics wastes	
13.2	Planting to complement the climate control of the house	A 9	Wind and sun protection, shading and beautification	
13.3	Provision for laundry to be dried outside in a sheltered (and private) area. Provision of indoor drying rack or line for wet days • Ceiling hoist or under-veranda lines • Outdoor clothesline in private position	A 10	Reduced energy from dryer appliance Bacteria killed from UV light–healthy option (+ Kiwi Culture to have a Hills in the backyard!)	
13.4	Use materials that will not damage the environment, are durable and low maintenance... • Maintenance spend over time	B	Durability and maintenance	
13.5	Minimise site works needed and work within bounds of site – incorporate and utilise existing trees and streams etc. as well as existing buildings as site features within the overall design.	A 9	Ground disturbance upsets natural ecology Mature amenities can be an economic feature also, in increased value, and provide shade/beautification etc.	
13.6	Minimise impermeable areas. • % of impermeable area	A 6	Impermeable surfaces increase the amount and speed of storm water runoff. They contribute to flooding and water contamination.	
13.7	Plants native to the area should be utilised, but an edible landscape, and vegetable garden should also be provided. • check species selection with WCC parks	A 8	Acknowledging natural heritage of the area, providing habitats for native species. Provide food for occupants.	
13.8	Minimise out door water requirements no in built	A 9	Reduce water use	

	irrigation system			
13.9	No plants should be used that could become weeds. • Check species list against WCC list.	A 10	Minimise risk of introducing new pests and disease	
13.10	Limit lawn area to outdoor living area • % of lawn • Lawn can be easily mowed with hand mower.	B	Increased permeability through intensive planting Less energy use, air and stormwater pollution through lawn mowing	

14. Aesthetics and decor – Karen/Susan

	Performance Specifications and • measures	Priority	Reasoning behind performance specifications See Karen Bayne, FR	Designers Log
14.1	Shows modern style as per architectural and interior design trends of present times • Would not look out of place in an architecture or House and Garden type magazine.	A 2	Needs to be desirable and appealing to present populace for interest and marketing purposes	
14.2	Invocative of Kiwi character and meaning – reflects NZ culture and heritage • Shows housing elements that are immediately recognisable to NZ public	A 4	Must be implicitly understood by market to brand and promote easily.	
14.3	Invokes feeling of warmth and homeliness to occupant through appropriate use of materials to connote desirable and positive meanings from décor. • Post-occupancy interview	A 5	Materials are known to convey certain affective qualities. e.g. Natural wood grain is known to be viewed positively for warmth, friendliness, caring and trustworthy connotations, while glass and steel can be used effectively to offset this due to cool, modern and industrial connotations.	

15. Construction process and maintenance – Greg

	Performance Specifications and • measures	Priority	Reasoning behind performance specifications	Designers Log
15.1	Allow provision of a maintenance record log book • Check log book in place. Audit at completion • Accuracy of log book assessed at POE		For records and to ensure maintenance undertake on a regular basis, and for future owners/ dwellers reference	

Design Brief Addendum: Additional requirements to enable performance monitoring of the NOW House

	Performance Specifications	Priority	Reasoning behind performance specifications	Designers Log
	General			
	Allow space for master units and PC close to meter board, but internally.		Burglar and weather proof.	
	Telephone access for PC modem with separate telephone no.		Remote communication and data download. This option is cheaper than cell-phone.	
	House should have a ceiling with a roof space above i.e. NOT a skillion roof		Allows un-intrusive sensor cable runs	
	Install 50mm diameter conduits into the roof space from ➢ Meter board ➢ Fuse board ➢ Water cylinder cupboard ➢ Solar water heater pipes or panel (depends on panel location and layout) ➢ PC/logger master unit location		Eases sensor cable connections after the house is complete	
	Electricity			
	Dedicated wiring circuits for: ➢ One lighting circuit per room ➢ One power circuit per room ➢ Dedicated circuits for fridge/freezer ➢ Dedicated circuit for dryer (if installed)		Electricity monitoring systems are simpler if most info is collected at one point rather than individual power outlets.	
	Sufficiently large outside meter-board and inside fuse board to allow placement of loggers. Placement of meter-board to be more than 4m of areas where people spend extended periods (for EMF's).		Electricity monitoring systems are simpler if most info is collected at one point rather than individual power outlets.	

	Gas			
	If reticulated gas is used one BRANZ gas meter has to be installed in each end-use line (i.e. cooking, water heating if present, space heating if present) and wired back to meter board. Place gas meter and electricity meter in close proximity.			
	LPG cooking is the preferred cooking option, but may be difficult to monitor.		Low gas pressure will be even further reduced by flow-through gas meters. Andrew Pollard is currently investigating other options.	
	Temperature			
	Installation of four thermocouples in wall cavities to measure internal wall surface temperatures and wired back to the master unit. Internal surface locations to be monitored: ➢ External bathroom wall ➢ External kitchen wall ➢ External master bedroom wall ➢ External living room wall All walls as far as applicable should be facing South, alternatively West or East.		Measure condensation risks	
	Thermocouple wires should not be cut and joined		Risk of signal noise	
	Solar Radiation			
	no special requirements			
	Noise			
	No special requirements			
	Solar Water Heater			
	Solar water heater must be pumped (rather than thermosiphon)		In order to measure water flow from solar water heater.	
	Occupancy Sensors			
	Possibly as part of the security system. Security system should be selected with this capability.			

	Air Quality			
	Can be done by a small number (10?) one-off air sample draws, possibly 5 after building completion and 5 after one year occupancy. No construction implications.		(Roman has contact details).	

	Humidity			
	Install stainless steel nails spaced 10mm apart into window timbers, with leads out into room areas. Must be calibrated before being enclosed.		Measure moisture content of framework in high-risk areas.	
	Water consumption			
	Use electric water pump rather than gravity feed for rainwater collection tank for toilet feed.		Difficult to monitor if only gravity fed.	
	Use mains pressure system		Low pressure systems might be influenced by in-line flow meters	
	Install water meters for ➢ Whole house (from mains) ➢ Rainwater collection tank			

What to Measure

Computer - Server	On-site computer (server) for remote components, DAQ card - wired sensors. Programmed with a LABview program. Computer to have modem for; uploading data. No data is to be broadcast.
DAQ	Suitable DAQ card with a number of counter inputs, and analog inputs (with most for use with thermocouples)
Remote Receiver	Remote Data Receiver (for temperature sensors)
Temperature	Remote - 1 per room + 2 living room + external, - 5 join T/H measurement per sensor
Surface Temps	Wired - for condensation risk (4 locations in house)(reference junction at master unit)
Surface Humidity	not measured
Humidity	Wired for moisture content in framing. Measure RH (in ambient air) in 2 living areas and 2 bedrooms and 2 wet areas.
Circuits (Electricity)	Total, Lights, Range, Hot Water, Heat Pump per pulsed input (i.e. Electricity meters)
Appliances	Exclusive wiring to Fridge-Freezer - Clothes Dryer, etc. per appliance

(Electricity)	
Noise	Sensors with loggers located in the master bedroom and the lounge.
Gas	Gas meters with pulsed output per meter or gas flow meter for low pressure situations (~$1500)
Water Use	Pulsed output water meters - total water, total hot water, individual end-uses i.e. shower, taps?? per meter
Solid Fuel (?)	Wire thermocouple to DAQ card sensor for throttle or loader control??
EMF's	Monitor prior to building erection
VOCs, CO and formaldehyde	Indoor - post completion, over a predefined period – see Paragon quote.
Construction waste generation	Measured volumetrically by visual assessment – engineering student to do? Segmented into land filled and recyclables/re-usables.
Water usage	Water metre measured monthly by occupant, recording number of dwellers for that period in log-book for both town and tank supply...
Solar	remote with pyranometer
Solar Water Heating	measure temperatures (thermocouples), flow, irradiance (previous item)
	flow meter
	Thermocouples
Water leaks	Catalogue in home maintenance manual
Mould growth	Catalogue in home maintenance manual
Occupancy Sensors	not instrumented
Weather Data	retrieve from weather stations

NOW House: Proposed time and motion study for calculating construction time and cost, materials use and waste generation.

The most appropriate time and motion study technique to determine the labour content for the construction of the NOW house is known as the Group Timing Technique. This technique was used by the U.S. Department of Housing and Urban Development investigation into alternative framing materials in residential construction[4]. The technique is normally used when investigating productivity differences. Forest Research has used the technique measuring sawmill productivity.

At best we can try and copy the procedure used for the American study and compare the results with the times in their report covering three alternative construction methods. The American study only compared construction materials and did not include roofing, cladding, painting, joinery, plumbing, electrical, ceilings, etc. To convert the American cost data

[4] U.S. Department of Housing and Urban Development. 1994, Investigation into Alternative Framing Materials in Residential Construction: Three Case Studies, NAHB Research Centre, Upper Marlboro, MD, USA.

to New Zealand dollars will be difficult, as product quantities are not given. The construction methods and the climatic conditions the houses were designed for are also extreme for New Zealand.

This means we will have to get comparative data from some other source. Apparently G.J. Gardener is willing to help with the costing exercise. They should also have good data on costs for their conventional houses. Analysing costs, with the help of G.J. Gardener, will cost about $5,000.
If we want to get the detailed times we will have to man the site during all production times, which means having two persons available for the total construction period (not cost effective). Alternatively we can rely on analysing the time sheets to give us gross hours worked by trade. If we analyse time sheets or trade invoices the cost will be $3,000.

If we provide 4 or 5 dedicated skips for each type of waste we can weigh the skips and calculate the waste generated for a cost of about $8,000. The problem with this approach is the chance of external waste being added to the skips, or waste being scavenged from the skips. To prevent this, skips will have to be placed in a secure compound, or new lids with padlocking devices fitted, for the construction period.

Filtering Elements Framework

This filtering framework is intended to assist with the selection of products and systems for the Now Home. While not a scientific quantitative analysis tool it will be useful to qualitatively assess the merits of one product versus another against the following filtering criteria:

Personal Wellbeing

Definition
The effect the component or system has on the personal wellbeing, health and safety of the occupants of the home.

Considerations:

- Injury prevention
- Indoor pollution (including but not limited to: dust, moulds, VOCs, toxins, fibre irritants, allergens, EMFs)
- Moisture
- Protection from crime
- Temperature
- Quality of light
- Noise
- Air exchange/ventilation
- Protection from fire
- Accessibility

- **Scoring Scale**

L Has very serious negative effects on the wellbeing of the occupants.
M No effect on personal wellbeing compared with an NZBC Code-minimum dwelling
H Has very beneficial effects on the wellbeing of the occupants.

Community Wellbeing

Definition
The effect the component or system has on the health or wellbeing of the community. This includes the home's interaction with the local community, but also considers the effect of the manufacture, installation or disposal of the item(s) on the wellbeing of the communities involved in those processes.

Considerations:

- Urban design
- Private vs. public space
- Effect on the transport network
- Creation of local employment
- Wellbeing of manufacturing and construction staff
- Character of the neighbourhood
- Effect on neighbours (and users of Olympic Park)

- **Scoring Scale**

L Has very serious negative effects on the wellbeing of the neighbourhood.
M No effect on Community wellbeing compared with an NZBC Code-minimum dwelling
H Has very beneficial effects on the wellbeing of the neighbourhood.

Environmental Wellbeing

Definition

The effect the component or system has on the natural environment. This includes the effect on the immediate environment as well as lifecycle effects.

Considerations:

- Air emissions
- Waste generation (including hazardous waste generation)
- Liquid waste generation
- Environmental practices of manufacturer
- Embodied energy
- Sustainability of resources
- Renewability of resources
- Eco toxicity

L Has very serious negative effects on the wellbeing of the environment.
M No net effect on the environment compared with an NZBC Code-minimum dwelling
H Has very beneficial effects on the wellbeing of the environment

Performance

Definition
The performance of the component or system.

Considerations

- Durability
- Quality
- Maintenance
- Moisture
- Ability to meet Future Needs

- **Scoring Scale**

L This product or system, when installed in accordance with the manufacturer's instructions, fails to achieve its stated design function, either by direct failure or by failure to provide support to other items which have complementary or other functions

M No discernible functional difference compared to an NZBC Code-minimum dwelling

H Provides exemplary performance when installed in accordance with the manufacturer's instructions and in some cases will exceed the claimed performance, either in direct functionality or in support of complementary or other functions

Desirability

Definition
The appeal of the component or system to the target audience. It is acknowledged that this criterion is highly subjective.

Considerations:

- Aesthetics
- Ergonomics
- Saleability
- Useability
- Marketability

- **Scoring Scale**

L Detracts from the desirability of the house when installed
M Is neither desirable nor undesirable
H Enhances the desirability of the house when installed

Affordability

Definition
The product or component is within the means of the intended purchaser of the house (average New Zealander). The initial (i.e. upfront) monetary cost as well the ongoing (i.e. any maintenance or replacement) cost should be taken into consideration. It is proposed that the total cost (i.e. initial plus maintenance and replacement) of the major elements should be calculated over at least 100 years.

Considerations:

- Capital cost
- Electricity costs over the items lifetime
- Water (and waste water) cost
- Other running costs
- Maintenance costs

- **Scoring Scale**

L This product/systems total cost over 100 years is very high, when compared to a similar product/system which has the same function.
M This product/systems total cost over 100 years is average.
H This product/systems total cost over 100 years is very modest.

Energy Resource Management

Definition
The effect the product or system has on greenhouse gas emissions caused by the operating energy demand of the home. (Embodied energy is included in *Environmental Wellbeing*)

Considerations

- Energy use of the home
- Type of energy used (renewable vs. non renewable)

- **Scoring Scale**

L Extremely fossil fuel intensive – uses non-renewable energy resources in areas where others will suffice.
M On par with fossil primary fuel consumption with an NZBC Code-minimum dwelling.
H Allows for very low fossil fuel consumption during occupancy phases.

Water Resource Management

Definition
The effect the product or system has on the sustainable management of the three waters, stormwater, waste water and potable water.

Considerations

- Amount of town supply water used
- Amount and quality of waste water produced
- Amount and quality of stormwater discharged
- Waste water treatment.
- Sensitivity of environment discharged into.

- **Scoring Scale**

L Has a negative impact on water management.
M Standard practice
H significantly contributes to the sustainable management of the three waters.

Solid Waste Resource Management

Definition
The product or system does no result in unnecessary solid waste generation.

Considerations

- Amount of waste generated
- Type and toxicity of waste generated
- Recyclability of materials and waste
- Use of recycled products
- Home composting
- Construction waste

- **Scoring Scale**

L Extremely material resource intensive with no provision for deconstructability or materials reuse
M Generates an average amount of solid waste during construction and/or operation
H Generates very little solid waste during construction and/or operation, or has excellent provision for deconstructability or material reuse.

APPENDIX 3
CONSTRUCTION PROCESS OVERVIEW

Overview of Construction Issues of Now House 1 Olympic Place, New Lynn

The construction phase of Now House 1 was complicated by a number of factors not normally found in standard house construction. These factors are summarised below, and together created a need for strong and consistent design and construction management.

Continuity of Personnel:

There were a large number of people involved in this project from the design phase through to the construction. The architect, Greg Burn, was commissioned to design the house (with considerable input from the Now House team) and was involved in early discussions with the builder. He had no formal involvement after that, although he very generously gave his input when asked. Building Consent drawings were drawn by the builder's in-house draftsperson without supervision by the architect, and these were then passed on to Robin Allison as the architect on site during construction. This lack of continuity and minimal level of design documentation and specification resulted in key details not being thought through from the beginning which caused problems later e.g. slab edge insulation and pergola design.

Site Choice:

The choice of site, while obviously expedient for other reasons, added extra layers of complexity to the project. Built on a reserve, the ownership issues and future use of the building took some time to sort out. An ongoing aspect of the design was the requirement for the house to be relocatable, which was at odds with providing thermal mass for passive solar gain. The location on the reserve also caused major security issues during construction, with several occasions of vandalism, theft and break-in.

Structure of the Building Company:

G.J. Gardners were chosen during the design process as being a mainstream building company "experienced in non-standard procedures". Discussions were held with the principal Bob Greenbury about the specialised and high-profile nature of this project and expectations regarding quality, code compliance, and future benefits to the company by positioning itself as a builder of eco-homes. Delays in obtaining Building Consent, firming up the quote and signing the contract meant that by the time construction was due to start, Bob Greenbury was no longer available and had passed this project to one of his construction managers, without apparently passing on the expectation that there would be a high level of scrutiny of the construction.

G.J. Gardner is essentially a building management company without in-house carpenters. All work is done on a sub-contract basis, answering to a site manager who looks after several building projects at once i.e. there is no one on site throughout construction, but rather a site manager who visits when needed and a succession of sub-contractors, each of whom is on site to do their specific job with little overlap between trades. This reduced the understanding of and commitment to the specific needs of this project by the subcontractors, and made it more difficult to enrol them to do things in a different way to their standard practise.

Construction Methods:

Standard construction practise, especially in the "affordable" end of the market, has developed to minimise material and labour costs by using a limited and readily available range of materials, able to be erected fast and often not requiring high levels of skill. In some instances, the care and skill previously required to fit components together has been substituted with adhesives, jointers, beads and fillers, bringing amounts of plastics, metals, and petrochemicals into the construction process. Avoiding these materials (because they are non-renewable, have high embodied energy, can be toxic, etc) requires more time and skill in design and building, as natural materials are often more variable than manufactured materials and require more knowledge and experience of the properties of that material.

Designing a house with systems and materials that are not standard practise requires good detailing at the design stage, and careful thinking through of all the steps by the builder before commencing.

Examples from Now House 1:

- Foundation insulation to the concrete slab: Polystyrene is a difficult material on site, being bulky, lightweight (blows around in wind), and fragile (necessitating the pumping of the slab concrete, as wheelbarrows would break the polystyrene). In the Now House, the foundation and slab bulged along one edge during the pour. When the polystyrene was fitted to the outside face of the slab down to the bottom of the foundation, it was difficult to get a tight fit against the foundation because of the bulge. The slab and foundation edges need to be very straight to allow a minimal flashing over the top of the slab-edge polystyrene. Hardiflex was used to protect the polystyrene from spade damage, and the method of jointing or flashing the corners and sheet joins was not considered until the hardiflex was fitted. More thought given to the whole system before commencing could have resulted in a much neater finish.
- Exposed concrete slab: This requires different treatment to a concrete slab covered by flooring. More care is required in laying the slab to get a flat surface especially at the walls to avoid uneven gaps under skirtings. The slab needs to be kept flooded during curing to avoid cracks, and saw cuts in appropriate places should be cut within 24 hours of pouring the slab. Polishing the slab produces a large quantity of slurry which should be captured and disposed of appropriately.
- Pergola: The detailed design of the pergola (including timber sizes and spacings) was not done until it was about to be built. At this point it was realised that the eaves construction would not allow easy support of pergola members at the house, and that the depth of timber purlins needed to span the wide area outside the main living room would cut around half of the available sunlight in winter. If this issue had been detailed at design stage, appropriate timber sizes, spans, and connections to the house would have been resolved.

Monitoring Requirements:

The installation of meters for water and power monitoring added to the work of these two trades; however this aspect went quite smoothly.

Construction waste monitoring was an aspect that required cooperation from all the trades in separating their waste into different categories. This only happened to a limited extent, and required quite extensive re-sorting prior to weighing and measuring. The subcontractors generally separated their waste when asked, but this required the site manager to brief each subcontractor as they came on site and this did not always occur.

Donated Materials:

This aspect of the project, while reducing costs for those items, also added to the complexity and number of people involved and caused some delays in supply and more time in managing this aspect.

Recommendations:

- Choose an architect who has experience in and commitment to passive solar design, sustainable materials and services, affordability and accessibility, and ensure that that architect is personally involved from the early design stages right through to producing working drawings and supervising construction.
- Ensure a high level of detailing and specification before commencing construction to minimise surprises and rework.
- The landscape design should be developed at the same time as the house design to ensure integration of all elements.
- Choose builders of an appropriate scale who are committed to doing a good job, thinking through the details, and putting in the extra effort required to trial new systems. Involve them early in the design process, so that details are realistic and achievable on site.
- Plan a construction waste management system that goes beyond monitoring and recycling to minimising waste through careful planning.
- A log should be kept of issues that arise and how they are dealt with to assist in future projects.