Planning the new building

This is the second in a series describing the design, construction and monitoring of a more sustainable urban house in Hamilton.

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Understanding the characteristics of a building site and its neighbourhood is important in informing the design process. Having already lived on our site for 3 years, we had first-hand experience of how it worked. The ecology of the land, location of the site, special features and local climate were important considerations in the initial design planning.

Having deconstructed the existing house (see *Build* June/July 2008, pages 72–74) we were left with a 650 m^2 section. Although larger than most urban sites today, its diamond shape, the gully and an existing workshop located in the south-western area (see Figure 1) meant that its practical buildable area was considerably less. Therefore, the new dwelling had to be positioned carefully.

Ecology and location

The site is on a small gully, finger-linked to the Waikato River. The gully network in Hamilton is a significant ecological feature, and its potential for restoration was an important design consideration. Protecting the gully from earthworks during construction and ensuring good water flows post-construction was factored into the design mix.

Maintaining a strong indoor connection with the gully is an example of the competing requirements typical when trying to address several different design aspects. The gully has implications for views, access and thermal design. Being located on the west of the site meant the potential indoor overheating (caused by larger western windows) had to be carefully managed from the outset.

The ability to walk or bike to work was key when purchasing the property. When initially searching for a house, we only looked within a 2 km radius of the CBD to lessen reliance on private transport. The site is reasonably close to local amenities: a 15-minute walk to town, and within 10 minutes' walk of two large supermarkets, a sports facility, a primary school and several places of worship.

Understanding the local climate

Accounting for the relationship between the local climate and building design is essential. Hamilton has warm, dry and settled weather during summer, with maximum daily air temperatures in the mid-20s. Winters are cool, with typical daytime maximum air temperatures in the early teens. The site has excellent solar access – sunshine (averaging 2,000 hours per year) is available year round to most of the site. As a result, we knew that, with good thermal design, comfortable indoor temperatures could be maintained passively all year round, and there is excellent potential for electricity generation from photovoltaics.

Rainfall in Hamilton is around 1,100 mm per year. This has implications for the design of rainwater collection/storage as well as stormwater control. Although obtaining local rainfall data is useful, observing the site under different rainfall conditions gave valuable guidance about possible placement and qualities of specific landscape and amenity features. As an example, being on site during heavy rainfall highlighted the need for good runoff strategies to avoid waterlogging.

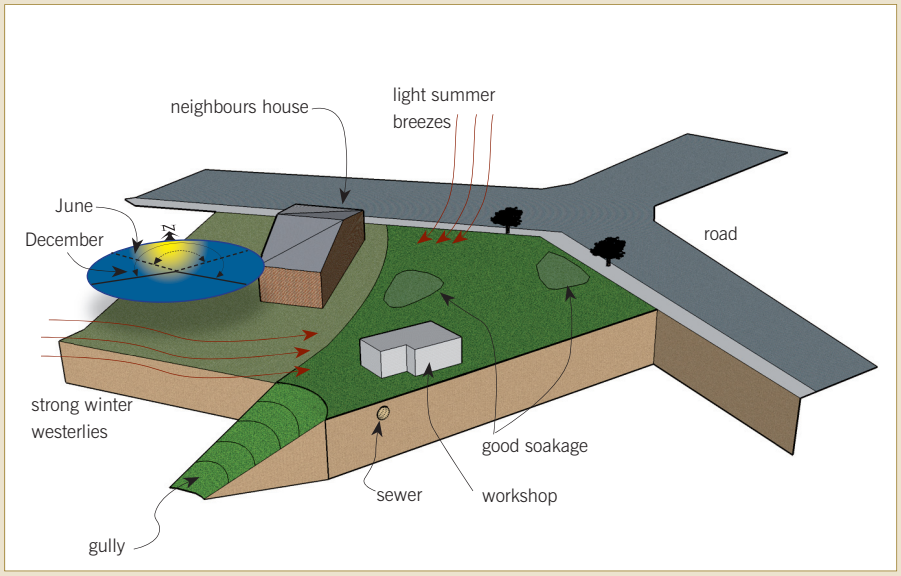
The Waikato region is less windy than many other parts of New Zealand, and the site is reasonably sheltered. Therefore, design considerations were mainly around protection from infrequent strong south-westerlies in winter and taking advantage of northerly breezes for summer cooling.

Overarching principles

We both wanted to design a home that would meet a range of sustainability goals (summarised in Table 1). This table later became part of the building consent specification documentation, to ensure that the council and the main contractors were informed early on of the principles underpinning the project. Almost all the core goals had specific targets,

Table 1: Sustainability principles.

Key principles	**Resource protection** To conserve non-renewable resources and enhance natural habitats at all stages of the building's life cycle.	**Environmental education** To grow the pool of knowledge, raise awareness, enhance skills and promote action for urban ecobuilding and more sustainable lifestyles.	**Community wellbeing** To contribute to the wellbeing and sustainability of people and nature in our community.	**Personal responsibility** To maximise our ability to take care of ourselves and nature, and create a healthy and sustainable lifestyle.
Core goals	**Designing for:** • minimal waste • sustainable energy • healthy water • lower impacting materials • sustainable transport • lower life cycle costs.	**Developing:** • design tools • documented processes • educational workshops • ongoing monitoring and learning.	**Supporting:** • our local economy • the protection enhancement of local habitat • the use of non-toxic materials and processes.	**Having:** • healthy living spaces • on-site food production • sustainable budgeting of time, money and energy • green purchasing policies.



Site schematic.

many of which will be explored in more detail in future issues of *Build*.

Although we realised that delivering on these goals was ambitious, having this framework to refer to focused the decision-making process. It helped to ensure that the practical implications of each of the three sustainability tenets – environmental, economic and social – were considered as the design developed. But having a framework *didn't* help with prioritising the issues – something that is unique to each site.

Design brief

There were several features of the original house that we wanted incorporated into the new design. They were the:

- simplicity of the overall building layout and form
- solid feel, resulting from a stronger structural framework than typically built today
- recycled rimu floorboards – but this time exposed, rather than hidden under carpet or vinyl.

Keeping the core goals in mind, the following design brief was established, with all points seen as no-compromise targets:

- An aesthetic that is clean, modern and simple, blending the best of high and low tech solutions.
- High-performing environmental design, incorporating enough water storage and energy generation to be close to self-sufficient for 2–3 people.
- The ability to grow a significant portion of the household's food requirements.
- For the house to easily be used as an educational tool.
- To trial and monitor some unconventional technologies and systems, such as the on-site treatment of all grey and black water.
- Compact construction for 3 people, with a maximum floor area of 150 m^2.
- Modestly priced at approximately \$2,000 m^2 (excluding the electrical generation system).

Preliminary design

It became obvious early on that the best way to meet the design brief, while keeping inside the building envelope, was to have a 2-storeyed house. A preliminary design emerged quickly once the 'often competing' environmental/resource requirements were addressed. The main building/landscaping features that emerged were:

- a simple rectangular shape, orientated with the long axis running west-east
- large north-orientated windows, an exposed slab-on-ground floor, very high levels of insulation and adjustable shading for the north, west and east glazing
- internal service areas (bathroom, stairwell and laundry) and external utilities (carport, clothesline, water treatment system and rain tank) all located on the southern side
- garden, tree crops and outdoor living spaces all having a northerly aspect
- an easily accessible, simple, mono-pitched roof, to monitor and check on the energy and water collection equipment.

In formalising the design, we found Google SketchUp (www.sketchup.com) to be invaluable. This free and easy-to-use sketching program allows one to quickly alter and play round with shapes, orientation, shading and site positioning and generally fine-tune initial 3D design concepts. Having instant and accurate access to sun path and shading information all year round was very useful. However, cardboard scale models are a good alternative.

Some good independent New Zealand-specific websites can greatly assist in the preliminary planning stages for more sustainable homes. LEVEL (www.level.org.nz) provides technical details on key environmental and health concepts to consider. Smarter Homes (www.smarterhomes.org.nz) introduces key environmental and health concepts and provides many useful links and guidelines.

Planning tips

The following things helped us in the initial stages of our design:

- Get to know your site as well as you can, so that it can guide the key characteristics of the building.
- Establish and document clear objectives that you can easily refer back to when there are tricky decisions to be made. It will keep you from getting mired in the details.
- Play around with three-dimensional models – whether they are real (i.e. cardboard) or virtual (i.e. electronic). They will quickly concentrate your solutions into practical design options.

If you need some further site-specific guidance, go to www.ecodesignadvisor.org.nz to see if there is an Eco Advisor operating in your region.

The next article in the series will continue discussing the design process.