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Title of Paper: At the Coal Face of Sustainability Implementation: Balancing the Environmental, Social and Economic Bottom Line in Urban Developments

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1 ABSTRACT

Over this decade, New Zealand’s urban growth planners will face increasing pressure to accommodate burgeoning populations within constrained urban boundaries without sacrificing the environmental and social values that New Zealanders hold dear. The challenges faced in balancing such economic, environmental, and social constraints in urban development is the focus of this paper.

To allow for a detailed discussion within a ‘real life’ context, this presentation focuses on a practical pilot study developed in partnership with Synergine, the Ministry for the Environment (MfE), Waitakere City Council (WCC) and the New Zealand Housing Foundation (NZHF) on a 77 lot NZHF subdivision at West Coast Road in West Auckland. The Sustainable Community Development Project, as the pilot study is known, is a case study designed to test the holistic triple bottom line definition of sustainability at a neighbourhood scale, at an actual site, so that long-term environmental, social and economic benefits (housing access and affordability) are maximised at the site, and the lessons learnt applied within the wider regulatory, and development community.

The ultimate goal of the Sustainable Community Development Project, and presentation of this paper, is the enabling and accelerating of the adoption of sustainable neighbourhood and household level design and practices in the life of average New Zealanders. To this end, the presentation will outline regulatory and budgetary challenges to the design and development of sustainable homes and neighbourhoods, capital and ongoing cost analysis of the sustainability features implemented at the West Coast Road site, social impacts and benefits of holistic triple bottom line design applied at the site, and a critique of the Project methodology and outcomes.

2 INTRODUCTION

The Sustainable Community Development Project hopes to capture and record the challenges to sustainable neighbourhood design through assessment of a housing development currently being constructed by the 'not-for-profit' agency NZHF. The site comprises 77 lots ranging in size from 280m² to 1247m² and will contain housing in eight different styles when fully complete. Key components of the planned development include stream restoration, an extensive linked open space network, stormwater treatment and attenuation wetlands, and extensive use of sustainable design features at an individual site level. The site is currently being developed with Stage One projected for completion in September 2009.

Anticipated outcomes and objectives of the Sustainable Community Development Project comprise:

- Increased capacity within WCC to support and empower the design of sustainable neighbourhoods and by default, individual homes.
- Maximisation of the social and environmental benefits at a neighbourhood and household level at the NZHF site at West Coast Road.
- Dissemination of the Project results to the wider regulatory and development community.
- Development and refinement of the TUSC Neighbourhood Tool.

2.1 The TUSC Project

The Sustainable Community Development Project both utilises the TUSC tool and links with the TUSC project. WCC initiated the TUSC (Tools for Urban Sustainability) project in mid 2005. TUSC is a web-based analysis tool that assesses and aids planning of homes and subdivisions against sustainability indices. It is free to use and simply requires inputs of home design details to calculate the water, energy, and stormwater savings achieved through different design choices. By drawing on the findings of case studies such as West Coast Road, TUSC intends to be a flexible and evolving tool making use of latest analysis techniques, accurate and contextual environmental data, new treatment technologies and design practices and up-to-the-minute monitoring databases.

TUSC assesses a range of sustainability features across a triple bottom line of environmental, social and economic indices. Factors considered include, but are not limited to: water and energy use of appliances and fittings, site density and ecology, location in relation to commercial, educational and social facilities, transport demand management, connectivity to walk and cycle routes, use of passive solar design, and wall and ceiling insulation.

Development of the TUSC Neighbourhood Tool

The Sustainable Community Development Project aligns with the third instalment of the TUSC project. TUSC Phases One and Two have seen the development, refinement and promotion of the TUSC Site Design, Audit and Development Remissions Tools. This Sustainable Community Development Project will advocate the use of these tools to local and regional authorities cementing their uptake, upkeep and potential to become a regulatory method. It will further see the completion of the TUSC Neighbourhood Tool, allowing triple bottom line assessment and design of sustainable communities at a subdivision or neighbourhood scale.

3 PROJECT DETAILS

An outline of the Sustainable Community Development Project details and methodology is provided in the following section.

3.1 Site Summary

The West Coast Road site covers a total area of 5.7 ha and is being developed in three stages as shown on Figure One below. The site comprises 77 lots ranging in size from 280m² to 1247m² and will contain housing in eight different styles. Key components of the planned development include stream restoration, an extensive linked open space network, stormwater treatment and attenuation wetlands, and extensive use of sustainable design features at an individual site and house level.



Figure 1: Stages of the Development

Through partnership with groups such as IHC and Habitat for Humanity, several specialist houses have been enabled at the site to cater for a range of needs within the community. Through funding from the Tindall Foundation ‘Eco House’ will be constructed at the site showcasing a number of environmentally sustainable features.

3.2 Project Timeline

Site Development

Earthworks at the West Coast Road site commenced 2007 with Stage One (shown to the right in the above Figure One). At the time of writing, Stage One and Two land development is complete and the Stage One stormwater treatment ponds have been formed and landscaped. Stage one house construction is underway and to date, two houses are occupied. It is anticipated that final completion and occupation of all houses in Stage One will occur in September 2009. Two ‘Habitat for Humanity’ houses located in Stage One have also been completed. Bulk earthworks have been completed in Stages Two and Three and house construction is expected to commence in late 2008, early 2009. The Eco House, which will act as a fully functioning home, will be completed December 2008.

Riparian margin planting throughout the site has been completed however the streamside walk and cycleway is still under planning as stream erosion has required relocation of two houses within Stage Two.

Project Timeframes

The Sustainable Community Development Project study commenced in October 2007 with the formation of a partnership between Synergine, MfE, WCC and NZHF. The Project will progress through six stages as discussed in the methodology (Section 3.6 below) concurrently to the development of the West Coast Road site so that lessons learnt during the development process are fed back in to the Project and development to allow iterative improvement. The Project is scheduled for completion in June 2009.

3.3 General House Design Features

Homes throughout the West Coast Road site will contain the following features to limit the use of water and power, reduce waste, and create a healthy, warm, well-ventilated environment.

Water

- Water efficient showerheads
- Dual flush toilets
- Aerating faucets
- No swimming or spa pools
- Water meters on all houses to monitor water usage

Waste

- Space for separate kitchen bins for organic and recyclable material
- Provision of individual site or communal composting bins / worm farms

Energy

Numerous energy saving features are proposed within all houses at the site. These are listed in Table One on the following page:

Heating and Cooling	<ul style="list-style-type: none"> ▪ Roof pitch and orientation to suit solar heating and PV panels ▪ Where possible, all houses oriented to the north ▪ Living areas grouped on the north, sunny side of the house ▪ Majority of household windows located on the northern aspect ▪ Passive ventilation (cross flow design) to avoid summer overheating and reduce reliance on fans or air conditioning ▪ Ventilated aluminium joinery ▪ No recessed ceiling lights to avoid heat loss through the ceiling ▪ Eave widths to allow winter sun capture and reduce summer sun ▪ Polished concrete floors in north facing living areas as thermal mass ▪ Wall and roof insulation 50% better than the New Zealand Building Code ▪ 150mm concrete slab floor with insulation ▪ Zero lot lines to reduce shading from adjacent buildings ▪ Snug fitting drapes or close fitting window and door treatments ▪ Internal doors to isolate temperature zones
Household Appliances	<ul style="list-style-type: none"> ▪ Energy efficient fridge/freezer & washing machines ▪ No clothes driers or dishwashers ▪ Cent-a-meter devices to enable residents to monitor power use ▪ Self cleaning ovens and induction cook tops
Hot Water Heating	<ul style="list-style-type: none"> ▪ Electric heated cylinder with grade 'A' insulation ▪ Hot water cylinder and pipe wrapping ▪ No swimming or spa pools ▪ Low flow shower heads ▪ Grouping of wet areas to reduce length of piping ▪ Some houses will contain solar water heating or solar heat pump
Lighting	<ul style="list-style-type: none"> ▪ Excellent use of natural light ▪ Compact fluorescent lights / energy efficient light bulbs
Indoor Environment Quality and Materials	<ul style="list-style-type: none"> ▪ Paints, floor coverings, window treatments, etc with low VOC rating and toxicity ▪ Solid wood cabinetry where possible ▪ Range hoods and bathroom extractors vented to outside ▪ Specify locally grown pine for fencing ▪ Sustainable timber for decking (e.g. FSC accredited, or NZ grown plantation)

Table 1: General House Energy Efficiency Features

3.4 Eco House Design Features

In addition to the features described for the general houses the following will be considered or installed on the Eco House:

Energy Generation	<ul style="list-style-type: none"> ▪ Wind turbines ▪ Photovoltaic cells
Stormwater Management	<ul style="list-style-type: none"> ▪ Permeable driveway ▪ Rain garden ▪ Rain tank
Water Use	<ul style="list-style-type: none"> ▪ Water smart gully to recycle water from shower, bath and laundry to toilet ▪ Water efficient washing machine and dishwasher ▪ Hot water demand pumping system
Energy Use	<ul style="list-style-type: none"> ▪ Solar powered under floor heating ▪ Reverse cycle heat pumps ▪ Thermosiphon Chromagen solar water system ▪ Energy efficient appliances and provision for outside drying ▪ Accessible master switches for controlling power points ▪ Remote controlled power sockets ▪ Well insulated skylights and open plan living to the north ▪ Wool insulation which absorbs and retains indoor air pollutants

Table 2: Eco House Features

3.5 Neighbourhood Design Features

Review of the West Coast Road neighbourhood plan using the TUSC tool was undertaken in November 2007 concurrently with the resource and building consent process. This review resulted in a number of changes to the proposed site layout and landscaping. The final neighbourhood design features recommended for inclusion at the site at the time of writing are as follows:

Stormwater

Stormwater management at the site is provided through three connected wetlands and ponds for Stage One and swales for Stages Two and Three. Individual site management features including a rain tank, rain garden and permeable driveway will be installed on the Eco House property. Road widths have been minimised throughout the site significantly reducing the potential runoff volumes generated by the site.

Connectivity and Internal Movement

The community is serviced by an extensive walk and cycleway network to promote foot traffic both within the community as well as connection to external features such as adjoining parks and local shops or bus stops. There are no public transport ie: bus routes, within the West

Coast Road development due to its small size, however, public transport will be promoted by information signs indicating the closest bus stops, and railway stations.

Amenity

Site amenity has been maximised through the orientation of houses onto park and stream areas to capitalise on views and through the formation of zipper lots with zero lot lines to take full advantage of sun light capture, avoid shading from adjacent houses and maximise privacy. A number of roadways and walkways throughout the site are located along the stream margins to protect and encourage access to the stream and natural environment. In Stage Two a raised building platform on the south side of the roadway will maintain view shafts from the houses over towards the stream, increasing both visual and perceived spatial amenity.

A range of house styles and associated lot sizes are proposed, from small two bedroom units to large family homes containing five bedrooms. This range in form was chosen to encourage the development of a mixed community and avoid the 'cookie cutter' feel of many Auckland urban subdivisions. Additional features adding to site amenity include minimised road widths to reduce car speeds and create a more pedestrian and play friendly environment.

Ecology

As with many urban streams and riparian margins throughout Auckland, the tributary of Waikumete Stream running through the site is degraded due to weed infestation, erosion, slumping, lack of shade and cover, and poor water quality due to untreated stormwater flows from the surrounding urban area. Restoration of the stream is proposed through extensive native planting of stream margins, linking to planting around the constructed treatment ponds and wetlands. In addition, street trees throughout the site will comprise a mix of natives and low maintenance fruit trees to improve site ecology and provide as source of free, readily available fruit for the residents.

Energy

At the time of initial site review in November 2007 conventional mains powered street lighting had already been installed in Stage One of the development. As part of the Sustainable Community Development Project, discussions were entered into with NZHF and WCC to achieve the following:

- Installation of LED street lights in Stage Two of the development
- Installation of solar street lights in Stage Three of the development
- The installation of low level path lighting to illuminate walkways, cycle lanes and reserve areas to improve safety and amenity whilst reducing glare associated with normal street lights and preserve the night sky.

3.6 Project Methodology

To maximise the capture of information and findings, the Project will move through six stages with reporting at each milestone, as follows:

Milestone 1: Project Set Up and Plan Review (Completed)

- Preparation of a Detailed Project Plan describing the entire Project process from commencement to completion.
- Literature / internet review of sustainable neighbourhood design.
- Review and reporting on the West Coast Road neighbourhood concept plan and housing design plans using TUSC.

Milestone 2: Installation of Community Education Centre (Completed)

Following completion of Stage One of onsite construction, a Community Education Centre (CEC) will be installed. The CEC will be operational for duration of Project and will be populated with education and advisory material on sustainability and will be equipped with a computer with an internet connection to allow residents access to the TUSC tool to audit their houses and their neighbourhoods themselves.

Milestone 3: Community Signage and Training

Milestone Three of the Project is due for completion 31 March 2009. It comprises the installation of community signage and organisation of a Resident Welcome Day to raise awareness of the social and environmental features of the West Coast Road community.

Milestone 4: Sustainability Assessment and Reporting

Following completion of Stage One of the development, and no later than 31 March 2009, a triple bottom line audit of neighbourhood and household level sustainability will be undertaken using TUSC. The sustainability assessment allows a means of tracking progress of the achievement of the sustainability goals of the neighbourhood at the midpoint of the Project. The results of the assessment will be captured in a Pilot Study Report which will form the key record of the findings, challenges and opportunities associated with the development of a triple bottom line sustainable community at West Coast Road.

Milestone 5: Community Open Day

To celebrate completion of Stage Two construction and launch of the education and dissemination phase of the Project, a Community Open Day will be held at the West Coast Road site. This Milestone is scheduled for completion no later than 31 March 2009.

Milestone 6: Final Site Audit and Design Guidelines

Milestone Six marks the completion of the Sustainable Community Development Project in June 2009. The final project deliverable comprises a final triple bottom line audit of neighbourhood and household level sustainability at the West Coast Road site using TUSC. The final results, overall conclusions and key findings gained from the Project will then be captured in a Final Site Audit and Review Report. To allow dissemination of the project findings, Milestone Six will further require compilation of a Sustainable Neighbourhood Design Guideline which will provide guidance on design and development of sustainable neighbourhoods, and will form a template from which WCC and potentially other councils can manage the design and development of sustainable developments to maximise social and environmental benefits and minimise timeframes and costs.

4 DISCUSSION

4.1 Is the West Coast Road Development Sustainable?

Water

TUSC rates all the NZHF house designs as achieving 42% saving in water use compared to the average equivalent New Zealand home. The neighbourhood is considered largely neutral in terms of water use as the use of irrigation of general planted areas and the operation of any communal water features is not proposed but neither are there any communal grey water recycling or rain capture initiatives.

Energy

Based on TUSC review of the neighbourhood concept plan, the total estimated energy savings for the eight houses designs proposed for use at West Coast Road range from 31% to 53% compared to the average Auckland home.

Stormwater

Stormwater management at the site follows the traditional paradigm of a piped network discharging to communal treatment and attenuation devices for each of the three stages. Further reduction in both runoff volumes and the size of centralised treatment devices could be achieved through:

- Use of permeable paving for communal parking and right of way areas
- Use of permeable pathways
- Formation of rain gardens in road way roundabouts
- Use of rain tanks and rain gardens at an individual site level

While the West Coast Road community offers an improvement on the water and energy use and stormwater management of traditional, medium intensity suburban development common around Auckland greenfield fringes, it was limited in its ability to achieve true sustainable design through a number of factors. These constraints were largely centred on budget, regulatory and infrastructure constraints.

4.2 Cost Constraints

High capital costs have excluded the use of energy or water efficient appliances, recycled building materials, solar water heating, heat pumps, wetback fireplaces, double glazing, permeable paving and grey water recycling among other features researched for inclusion at the site or household level.

Such practical findings from the Project have to date, revealed the significant cost barrier to installing environmentally sustainable features and the difficulties inherent in creating a triple bottom line sustainable community particularly for the lower income bracket for which NZHF acts for.

4.3 Regulatory Constraints

Although there has been a great deal of worthwhile debate, achieving sustainable urban development within New Zealand continues to be constrained by restrictive local body rules and a lack of information and practical case study data. Local authorities similarly lack:

- Tools to assess cumulative effects and evaluate cost/benefit in terms of social, cultural, economic and environmental outcomes at a neighbourhood scale;
- New design approaches to urban form that will lead to affordable, socially and environmentally sustainable urban development's; and
- Linkages between resource and land use planning, infrastructure, transportation, the water cycle, waste, the energy cycle, and building design and construction.

Added to this lack of tools and data is a regulatory review and evaluation processes developed under a traditional single (economic) bottom line paradigm. This lack of flexibility can act to hamper timely processing of resource and building consents, escalate costs and timeframes and further limit innovative approaches to suburban development.

4.4 Infrastructure Constraints

While there are a large number of bus stops and parks within walking distance of the site, the transport sustainability of the site was limited, like many of Auckland's city fringe/ greenfield developments, due to its relative isolation and distance from local commercial and community centres, services and facilities.

5 CONCLUSION

While clear gains have been made at the site through the review process and will continue to be made as the Sustainable Community Development Project progresses, the question remains as to whether the West Coast Road site can truly be termed a "Sustainable Development". The Project has confronted in a practical form the issues facing many councils and developers, in not only Auckland but any major urban centre; how to reconcile suburban sprawl with sustainability? What is the value of educating on sustainability when the majority of homeowners live in unsuitable homes which they cannot afford to retrofit? Why promote public transport within a development when the supporting infrastructure is lacking? While this Project or presentation has not answered all these questions it has acted to inform the debate so that councils are better equipped to face these questions with tangible results and data.

By recording the engineering and planning details of a particular site, the Sustainable Community Development Project has acted as a specific case study on developing sustainable neighbourhoods under the current regulatory and funding framework within a set of defined ecological and engineering constraints. The Project has highlighted the onerous budget constraints facing developers, builders, and homeowners wanting to install energy and water efficient devices and utilise recycled or high quality building and cladding materials. It has further revealed the difficulties facing developers wanting to produce developments that while meeting the ethos of the regulating authority do not fit within the current consent framework and are this hard to assess and approve within current regulatory requirements. The Project has however, made clear the great gains possible through partnerships within council, developers, community groups and the communities themselves. Through working together,

communities are empowered to improve and enhance not only their individual homes, but neighbourhoods, with clear health, social and economic results.

It is hoped that the Sustainable Community Development Project will capture the challenges facing the design and implementation of triple bottom line sustainable neighbourhoods and by sharing these findings will inform broader discussion on achieving sustainable neighbourhoods within the urban context in New Zealand.