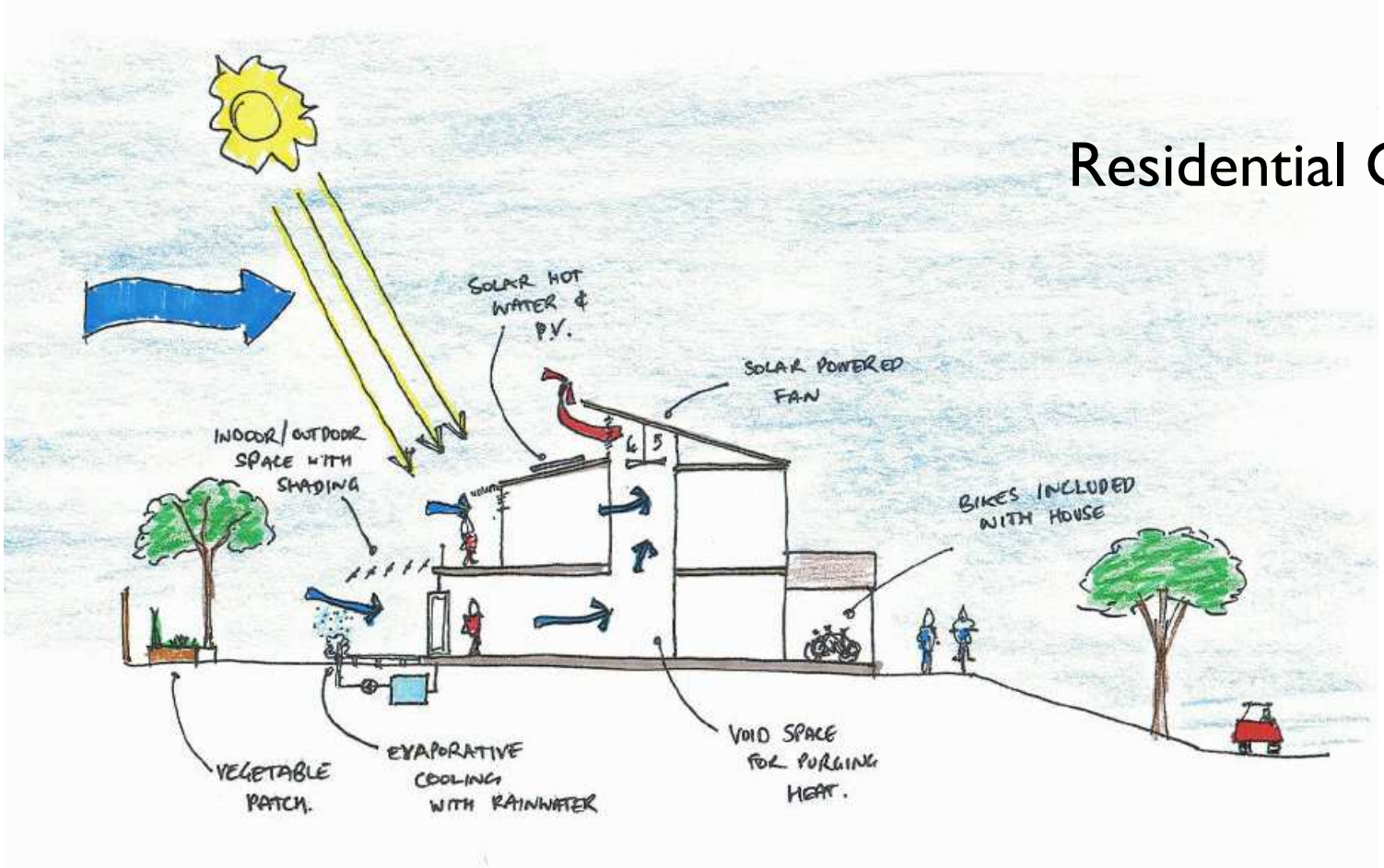
Residential Opportunities



Contents

Sustainability Statement

The sustainability statement outlined in this document has been established to ensure that the sustainability objectives that have been considered are integrated into the Stockland proposal and delivered throughout the design, construction and on-going management and operation of the development.

The sustainability statement establishes:

1. An overall sustainability policy for the development
2. The desired sustainability performance targets
3. The sustainability initiatives that have been integrated into the design of the Stockland proposal. These initiatives are categorised into:
   - Mandatory requirements: ESD initiatives that will become mandatory for the development. These requirements are identified in the following tables as indicated below.
   - Encouraged initiatives: ESD initiatives which provide a positive environmental contribution but that the developer can only encourage the tenants/residents to adopt. The encouragement can be promoted by providing a greater public awareness of the benefits of the initiatives.
   - Emerging technologies: ESD initiatives that are not commercially feasible at present but will be an emerging technology in Australia in the future. At present these technologies require external funding in order to make feasible. The development team will take the responsibility of assessing these emerging technologies as the project progresses.

Structure of the Sustainability Team

To develop, implement and monitor the objectives and outcomes of this sustainability statement a specialist team with considerable expertise and experience in the application of the principles of sustainable development has been assembled. Each of the following team members have contributed to the achievement of a highly integrated sustainable development.

Development management	-	Stockland
Masterplan Architect	-	Annand Alcock
Landscape	-	Clouston Associates
WSUD	-	Forbes Rigby
ESD	-	CJP
Ecology	-	ERM

Sustainability Policy

The development of the Vincentia District Centre presents a unique opportunity to influence the social, environmental and economic outcomes of the Bay and Basin area. The development will be a truly integrated community with a range of services and facilities to meet its needs. With this comes the responsibility to ensure that the exceptional natural beauty and ecological significance of the area is not compromised.

The vision statement for the project is "to create a high quality, active, integrated and sustainable coastal community whereby its character is informed by the unique bushland setting and undulating topography and where ecological impacts are minimised".

The development will incorporate buildings that are designed for occupant comfort, the latest technological advances in energy efficiency, stormwater management, water conservation, waste management and material selection. The resources savings demonstrated by the innovative ESD strategies will provide considerable environmental benefits, will provide public awareness and will encourage public ownership of these environmental issues.

Objectives and Targets

The project team has established a set of performance targets to compare the proposed project in Vincentia with the development of a similar typical development. The resource conservation targets established for the project are:

- **Energy conservation:** Develop and optimise the energy systems to minimise fossil derived energy compared with conventional systems
- **Water Conservation:** Reduce the potable water consumption and demand on the sewerage system
- **Materials:** Reduce the PVC usage in materials and promote materials with a low environmental impact and high indoor air quality.
- **Waste management:** Reduce waste in demolition, construction and operation.

The performance targets are indicated in the table below

% saving in the resource			
	Commercial	**Retail**	**Residential**
Energy	30%	30%	25%
Water	50%	50%	40%
Waste	50%	50%	60%

The % percentage savings indicated above are in comparison to a traditional development of the same size.

A Sustainable Community

The following key indicators have been used to provide an overall evaluation of the sustainability of the development;

- Environmental
- Social
- Economic

The key sustainability issues are summarised below:

Environmental

- Protection of known threatened species on site
- Retention of existing trees where possible and safe
- Preservation of the habitat of the Jervis Bay leek orchid
- Protection of the SEPP14 wetlands and the pristine waters of Jervis Bay through the use of innovative water sensitive urban design initiatives
- Retention of the significant vegetation in the riparian corridors and of the significant mature trees within the residential streets and lots
- Development of energy efficient buildings throughout residential, commercial and retail that will set a benchmark for Australia.

Social

- Provision of employment opportunities within retail precinct
- Large development allows for diversity of housing style as well as product size
- Retirement living developments providing further diversity of product
- Potential for true integration of residential, retail and civic facilities
- Provision of improved open space and small scale active and passive recreation facilities
- Create a network of cycle ways connecting with extensive existing cycleway network connecting to the beach, shopping centre and existing town
- It is envisaged that a mix of 500-600 full time, part time and casual jobs would be created by the project

Economic

- Provision of employment within retail precinct
- Employment generation during construction period

ESD Initiatives

The following table details the ESD initiatives considered for the projects. The ESD initiatives have been categorised into:

Mandatory (M): ESD initiatives that will become mandatory for the development. These requirements are identified in the following tables as indicated below.

(M): Mandatory

Encouraged (E): ESD initiatives which provide a positive environmental contribution but that the developer can only encourage the tenants/residents to adopt. The encouragement can be promoted by providing a greater public awareness of the benefits of the initiatives.

(E): Encouraged

Emerging (Em): ESD initiatives that are not commercially feasible at present but will be an emerging technology in Australia in the future. At present these technologies require external funding in order to make feasible. The development team will take the responsibility of assessing these emerging technologies as the project progresses.

(Em): Emerging

Separate tables have been developed for the different building types- residential, commercial and retail.

The following ESD indicators were used to evaluate the environmental performance of the development in energy, water, waste, materials, indoor environmental quality, transport, ecology, community initiative and public awareness and educational initiatives:

Residential ESD initiatives

Indicator	Sector	Initiative	Mandatory (M) Encouraged (E) Emerging (Em)	Requirements/Benefits
Energy	Residential	Passive Design	(M)	✓A minimum performance requirement of achieving 4 star NatHERS rating (or equivalent BASIX rating) for all residential dwellings. This will improve occupant comfort and reduce energy ✓A minimum BASIX requirement of reducing energy consumption by 25% has been established ✓To meet the minimum BASIX performance requirement the project home builder may need to respond to the following issues: • Living rooms to be orientated wherever possible to face north (within 30 degrees east and 20 degrees west of north) • Roof insulation and wall insulation • Dedicated natural ventilation openings with flyscreens for all homes to provide controllable natural ventilation. • External shading on all east, west and north facing windows
Energy	Residential	Energy efficient lighting	(M)	✓A minimum of 75% of a dwelling is to be lit by compact fluorescent lights and 90% of low voltage downlights specified is to be 35W low-voltage downlights (or alternative equivalent) rather than 50W dichroic.

Indicator	Sector	Initiative	Mandatory (M) Encouraged (E) Emerging (Em)	Requirements/Benefits
				✓External lighting to be minimised and controlled via motion detectors
Energy	Residential	Solar hot water	(M)	✓All dwellings will have solar hot water with electric backup – if solar is unfeasible due to the overshadowing of trees then solar heat pumps should be used
Energy	Residential	Renewable energy	(E)	✓Provide space allocation with the required orientation for installation of PV panels and associated wiring in the future
Energy	Residential	Renewable energy via PV panels	(E)	✓The benefits of installing PV panels will be described and encouraged. A minimum of three PV panels per dwelling will provide enough green energy for all lighting requirements.
Energy	Residential	Low energy appliances	(E)	✓The benefits of selecting white goods with high star ratings will be described and encouraged. A minimum performance criteria will be to select white goods within 1 star of the best available locally at the time
Energy	Residential	Low energy air conditioning	(E)	✓The benefits of the passive systems will be described to the public to show that the requirements for AC are minimal. If occupants desire AC the following criteria has been provided: • AC to be zoned to suit the layout of the house • Demonstrate complete avoidance of HCFC and CFC based refrigerants • AC units to be inverter drivers • AC units to be a minimum 4 star rating.

Indicator	Sector	Initiative	Mandatory (M) Encouraged (E) Emerging (Em)	Requirements/Benefits
Energy	Residential	Micro-cogeneration	(Em)	✓The use of individual micro-cogeneration plant to provide electricity and heat locally to each dwelling has been considered. This technology will be available in Australia within the next 2 years and the feasibility of the proposal is dependent on the availability of natural gas.
Water	Residential	6/3 litre dual flush WC's	(M)	✓Reduction in potable water to achieve the BASIX requirements
Water	Residential	*AAA* rating to all shower heads	(M)	✓Reduction in potable water to achieve the BASIX requirements
Water	Residential	Aerators fitted to hot and cold water taps over basins and sinks	(M)	✓Reduction in potable water to achieve the BASIX requirements
Water	Residential	A minimum 3,000 litre rainwater tank and pump unit for collecting roof rain water to supply garden irrigation system and WC flushing for all dwellings. All outdoor taps connected to rainwater tank	(M)	✓Reduction in potable water to achieve the BASIX requirements
Water	Residential	WSUD	(M)	✓Provision of bio retention swales and permeable pedestrian ways around

Indicator	Sector	Initiative	Mandatory (M) Encouraged (E) Emerging (Em)	Requirements/Benefits
				selected roads.
Water	Residential	Car/Boat wash down	(E)	✓Provision of a centralised car/ boat wash down facility using recycled water
Water	Residential	*Water wise* landscape selection throughout all gardens	(E)	✓Reduction in potable water to achieve the BASIX requirements.
Waste	Residential	Waste reduction during construction	(M)	✓The contractor will aim to recycle 80% of construction waste.
Waste	Residential	Suitable recycling facilities	(M)	✓Separate recycling of paper/cardboard, glass/plastics and aluminium cans
Waste	Residential	Native plants	(M)	✓Wild flower and seed collection scheme commissioned
Waste	Residential	Organic waste separation	(E)	✓Design of kitchen waste disposal to allow for the separation of organic waste which could be used for garden compost along with green waste. Alternative a fortnightly pick-up service for green waste is encouraged.
Water	Residential	Greywater treatment	(Em)	✓There has been rapid and continuing development of greywater treatment and the associated guiding legislation by NSW Health. The key sensitivity issue with the use of greywater recycling for this development is the potential environmental impact of the treatment plant if not maintained properly
Water	Residential	Blackwater treatment	(Em)	✓There has been rapid and continuing development of blackwater treatment and the associated guiding legislation by NSW Health. The key sensitivity

Indicator	Sector	Initiative	Mandatory (M) Encouraged (E) Emerging (Em)	Requirements/Benefits
				issue with the use of blackwater recycling for this development is the high supply but low demand for the organically rich effluent and the potential environmental impact of the treatment plant if not maintained properly.
Materials	Residential	Materials matrix	(E)	✓A materials matrix to be developed that provides a framework for the selection of materials based on the environmental performance criteria such as – recycled content of material, embodied energy, effect on indoor air quality.
Materials	Residential	Reduction in PVC	(E)	✓HDPE pipework for services will be used instead of PVC with the option for steel *Enviroflo* gutters
Indoor air quality	Residential	Cycleways	(M)	✓All key roads will have dedicated shared bicycle/pedestrian paths throughout the development.
Indoor air quality	Residential	Fireplaces	(E)	✓Restrict the use of wood fire heating
Transport/ Indoor air quality	Residential	Fewer vehicle kilometre travelled	(E)	✓Public transport routes connect key local destinations and connect with the wider public transport system including Vincentia and Nowra
Transport	Residential	Fewer vehicle kilometre travelled	(E)	✓Shops to offer internet purchasing and home delivery of shopping.
Transport	Residential	Bicycle	(E)	✓The home builder will form a relationship with a bicycle supplier to provide discount priced cycles as part of the home purchase deal
Transport	Residential	Bicycle	(Em)	✓Electric bicycle powered by renewable energy stations

Indicator	Sector	Initiative	Mandatory (M) Encouraged (E) Emerging (Em)	Requirements/Benefits
Transport	Residential	Public transport powered by Green Energy	(Em)	✓The feasibility of powering electrically powered buses from the renewable energy generated on site
Educational initiative	Residential	Size of house	(E)	✓Advice will be given to a potential resident on the size of house required for a particular lifestyle
Community initiative	Residential	Leisure	(E)	✓Negotiate with council for residential leisure club membership (12months subscription)
Community initiative	Residential	communications	(E)	✓Provide wherever possible broadband connection to all homes to encourage home based employment

Overall the mandatory sustainability initiatives will save the following resources for the residential development:

Water 116 million litres/year

Energy 2,200 tonnes of carbon dioxide /year

Waste 680 tonnes of rubbish/year

The proposed development in Vincentia has challenged the conventional and emerging guidelines for sustainable developments in Australia. The focus has been in the delivery of a development that will become a benchmark over the next 10years in sustainable living. The objective of this report is to outline the sustainability initiatives that have been consider and that have been integrated into the Stockland proposal.

The development will incorporate the latest technological advances in energy efficiency, stormwater management, water conservation, waste management, material selection, and occupancy comfort. The resource savings demonstrated by the innovative ESD strategies will provide considerable environmental savings, will provide public awareness and will encourage public ownership of these environmental issues. The dwellings will also be designed so the occupant can sit down in an environment where they can read a newspaper without having to switch on the lights, where natural ventilation can be controlled by the touch of a button, where they can see how much water and energy they used today in comparison with yesterday and to be in an environment that is more in balance with the outside environment.

What guidelines can we use to measure the environmental performance of our development?

NSW Planning have recently developed the new *BASIX* sustainability index that will introduce mandatory, minimum performance standard for the consumption of energy and water for metropolitan developments in NSW in July 2004. The initial targets are to achieve a minimum water conservation of 40% and energy conservation of 25%. The index will be developed further to incorporate the other indicators of sustainability such as material selection, transport etc.

What performance targets have been established for the project?

The project team have established the following challenging performance targets for the residential component of the project:

1) **Water Conservation** – reduce water consumption by **40%**
2) **Energy Conservation** – reduce energy consumption by **25%**
3) **Waste Management** – a recycling waste target of **60%** from households
4) **Materials** – reduce PVC usage by **50%**

Introduction

The Vincentia development has a site area of some 126 Ha of which around 60 Ha will be retained for open space and conservation purposes. The District Centre is to be located adjacent to the crossroads of the Wool Road and Naval College Road, and will initially have around 20,000m² of retail and commercial floorspace, with eventually up to 32,000m²of development. The residential areas to the north and west of the centre will contain around 600 dwellings with a strong focus on integration into the bushland surroundings. 136 adaptable housing units are also proposed in the Village East. Development of residential and commercial uses is intended to consolidate a community focus around the Bay and Basin Leisure Centre and nearby High School.

The vision statement for the project is:
"to create a high quality, active, integrated and sustainable coastal community" whereby its character is informed by the unique bush land setting and undulating topography; and where ecological impacts are minimised.

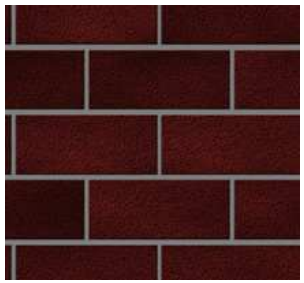
CJP have been appointed to promote and develop Ecologically Sustainable Development (ESD) strategies throughout the design stages of the project in Vincentia.

This vision will be realised with the successful integration of the ESD strategies that incorporate the latest technological advances in energy efficiency, storm water management, water conservation, waste management, and occupancy comfort. The resource savings demonstrated by the innovative ESD strategies will provide considerable environmental savings, will provide public awareness and will encourage public ownership of these environmental issues.

This report addresses the ESD issues for the residential development.

Methodology



The following ESD indicators were used to evaluate the potential environmental performance of the development:

- Energy
- Water
- Waste
- Materials
- Transport

The social, economical and environmental impact of the indicators above have been assessed. Throughout, our philosophy has been to identify the opportunities to reduce the need for each resource, then look at options to reuse the resource or obtain that resource from a renewable source.

Each section of the report has been set out with the following headings for each environmental consideration:

- **Background** – The context in which that resource is used
- **Objective** – the key objectives in using that resource in a more sustainable way
- **Options** – descriptions of the products available and their considerations
- **Performance** – How those products fit into the Vincentia development

Demonstrating the environmental savings of the development is best done using easily identifiable quantities that anyone can picture. These are;

- Energy use – The average family-sized car pumps out around 4 Tonnes of CO_2 into the atmosphere every year. This is equivalent to the pollution created by a coal burning power station generating 4,250kWh of electricity. 1kWh of energy used is the equivalent of leaving a room convection heater on for an hour.
- Water Use – An Olympic swimming pool holds around 1,000kL of water
- Waste Generation – Wheelie bins hold a relatively small amount of waste so development-wide savings gives too big a number for people to really picture. Instead, the small, car-sized skip that holds 3.5 Tonnes of waste has been used.

How can you measure it?

Many councils are requesting a quantitative assessment to demonstrate compliance with their environmental and sustainability policies. Historically these have been in the form of Development Control Plans (DCPs) that require minimum NatHERS ratings but as of July 2004 a new system replaced all DCPs with a state-wide standard – BASIX.

NatHERS – (Nationwide House Energy Rating Software) is a simple computer simulation tool for house energy rating in Australia developed around 5 years ago by CSIRO. It provides a benchmark for assessing the thermal performance of houses in NSW in terms of how much energy is required to heat and cool the house.
It does not consider energy use of appliances, water use, waste management or material selection (apart from the effect of insulation and thermal mass)

HOUSE ENERGY RATING

BASIX – BASIX is a new web-based application which will assess the potential performance of residential developments against a greater range of sustainability indices. It has been developed by the Department of Planning (DoP) and became a compulsory part of planning regulations for Metropolitan Sydney in July 2004, with the rest of NSW following in July 2005. Currently it addresses only issues of water use and energy use, including appliance use but later versions will include measures of waste management, material selection and transport.

BASIX

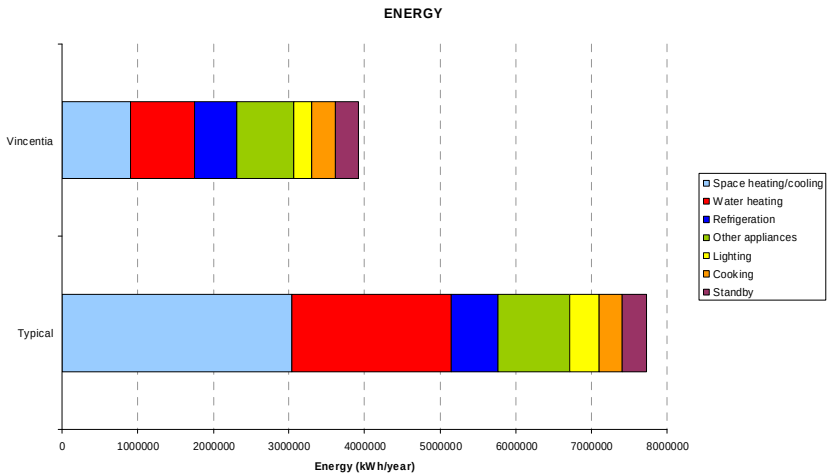
What improvements should be targeted?

Overall our objectives for the development in comparison to a typical residential estate are:

- Water Conservation – reduce water consumption by 40%
- Energy Conservation – reduce energy consumption by 25%
- Waste Management – reduce waste to landfill by 60%

Establishing the above objectives for the project will ensure compliance with BASIX requirements.

Energy Consumption



Background

A typical Australian house might use 13,000kWh of energy annually for:

- 39% Space heating and cooling
- 27% Water heating
- 12% Other appliances
- 9% Refrigeration
- 5% Lighting
- 4% Cooking
- 4% Standby power

This means that a development of 600 houses, like Vincentia, would consume 7,800MWh per year, responsible for generating as much CO_2 as 1,833cars.

Since July 2004, new houses in metropolitan Sydney have been required to reduce the average energy consumption for a typical house by 25% under a new planning system, BASIX . Rural houses were required to meet these targets the following year.

Objectives

Using a more efficient hot water heating system and air-conditioning system will drastically reduce energy consumption. Similarly, efficient appliances will save energy. Alternative sources of energy such as renewable and alternative fuels can also make considerable savings over conventional grid electricity.

The project team should aim to achieve a 4.5 star NatHERS rating, or an energy saving of at least a 25%, for all residences (whichever is greatest). These savings would give an overall energy saving of 2,340MWh, effectively taking 550 polluting cars off the road.

The following pages detail ways in which energy savings are achievable. Adaptable housing will have the same requirements but has not been included in the calculations.

Passive Design

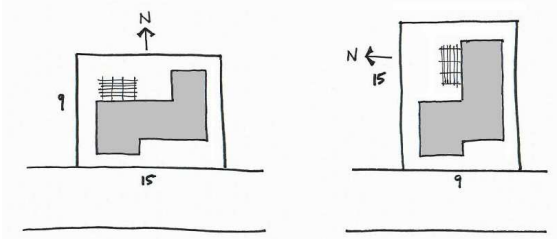
Passive design is all about reducing energy use by making a better product in the first place. In the micro scale this means a well designed house but on the macro scale this means better master planning, lot division and street arrangement – if this is not considered up-front then the development will use resources unnecessarily.

Orientation

The orientation of the homes is important. Solar access should be optimised to ensure minimal cooling is required in summer and that free winter heating from low level sun is maximised. The orientation of dwellings relative to solar access can significantly influence amenity, internal temperatures and the demand for heating and cooling. The optimum orientation for dwellings is to maximise the northern solar access to living rooms and to minimise the glazing to the west.

Shading

Shading design ensures sufficient solar access in winter and minimal heat gains in summer. For fixed shading, appropriate angles need to be determined for each orientation, operable shades also need to be considered. The eave overhangs will be used for shading where posssible and external shading will be provided for all exposed north, east and west facing windows



Plot layout and shape needs to be adjusted for orientation

Insulation values of up to R3 can be achieved by using products such as aircell (above)

Ventilation

Improved indoor air quality comes from cross ventilation via openable windows and doors and dedicated secure vents. These vents can then be left open when the house is unoccupied to purge heat that is building up during the day without any security issues

Daylighting

Significant reductions in lighting energy can be achieved with good façade and glazing design to optimise daylight levels in habitable rooms. Care needs to be taken that the daylight is weighed against increased heat gains to optimise the amount and type of glazing.

Insulation and Thermal Mass

A good level of insulation is required to reduce the requirements of cooling and heating, and thus reduce energy use. Also, thermal mass will reduce peak cooling/heating loads by storing some heat in the winter and also to absorb heat in the summer to improve comfort.

Performance

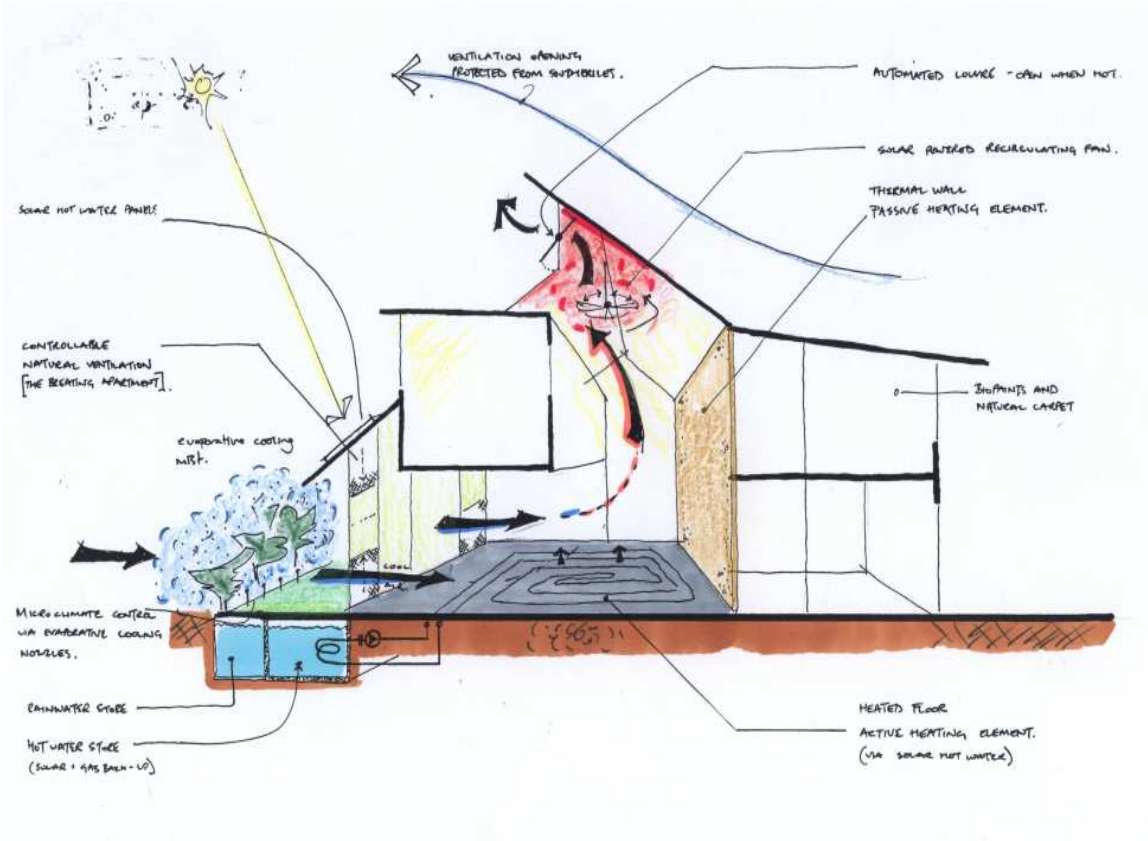
Savings are difficult to quantify. Providing a poor design will add to the energy consumption, improving the design will reduce the energy often with very little additional cost, 20% energy savings on AC and lighting are achievable which equates to a 10% saving in the total energy.

Total House Energy Saving	10%
Payback Period	< 5 years
Total Greenhouse Gas Avoided over whole development (no of cars taken off the road)	183 Cars

Home of the future

The homes for the Vincentia project will set a benchmark in terms of energy efficiency and occupant comfort. Consideration should be given to reducing the actual size of the houses and promoting the connection between the indoor and the outdoor spaces in order to provide a larger overall living space with a minimal environmental impact.

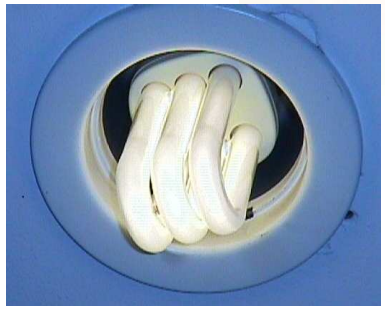
- **Orientation:** the orientation of the house and relationship to the plot will be consider and different lot dimensions should be given to different aspects. The key to the orientation location of the living room in relationship to north.
- **Indoor/outdoor relationship:** developing usage external spaces that can become an extension to the living room
- **Use of materials:** Appropriate use/mix of thermal mass and insulation, reverse brick veneer construction, insulation of the perimeter of the floors.
- **Breathing homes:** The use of dedicated natural ventilation openings with integral fly screens to provide controllable natural ventilation.
- **A comfort index:** Development of a comfort index for homes to complement NatHERS.
- **Heating and cooling:** The elimination of the requirement for AC due to the passive performance of the spaces with the option of using *inslab* heating linked to the solar panels
- **Solar powered fans:** the use of solar powered fans for increased ventilation on hot days.



The above diagram is an example of how some of the listed ESD initiatives can be integrated into the project. The concept indicated has been developed by CJP, AJC Architects and Cosmopolitan Developments

Lighting

Standard incandescent lighting consumes a lot of energy while low-voltage downlighters consume even more. Compact Fluorescent Lighting (CFL) consumes 75% less energy than incandescent lighting and can fit straight into most light fittings. For most globes, the light is whiter in colour than incandescent fittings but more yellow fittings are available. Capital costs are higher for CFLs but the globes last around 8-10 times longer than a standard globe - This gives payback in just over a year, then savings for a potential further 4 years.



Performance

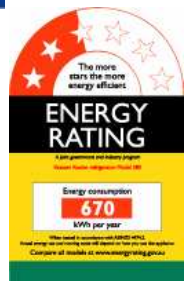
Ideally, 75% of a dwelling can be lit with CFLs with only the lounge and bedrooms using conventional lighting.
Lighting consumes around 5% of the total house energy. Using CFLs gives savings of 75% energy consumption over 75% of the house.

Total House Energy Saving	3%
Payback Period	1 year
Total Greenhouse Gas Avoided over whole development (no of cars taken off the road)	51 Cars

Low-energy Appliances

All appliances are now star-rated on a scale of 1-6 with 1 star meaning poor energy performer and 6 stars meaning excellent energy performer. In 2000 the scales were recalculated to make it harder to achieve 6 stars and now most appliances sit at around 2-3 stars with energy efficient appliances at around 4 stars.
There are 4 different groupings of appliances (not including AC). For each group a Base Energy Consumption (BEC) has been calculated, the star rating is awarded in relation to the saving against this figure. For instance, a 10% reduction may give 1 star, a further 10% saving gives 2 star and so on, up to the 6 stars, actual savings vary for each group:

- Fridges and Freezers require a 14% to 23% reduction in energy for each star
- Washing machines require a 27% reduction for each star
- Clothes Dryers require a 15% saving for each star
- Dishwashers require a 30% saving for each star



Performance

If a standard 2 star appliance consumes a given amount of energy then a 4 star appliance will consume between 24-36% less energy. That means the 21% used in appliances and refrigeration in a typical house will reduce by around a third. The extra cost per appliance would be around $250, or $1000 total. The benefits of the use of low energy appliances will be encouraged and described to potential purchasers

Total House Energy Saving	6%
Payback Period	13 years
Total Greenhouse Gas Avoided over whole development (no of cars taken off the road)	116 Cars

Energy Efficient AC

Passive design can drastically reduce the need for air conditioning (AC) but there will still be some situations where the house occupants will be uncomfortable and so they may opt for AC.
A number of different mechanical AC systems are widely available:

The benefits of the passive systems will be described to the public to show that the requirements for AC are minimal. If occupants desire AC the following criteria has been provided:

- AC to be zoned to suit the layout of the house
- Demonstrate complete avoidance of HCFC and CFC based refrigerants
- AC units to be inverter drivers
- AC units to be a minimum 4 star rating

If gas is available at the site then a gas bayonet will be provided within each living room for supplying gas heating if required in the future

Performance

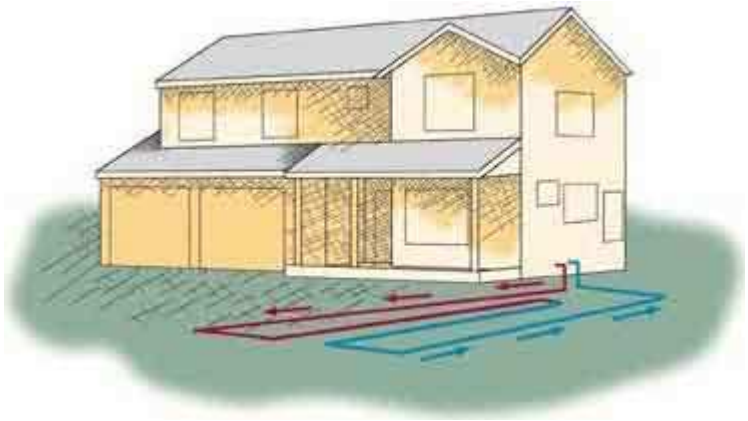
A 4star rated AC unit will use 25% less energy than a 2 star unit. This means the 39% of energy used for heating and cooling in a typical house will reduce by around a quarter. The extra cost of the air conditioner would be around $2000. The benefits of the use of low energy AC appliances will be encouraged and described to potential purchasers

Total House Energy Saving	10%
Payback Period	15 years
Total Greenhouse Gas Avoided over whole development (no of cars taken off the road)	183 Cars

Heat Pump Hot Water Heating

Heat pumps draw heat from the ambient air like a reverse cycle air-conditioner.
Panels can be mounted anywhere, even vertical walls. However they are more efficient if placed in direct sunlight.
Heat pumps still require a boost to provide the extra heat needed to raise the water from 50°C to 60°C. This will most likely be an electrical coil.
Manufacturers include Quantum and Edwards.

Geothermal heat pumps can use coils in the ground instead of air panels to draw heat from the earth where it is a constant 16-18°C. The system is more efficient than panels in winter but less efficient in summer. For hot water generation only, the systems are comparable but for a hydronic space heating system the geothermal system is more efficient.



DIMENSIONS		
Key	Models	
	270T2-S	340T2-S
A	1117	1417
B	1780	2080
Model	Description	
270T2-S	270 Litre Turbo Series 2 Solar	
340T2-S	340 Litre Turbo Series 2 Solar	

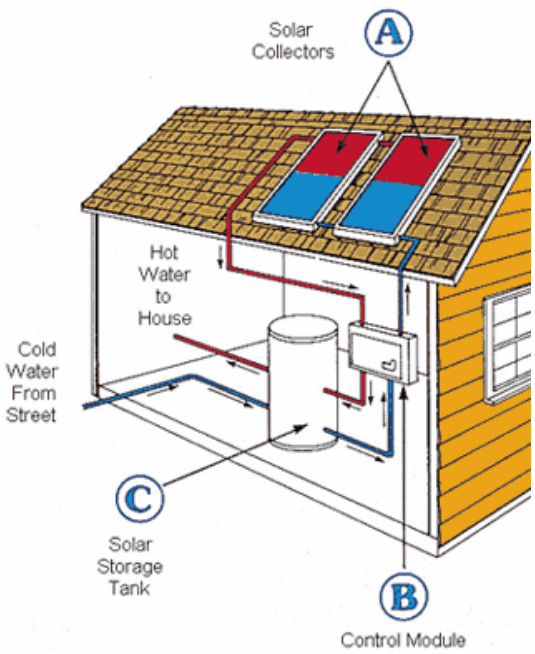
Performance

A heat pump system for a family of four costs around $2500 more than a conventional system and will save approximately 50% of the energy used for hot water generation.

Total House Energy Saving	14%
Payback Period	> 13 years
Total Greenhouse Gas Avoided over whole residential development (No of cars taken off the road)	257 Cars

Solar Hot Water Heating

Panels are mounted on the roof that collect heat from the sun to heat domestic hot water.
A well designed system will provide around 60% of the energy required to heat hot water for free. This means the panels must be aligned North at a vertical angle of 40°.
Solar hot water systems still need a boiler to provide hot water at night or in cloudy conditions. They are best paired with a gas-fired boiler to boost the temperature. As gas is not available at the site, electric boosting would be required.
Renewable Energy Certificates (RECS) are available from the government that reduce the additional cost from $2000 to around $600 giving a payback of around 3 years.
Manufacturers include Edwards and Solahart.



Performance

A 2 panel (4m^2) system for a family of four costs around $2000 more than a conventional system and will save approximately 60% of the energy used for hot water generation.

Total House Energy Saving	16%
Payback Period *(3 years with RECs)*	10 years
Total Greenhouse Gas Avoided over whole residential development (No of cars taken off the road)	293 Cars

Photovoltaic

Photovoltaic panels convert sunlight directly into electricity. Unfortunately, most of the energy is wasted in heat build up, most panels are less than 10% efficient. Also, because photovoltaic is still a relatively new technology, costs of panels are reasonably high.
Government subsidies are available but the extent of them has been drastically reduced over the past few years and should not be counted into the payback period.
Solazone in Queensland (07 5448 7010) produces a panel that is built into a sheet of colourbond steel. This can reduce payback by saving on the cost of roofing product but it also provides a more aesthetic finish with reduced installation costs.

Performance

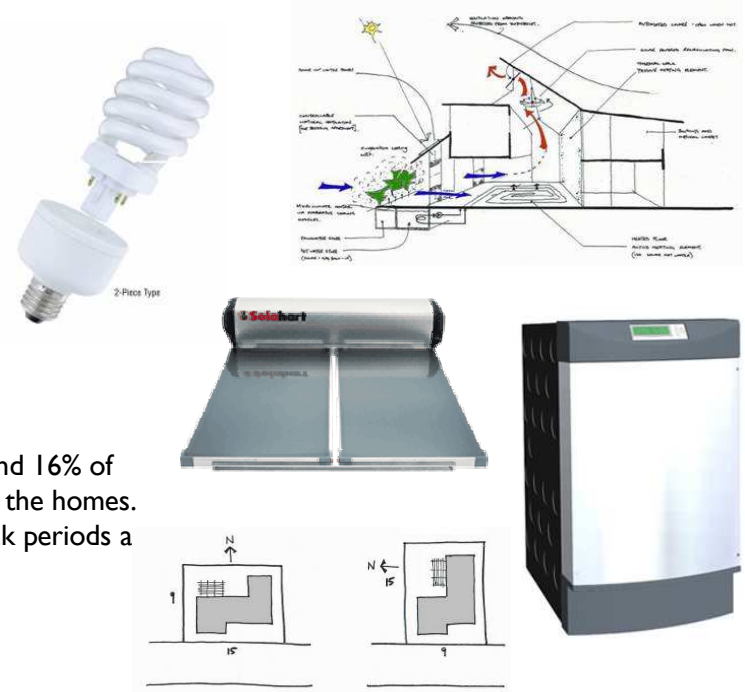
A 12-panel system (12m^2) will produce 1kW of electricity which is around 20% of the load within a typical house. With an inverter grid-connection the system will cost around $15,000. Alternatively four panels could be provided to generate green power for the lighting at a cost of approximately $6,000.

Total House Energy Saving	20%
Payback Period	> 60 years
Total Greenhouse Gas Avoided over whole residential development (No of cars taken off the road)	372 Cars

Energy Use - Recommendations

Mandatory

- Passive design will minimise energy use. Some small extra cost in insulation, shading and ventilation openings may need to be allowed. Savings will be around 10%.
- Fluorescent lighting reduces energy consumption with little extra cost and should be specified for up to 75% of fittings, saving 3% of home energy.
- Solar hot water panels with electric boosting should be included saving 16% of home energy use. If solar is not suitable a heat-pump system would save around 14% of home energy use.
- Consideration of plot shape relative to orientation is critical at the planning stage in order to achieve the required NatHERS and BASIX rating for the homes. A minium performance requirement of achieving a 4 star NatHERS rating and the BASIX requirement.



Encouraged

- 4A rated appliances (including AC) reduces energy use over conventional appliances, saving around 16% of home energy use. The extra cost of the appliances could be applied as an add on package cost to the homes.
- Photovoltaic solar panels are at present an expensive way of producing electricity, though payback periods a getting smaller. The technology will be encouraged and demonstrated within the display home.

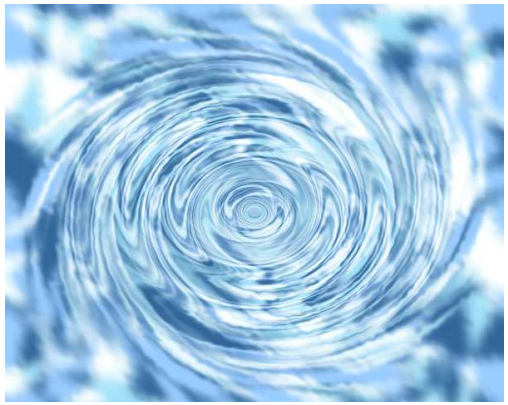
Emerging technology

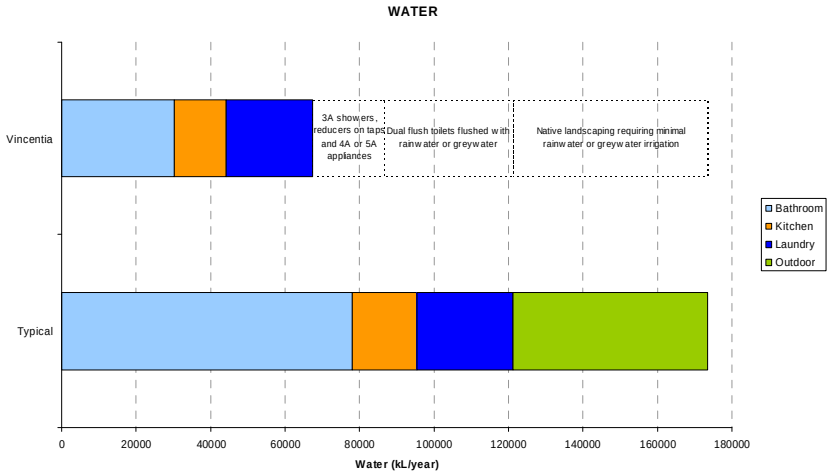
- Micro CHP systems are in their infancy with some test models in use in the U.K. They are ideal for heating systems and in the future could be combined with small absorption chillers for providing cooling. Micro CHP would save around 25% of home energy use, though this replaces savings in solar hot water generation so overall savings would be 10%. However a gas connection is required.
- Alternative fuels may provide energy in the future but are most suitable when paired with a significant waste generating industry, e.g. burning sugar cane on site to generate electricity for sorting machinery etc. They require huge capital infrastructure investment.

Performance

Including the definite features described above will give savings of up to 39% with a further 26% savings available for items under consideration

Total House Energy Saving	25%
Payback Period	< 5 years
Total Greenhouse Gas Avoided over whole residential development (No of cars taken off the road)	458 Cars





Background

Water is a precious and high demand resource and reducing consumption is a critical part of alleviating pressure on sources and maintaining water availability. The key issues relating to water are:

- Reduction of water usage through efficient appliances
- Reclaiming water that would otherwise be lost - Rainwater
- Reuse of water - Greywater
- Recycling of water on-site prior to release - Blackwater

A typical household uses approximately 250kL of water each year for the following uses:

- 10% kitchen sink
- 25% bathroom sink, shower and bath
- 20% toilet flushing
- 15% laundry sink and washing machine
- 30% outdoor for garden and washdown

For Vincentia the amount of water used in 600 households would be 150,000kL or the equivalent of 150 Olympic sized swimming pools per year.

Objectives

Water use can be reduced through efficient fittings and appliances. Also, potable water use can be reduced by collecting rainwater or reusing water (greywater and blackwater).

From July 2004, houses in suburban Sydney were required to use 40% less water than the average conventional home. This was introduced state-wide in July 2005.

For Vincentia the target is 40% water reduction over the average house. This will save 75,000kL of water per year, the equivalent of 75 Olympic swimming pools. Reducing the impact on the sewer should also be considered but this will only be possible by reusing or recycling water.

AAA Fittings

The best way to be water efficient is to reduce water use in the first place.
AAA rated fittings are available for the showerhead and taps. They generally reduce flow by 50% but aerate the water to give the impression of standard flow.
AAA rated toilets have 3/6L dual flush cisterns with an average flush of around 4L in comparison to the standard 11L cistern of 15 years ago.
These fittings have become standard fit in most new-build instances with little or no additional cost and considerable savings in the bathroom.

Savings are less apparent in the kitchen. This is because generally speaking things are filled in the kitchen (jugs, saucepans, buckets, the sink etc.) so it doesn't matter the rate at which they are filled. If people are rinsing things under running water, such as vegetables or plates, then using AAA fittings will save water.
Similarly there is no need to fit AAA taps to the bath – it would just take much longer to fill the bath.

Performance

Installing AAA fittings throughout the home will save 40% of the water use in the bathroom. There would be little or no additional cost, even retrofitting appliances takes less than a year to payback. Overall, there would be little or no saving in the kitchen.

Total House Water Saving	18%
Payback Period	<6 months
Total Water saved over whole residential development (no of olympic-sized pools filled per year)	36

Water Efficient Appliances

Washing machines and dishwashers can be selected that use water more efficiently.
Front loading washing machines with a 4A or 5A rating use at least 30% less water than standard top-loading washing machines.
4A or 5A Dishwashers use at least 20% less than a standard unit. Some units have 2 drawers to allow half loads to be done more easily.

Performance

Installing 4A appliances will save 30% of the laundry water use and 20% of around half of the kitchen water use. The extra cost of the appliances will be roughly $300 each (although a water-efficient appliance is likely to be energy-efficient too so the extra cost will be offset by two lots of savings).

Total House Water Saving	5.5%
Payback Period	> 40 years
Total Water saved over whole residential development (no of Olympic-sized pools filled per year)	11

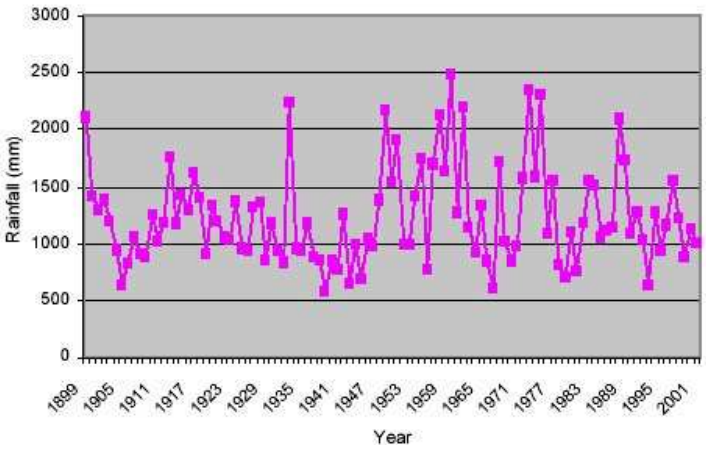
Rainwater Tanks

The rainfall in Vincentia ranges from 585mm in 1940 and 2500mm in 1961. The average family home has a roof area of around 175m2 so this means that 175kL of water should be available for collection. However, after a dry period the roof must be flushed of debris and the roof will always absorb some water. Also, in times of heavy rain there won't be enough storage so some water will overflow straight to storm drains.

Rainwater is relatively clean and free of any harmful bacteria. NSW health allows rainwater to be consumed but recommends grid water if available. Rainwater can be safely used for most activities including flushing toilets, watering the garden, washing the car and washing clothes without any treatment other than basic solids filtration, replacing up to 65% of potable water use.

If rainwater is to be used for flushing toilets then a mains top-up must be fitted to ensure water is always available. This makes the system twice as expensive as a stand-alone rainwater tank system.

The rainwater tank will be an integral unit with first flush diverter, mains water top up, overflow pipe and pump unit.



The graph above indicates the range of rainfall for the Vincentia area since 1900

Performance

A rainwater tank will be installed for each dwelling. This will save up to 100kL per year or 40% of the base water use.

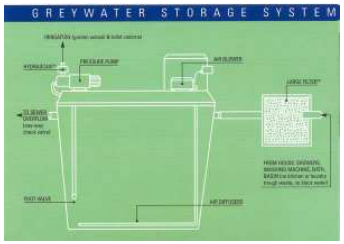
Total House Water Saving	40%
Payback Period (with toilet flush)	20 years
Total Water saved over whole residential development (no of olympic-sized pools filled per year)	80

Greywater Systems

Greywater is water that has been used before but has not passed through humans, therefore it is relatively low in harmful pathogens. The advantage of using greywater over rainwater collection is that not only does it reduce potable water use, it also reduces the load on municipal sewerage facilities, allowing more people to live in an area with no increase on infrastructure demand. Payback on greywater systems can be deceptive because it doesn't include the saving in waste water – but in the future we may be charged for our waste, halving the payback period.
However, NSW Health have strict controls for greywater reuse:

- Greywater from a washing machine can be diverted to sub-surface irrigation pipework in the garden. It must be manually switched (or pumped from a surge tank < 100L) when required and cannot be used during rainy periods. Root vegetables that will be eaten raw must not be irrigated with greywater. Nitrates in laundry powder can promote weed growth, natural detergents are available that do not include these additives and should be used.
- If greywater is to be used for flushing toilets or spray irrigation, or any purpose in which it may come in contact with humans, then it must be treated to a secondary level through the use of reed beds or an Aerated Waste Treatment System – the same system used for full sewerage treatment.

Victoria has a more relaxed treatment requirement. A number of manufacturers there produce units that use greywater to flush toilet cisterns as well as providing sub-surface irrigation, saving up to 35% of the annual water use with a slightly reduced payback.



The introduction of BASIX this year, with a category for using greywater for toilet flushing, may encourage NSW Health to relax their requirements or for someone to provide a system that complies.

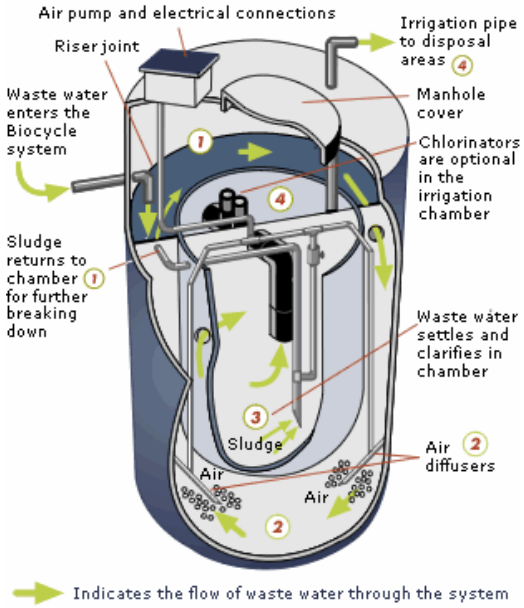
Performance

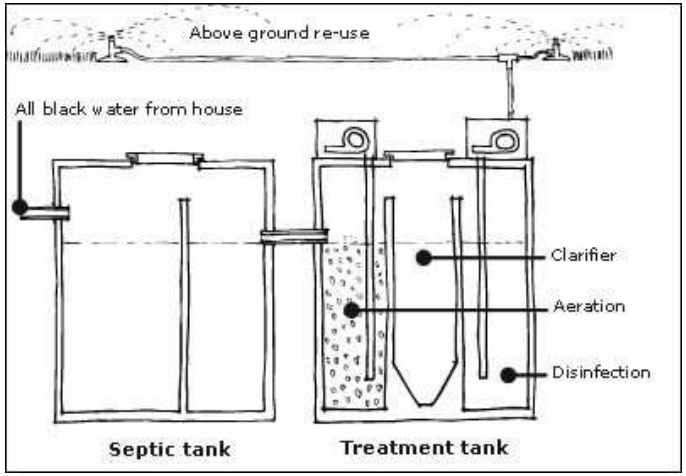
Installing a sub-surface irrigation system with an automated greywater diversion device costs around $1000 and provides irrigation water for the lawn and flower beds.

Total House Water Saving	15%
Payback Period	25 years
Total Water saved over whole residential development (no of olympic-sized pools filled per year)	30

Blackwater Systems

Blackwater is water that has passed through humans or has been used in cooking so it is high in harmful pathogens and suspended solids.
The only way to treat blackwater is to put it through a full Aerated Waste Treatment System (AWTS) that separates out the solids and filters the water back to a clear odourless liquid suitable only for irrigating the garden.
Although 100% of domestic water use can be recycled, unfortunately only 20% of potable water is required for irrigation meaning 80% has to be dumped to either the sewer (wasted energy as it will be treated twice) or dumped to stormwater drains which is not acceptable to NSW Health.
Regular cleaning and maintenance also has to be considered.
This means that blackwater systems are only really applicable for isolated properties where there is a huge area of ground to irrigate and no stormwater drains to pollute.
Also, Shoalhaven has recently installed a large-scale municipal blackwater recycling system so there is little incentive to recycle water on-site at each dwelling.





Performance

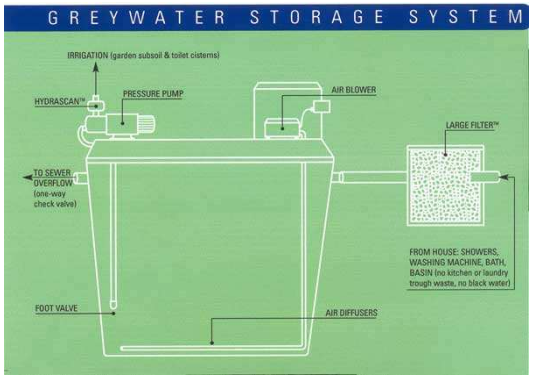
Installing an individual AWTS system would cost around $6000 and save 20% potable water use in irrigating the garden.

Total House Water Saving	20%
Payback Period	120 years
Total Water saved over whole residential development (no of olympic-sized pools filled per year)	40

Water Use - Recommendations

Mandatory

- *AAA* fittings have become industry standard and have little extra cost. They save 18% of the annual home water use.
- Rainwater Tanks collect vast amounts of water that would otherwise be lost to the drains. The water requires little treatment and there is no ongoing plant maintenance. Rainwater tanks can provide up to 40% of water use in the home. The rainwater will be used for WC flushing and irrigation of the garden.
- Controls over the area of lawn and type of landscape for each dwelling will be introduced to reduce the water consumed by garden irrigation.



Encouraged

- 4A rated appliances reduce water use over conventional appliances, saving around 6% of home water use. The extra cost of the appliances could be applied as an add on package cost to the homes.

Emerging technologies

- Greywater could be used to flush toilets as well as watering the garden saving around 25% of water use. A number of products are available in other states but currently NSW Health does not approve them. A greywater diversion device for the garden would reduce water use but would require more intervention (can't use when raining, need to monitor detergent type) from the user than the toilet-flushing system.

- Composting toilets require too much of a lifestyle change. There is considerable ongoing maintenance and they have the potential to pollute the neighbourhood. The cost of the system means that for sewered developments water savings would take too long to give payback.
- Similarly, on-site blackwater treatment is expensive and saves only a relatively small amount of potable water for the environmental risk involved in not maintaining the plant sufficiently.

Performance

The mandatory requirements will provide a water saving of approximately 40%.

Total House Water Saving	40%
Payback Period	20 years
Total Water saved over whole residential development (no of Olympic-sized pools filled per year)	116

Background

An average Australian house discards up to 1065kg of waste each year. For the Vincentia development this equates to 639 tonnes or 183 skips of rubbish going to landfill annually. Typically this amount of waste is made up of:

- 18% green waste from the garden
- 21% food organics
- 28% paper
- 11% glass
- 2% recyclable plastics
- 0.5% liquid paperboard
- 3% steel and aluminium
- 17% other

There is already infrastructure in place to recycle 44% of the rubbish from the average house and local residents are recycling 20-30% of their rubbish at present.

Shoalhaven City Council provides kerbside collection of regular waste and a fortnightly recycling service for paper, plastics, glass, steel and aluminium cans. Recyclable material is taken to the Materials Recovery Facility (MRF) in Bomaderry where it is separated by hand, baled and forwarded to re-processing facilities around the country.
Landfill is at West Nowra Landfill. Leachate is collected in an on-site holding pond and used in a closed system irrigation area. Landfill gas will be reclaimed and used in a 1MW generating plant, producing green energy, due to be completed in 2006.

Greenwaste is collected on demand at $5 per collection. Soilco then mulch and compost it. The main problem in the area is the dumping of green waste in the National Park.

Objectives

To further reduce waste going to landfill, so that 60% of domestic waste is recycled.
This is best achieved by recycling green waste and food organics.

Vegetable Patch

Providing an area within the garden to grow vegetables is good for the environment. It reduces;

- the amount of agricultural land required to support humans
- transportation costs in getting food to the supermarket and then to your home
- packaging involved in distributing food

It can be fed using compost and mulch created from household organic waste and watered using collected rainwater.

There are also other benefits such as

- better tasting/more nutritious food
- to save money
- for exercise
- therapy
- education
- social interaction
- neighbourhood improvement
- as a family activity

Performance

A 30m^2 vegetable patch can supply up to 10% of the average family food supply. Assuming an average food bill of $8000 per year this is worth around $800. There would be approximately 200kg of vegetables of which 1/3 could be packaging. Landscaping of raised beds and fence trellis work would cost at most $1000.

Total House Waste Saving	5%
Payback Period	1 year
Total Waste saved over whole residential development (no of 3.5 Tonne skips filled)	12

Food Packaging and Plastic Bags

Food packaging is the predominant source of domestic waste.
It can be reduced by:

- Buying local, buying fresh – fresh food doesn't have as much packaging as mass produced products. There's also less transportation with locally produced goods.
- Refuse plastic bags – using reusable cotton bags limits plastic bag waste. 6 Billion plastic bags are used in Australia every year (about 1 bag per person per day), tied end to end they would wrap around the Earth 37 times! Huskisson recently became the first NSW town to become a plastic bag free zone.

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Performance

Results are difficult to quantify. If retailers are forced to charge 4c per plastic bag (Ikea, Bunnings and Lidl already do this) and a cotton bag costs $2 then it would take around 50 trips to payback. The average family uses around 1200 bags per year.

Total House Waste Saving	1%
Payback Period	1 year
Total Waste saved over whole residential development (no of 3.5 Tonne skips filled)	3.3

Vermiculture and Composting

Vermiculture (worm-farming) and composting are excellent ways of reducing food and green waste

- Composting can break down grass cutting, plant pruning and pre-plate food (vegetable peels) into valuable compost. Compost can give extra nutrients to vegetables and plants and act as a mulch to reduce water loss from the soil. It can be used on lawns but it must be spread very finely.
- Worm farms break down post-plate food waste into a valuable fertilizer and compost-type product. Worms eat their way up through the food waste leaving behind castings (excrement) that makes good compost. Urine seeps to the bottom and can be tapped off to use as liquid fertilizer. Also, worms can be removed from the farm and used as bait for fishing.

Neither of these processes produce any nasty smells or waste. During composting heat is produced that kills harmful bacteria, but it requires plenty of air so the bin needs to be purpose made and well ventilated. Worm farms are more self- contained and require little or no human intervention, the worms will eat anything organic apart from meat, onions and pet excrement.

Performance

Composting and Vermiculture can reduce organic and food waste to zero, so long as the compost can be used within the garden or veggie patch. A worm-farm and compost bin setup will cost around $150. This means the occupant wouldn't need to call for green waste pick-up once a fortnight ($130/yr).

Total House Waste Saving	39%
Payback Period	< 2 years
Total Waste saved over whole residential development (no of 3.5 Tonne skips filled)	95

Waste Sorting

65% of waste in the kitchen can be easily sorted, the biggest problem is that when preparing food most of us don't have the time to go out to the garden or street to divide the rubbish into the relevant bins so all rubbish just goes into the one kitchen bin.
Providing waste sorting bins within the kitchen encourages recycling by making it easy to sort at source.
There needs to be at least two bins, one for waste and one for recyclables, although ideally there needs to be one bin for each waste stream; one for food waste (vermiculture/composting), one for paper, one for recyclables and one for waste.

Performance

Up to 65% of domestic waste can be recycled through the kitchen, reducing landfill.

Total House Waste Saving	65%
Payback Period	N/A
Total Waste saved over whole residential development (no of 3.5 Tonne skips filled)	159

Waste Reduction - Recommendations

Mandatory

- Full recycling facilities will be provided for all dwellings with separate recycling of bottles/ aluminium cans, paper, green waste and general rubbish.
- Kitchen units will be designed with the facility for the separation of organic waste.
- The sustainable benefits of residents using vegetable patches in the back gardens will be described with the additional benefits of using organic waste for composting.

Encouraged

- It is acknowledged that Green Waste disposal is is an issue in Jervis Bay and a council operated green waste collection system will be encouraged.
- As well as encouraging the use of vege plots in back gardens and localised composting from organic and green waste- vermiculture composting will also be encouraged
- A plastic bag free zone is encouraged throughout the development. Plastic bag use can be drastically reduced by making bags unavailable (as in Huskisson) and providing cotton bags cheaply.
- Buyback centres, recycling of building materials and garage sales should all be encouraged but ultimate responsibility lies with the consumer - however, not providing the facilities will guarantee that they will never be used.

Emerging technologies

- The use of organic waste for biomass energy generation was considered on a micro and macro level

Performance

The facilities and infrastructure for recycling waste will be provided but the success of the recycling system depends on the ownership taken up by the residents. The recycling facilities provided will give the resident the opportunity to recycle up to 60% of their waste.

Total House Waste Saving	60%
Payback Period	< 2 years
Total waste saved over whole residential development (no of 3.5T skips filled per year)	195

Materials Use

Background

A typical house might have 1000GJ of embodied energy which could be equivalent to up to 20 years of operational energy.
The materials considered should be assessed in accordance with ISO 14040 with respect to their:

- Impact on indoor air quality through volatile organic compound (VOC) emissions and toxic pollution from disposal
- Resource efficiency due to depletion of natural resources, recyclable content and end-of-life reusability and recyclability
- Environmental consequences from the impact on the ecosystem where the raw material is extracted or grown
- Embodied energy used to mine or grow, transport, process, and manufacture including distribution and transport to site
- Maintenance requirements and durability
- Packaging and waste

Objectives

• Recycle 80% of waste during construction by providing multiple sorting bins
Achieve a high level of indoor air quality by selecting materials with low volatile organic compound (VOC) emissions
• Reduce PVC use by 50%

Materials

Material	Considerations	VOC Emissions	Resource Efficiency	Environment Impact	Embodied Energy
Timber	Natural, renewable, readily available and easy to work	None	Renewable	Low	Low
Aluminium	High strength to weight, natural corrosion resistance, shaping ease	Process	Recyclable	High	High Low for recycled
Steel	Flexible, readily available	Process	Recyclable	High	High
Copper	Corrosion resistant, expensive	Process	Limited	High	Medium
Concrete	Flexible, high thermal mass, readily available	None	Limited	Medium	Low
Glass	Transparent	None	Recyclable	Medium	Medium
Wool	Natural, renewable, fire resistant	None	Renewable	Medium	Low
PVC	Flexible, high strength to weight	Disposal	Limited	High	Medium

Options	Considerations	Performance	Cost
Zero VOC emission paints	Limited colour range available	Improvement of indoor air quality	
Natural carpet materials	Wool considered best carpet material	Improvement of indoor air quality	
Provision of *EcoPackage*	Advice on finishes and furnishings	Improvement of indoor air quality	
HDPE pipework rather than PVC	Non chlorine plastics are easier to dispose of at end-of life and have less toxic by-products during manufacture	Reduction of PVC by 50%	

Materials - Recommendations

Encouraged

- The benefits of selecting materials that have a positive effect on the indoor air quality will be described to potential residents. Such materials such as natural wool carpets, natural based paints will be encouraged.
- A target of achieving a 50% reduction in PVC has been established for the project. This will be achieved by the use of HDPE pipework instead of PVC and the use of steel rainwater gutters.
- Utility services locations will be designed to optimise pipe routes therefore minimising materials
- Lots will be designed to drain to the street wherever possible to minimise the need for interallotment drainage and associated construction work

Emerging technologies

- The use of new environmentally friendly materials such as *Easy Board* for internal walls and alternative roofing materials.

Mandatory

• Linking of pathways into a comprehensive pedestrain circulation and cycleways sytem to encourage non motorised
• Secure bicycle storage facilities should be allowed for the residents and visitors
• Cycleways will complement exiting infrastructure such as the Bay to Basin Cycleway which goes around the site and provides cycle access to the beach.
• The home builder will form a relationship with a bicycle supplier to provide discount priced cycle as part of the home purchase deal

Encouraged

• Walking school buses' pick up schoolkids from their homes and walk them safely to school providing supervised exercise.
• Shops to offer internet purchasing and home delivery of shopping
• Public transport routes connect key local destinations and connect with the wider public transport system including Vincentia and Nowra. Electric power public transport charged by renewable energy will be encouraged
• internet shopping should be encouraged so that on-line residents could order produce from the local stores and have it delivered it their home.
• Provision of a centralised car/ boot wash down facility using recycled water

Emerging

• The feasibility of powering electrically power buses from the renewable energy generated on site will be considered
• The communication of public transport times and transport/pollution information via the internet
• Electric bicycle powered by renewable energy stations

Overall Recommendations

Options for reducing energy and water use and waste generation have been presented, if these are integrated into the design then Vincentia will be a significantly ecologically sustainable development.

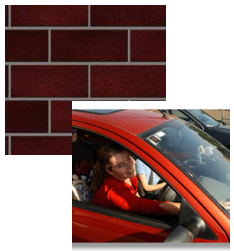
Some options are extremely cost effective and should be included as a matter of course. Other options have slightly longer payback periods that require more environmentally based investment than simple monetary return, these should be further investigated in subsequent design stages to ensure the non-monetary benefits make them worthwhile.

While this report has concentrated on the micro scale, i.e. the savings that can be achieved in each home, huge benefits can be achieved on the macro scale and should be adequately investigated first. For instance, only a limited amount of energy saving is possible if the homes are badly orientated in the first place because of lot divisions. Similarly, if houses are located a long way from the shops then people will be more likely to use their cars, undoing any energy efficiency within the home. These kinds of planning issues often have little or no additional cost but are often overlooked.

Total House Energy Saving	25%
Payback Period	< 5 years
Total Greenhouse Gas Avoided over whole residential development (No of cars taken off the road)	458 cars

Total House Water Saving	40%
Payback Period	20 years
Total Water saved over whole residential development (no of Olympic-sized pools filled per year)	116 Pools

Total House Waste Saving	60%
Payback Period	< 2 years
Total Waste saved over whole residential development (no of 3.5T skips filled per year)	195 skips



Initiatives have been recommended for material selection and transport provisions that will significantly improve indoor air quality, amenity of homes and surroundings and reduce material use and vehicle emissions.