

HOUSE OF REPRESENTATIVES
STANDING COMMITTEE ON ENVIRONMENT AND HERITAGE

Discussion Paper

Sustainable Cities 2025

The discussion paper does not present the views or conclusions of the Committee

Inquiry into Sustainable Cities 2025

The House of Representatives Standing Committee on Environment and Heritage is undertaking a new inquiry into *Sustainable Cities 2025*. The inquiry is timely given that 2004 is the Year of the Built Environment and there will be a national focus on the spaces we live in and how we improve the liveability of our cities and settlements.

The inquiry into *Sustainable Cities 2025* seeks to identify current and future patterns of settlement, the sustainability issues associated with these settlement patterns, and how government policy might ensure that developed areas retain an Australian lifestyle without diminishing the future value of Australian eco-systems.

The purpose of the inquiry is not to set specific actions for particular areas, but to provide a 'national map' of issues and approaches. This discussion paper scopes some of the issues currently being raised in discussions and research into sustainability of Australian cities.

The attached discussion paper identifies several components which contribute to a sustainable city, and outlines the issues and vision of these components. At this stage, there are many more questions than answers. Two key issues for industry, government and communities is how to balance these components, and what innovative alternatives or international models can usefully be applied to the Australian situation. As a nation, once we can define a vision and a set of objectives for future city settlements, a critical issue will be developing the implementation strategies to achieve that vision.

This discussion paper is not a definitive approach to the issues of sustainable cities in Australia. It considers only part of the terms of reference for the inquiry by raising issues and questioning what vision we have for a sustainable city and so how we might develop a blueprint for the future.

The discussion paper does not present the views or conclusions of the Committee.

The purpose of the discussion paper is to scope some of the key areas central to developing a blueprint for a sustainable city, and to canvas for input from a wide range of professions, community groups, local and state governments, researchers, businesses, industry associations and individuals. The aim of this paper is to assist and challenge those who may make a submission or otherwise assist the Committee in the inquiry.

Submissions to the inquiry may respond to the discussion paper or to all or some of the terms of reference. Details of the terms of reference and making a submission to the inquiry are provided overleaf.

Terms of Reference

Inquiry into Sustainable Cities 2025

The Committee will inquire into and report on issues and policies related to the development of sustainable cities to the year 2025, particularly:

1. The environmental and social impacts of sprawling urban development;
2. The major determinants of urban settlement patterns and desirable patterns of development for the growth of Australian cities;
3. A 'blueprint' for ecologically sustainable patterns of settlement, with particular reference to eco-efficiency and equity in the provision of services and infrastructure;
4. Measures to reduce the environmental, social and economic costs of continuing urban expansion; and
5. Mechanisms for the Commonwealth to bring about urban development reform and promote ecologically sustainable patterns of settlement.

Submissions can be e-mailed to Environment.Reps@aph.gov.au

Or sent to the following address:

Environment and Heritage Committee
House of Representatives
Parliament House
Canberra ACT 2600

The closing date for submissions is **Friday 31 October 2003**

The discussion paper is available at
www.aph.gov.au/house/committee/envIRON

Discussion Paper

Sustainable Cities 2025: A Blueprint for the Future

Cities of the future must be sustainable cities. Above all, they must be the cities that meet the future social and economic needs of Australia within the unique context of the Australian landscape.

The sustainable city of the future will integrate the built and natural environment. The sustainable city will assist in retaining the biodiversity of Australia, have a developed infrastructure that gives efficient and equitable access to services and utilities, preserve the essentials of the 'Australian lifestyle' and contribute to the economic wealth of the nation.

This future vision will not be achieved without planning and without a clearly articulated strategy.

There are international initiatives to develop sustainable cities and to address many of the problems faced by expanding cities in both developed and developing nations. Local and State initiatives in Australia are also addressing specific sustainability issues for cities and urban settlements. The challenge remains for a more holistic national approach which integrates the components of an Australian sustainable city and provides a model which can be devolved to and adapted by State and local governments.

There are several components to a sustainable city. The following are suggested as a set of visionary objectives for the Australian sustainable city.

The sustainable Australian city of the future should:

1. Preserve bushland, significant heritage and urban green zones;
2. Ensure equitable access to and efficient use of energy, including renewable energy sources;
3. Establish an integrated sustainable water and stormwater management system addressing capture, consumption, treatment and re-use opportunities;
4. Manage and minimise domestic and industrial waste;
5. Develop sustainable transport networks, nodal complementarity and logistics;
6. Incorporate eco-efficiency principles into new buildings and housing; and
7. Provide urban plans that accommodate lifestyle and business opportunities.

1. Preserve bushland, significant heritage and urban green zones.

Environmental conservation and urban expansion were traditionally only considered together when their borders touched or interacted – that is where urban development encroached on habitat or significant ecosystems.

As urban areas expand, a harmonised rather than frontier approach is required to retain Australia's biodiversity, eco-systems and to provide settlements which can be co-habitated by people, flora and fauna. The urban environment should continue to be uniquely Australian and the features of the landscape should not be ghettoised to isolated non-inhabited parts of the country.

Urban green zones provide important health and lifestyle benefits, aiding in pollution reduction, providing recreational opportunities and areas for community gatherings.

Similarly, the built heritage is under pressure in areas of growth and housing expansion. National approaches to preserving bushland, conservation of built heritage and urban green zones should be aimed at integrating natural and built environments. To achieve this broadacre (or whole of landscape) planning, embracing identified areas of significant heritage and conservation value, needs to take place across both public and private, and new and existing regions of development.

Questions for Consideration

- ***Does the inclusion of green zones within city planning result in further urban sprawl, which has a greater detrimental effect for the environment by encroaching on more surrounding bushland?***
- ***What are the possible impacts of either increasing or limiting the proportion of bushland and urban green zones?***
- ***Can green zones be multi-purpose – serving the recreational and social needs of city dwellers while also providing habitat and environmental benefits for native flora and fauna?***
- ***Is it appropriate to provide incentives to encourage partnership arrangements with land holders and developers to preserve remnant vegetation on private lands?***
- ***How do we ensure that preserved sites of built heritage are culturally valued and appropriately integrated into planned developments?***
- ***How do we ensure that public green zones are integrated into new developments?***

2. Ensure equitable access to and efficient use of energy, including renewable energy sources.

As cities grow and energy needs escalate, there are problems of meeting the supply of inner city and industrial areas, and providing the infrastructure to deliver energy to spreading developments. Inefficient energy usage results in higher energy needs and increased air emissions.

To meet future consumption needs and manage air emissions, the sustainable city must diversify its sources of energy generation and, where possible and appropriate, incorporate renewable energy sources.

A sustainable city would successfully uncouple economic growth from increased energy consumption.

Lower energy consumption rates, greater efficiency and increased use of renewable energy sources have potential benefits to city settlements in terms of infrastructure costs, air emissions and more secured long term access to energy sources.

Questions for Consideration

- ***How might we implement a shift from the existing large-scale energy generation and distribution infrastructure towards an alternative model?***
- ***How can the uptake of renewable energy for residential and commercial properties be promoted?***
- ***What are the impediments to utilising renewable energy sources in residential, commercial and industrial areas and how might these be addressed?***
- ***Should renewable energy generation be promoted at the single dwelling level or across city regions?***
- ***Are there economic, and hence social, implications of a city increasing its use of green power and developing new complexes which are predominantly self-sufficient in terms of energy generation?***
- ***Should higher efficiency standards be mandated for all new dwellings, appliances and business operations?***
- ***How can residential and commercial developments incorporate renewable energy generation into planning and construction?***
- ***To what extent should public transport systems seek to change to renewable energy sources?***

3. *Establish an integrated sustainable water and stormwater management system addressing capture, consumption, treatment and re-use opportunities.*

With urban sprawl and the expansion of low density housing at city outskirts, cities of the future will undoubtedly exceed the existing capacity of surrounding water supplies and receiving waters. The characteristic approach of many large cities to water and stormwater management (that is, piping in large water supplies and piping out equally large quantities of waste water), cannot be efficiently maintained as the consumption and geographical size of a city expands.

Treated waste water and collected stormwater is traditionally discharged to the coast or waterways. This practice is detrimental to the marine or riparian environment, and represents a waste of what might otherwise be a valuable water resource. A change in water management methods is needed alongside changed settlement patterns.

With the development of more high density and transit-orientated urban villages, there is the potential to also develop more localised, small scale systems of urban water treatment, including water harvesting, treatment and recycling.

Questions for Consideration

- ***Should cities of the future be looking to develop more localised small scale systems of urban water management?***
- ***What scale of residential water management systems is most efficient and sustainable?***
- ***How do we transform existing developed city areas into more sustainable water management systems?***
- ***How do we encourage areas to abandon existing waste water systems, which may discharge to the ocean or other waterways, in favour of alternative waste water treatment methods?***
- ***What incentives or market based instruments might be appropriate for residential and commercial enterprises to encourage responsible water consumption and re-use?***
- ***Are more standards and guidelines needed for new development to minimise waste and storm water and to maximise capture and re-use opportunities?***

4. Manage and minimise domestic and industrial waste.

Larger cities have been characterised by larger amounts of waste which is more difficult and costly to transport to depots for treatment. The sustainable city must more fully embrace the ethos of product stewardship with suppliers and purchasers recognising a responsibility for the waste generated from production processes, packaging and consumption.

A sustainable city must unite the community, industry and government to push for and implement sustainability within their spheres of influence. The sustainable city cannot relegate its waste or the environmental cost of its consumption patterns to regional areas, pockets of landfill or city industrial zones.

City consumption must take into account the production process that occur within its metropolitan limits and also those which indirectly contribute to servicing consumer needs. It is not sufficient for a city to locate within its boundaries green businesses which minimise waste and operate on eco-efficient principles if, beyond those city limits, other production systems which produce goods or input for city consumption, are not infused with the same environmental accountability. While environmental accountability must be driven by a national agenda, the sustainable city must inculcate this ethos of local responsibility for production processes and their environmental impacts.

Cities will continue to be economic epicentres and the size of industrial hubs will grow alongside residential city expansion. Cities must be designed not just for people, but also for the production of goods and services which meet the demands of city dwellers, provide employment opportunities and generate economic wealth for the nation.

Australia is currently one of the highest consuming societies in the world – a reversal of this trend is fundamental to the development of sustainable cities in Australia. We must increase efficiency, reduce the volume of waste and manage more appropriately that waste through treatment and recycling.

A sustainable city must embrace green businesses and driven by corporate environmental awareness. Sustainability initiatives, including energy efficiency and waste and water management, cannot happen 'around' industry. They must have the active commitment and leadership and participation of industry.

Questions for Consideration

- ***How does a sustainable city bring about attitudinal change and encourage its inhabitants to accept greater responsibility for waste minimisation and management?***
- ***What types of industry are appropriately located within cities, and how do sustainable cities respond to production processes and waste treatments that exist to meet city consumption patterns but occur outside of city limits?***

- *What strategies are appropriate to encourage eco-efficiency and the reduction of domestic waste?*
- *What strategies are appropriate to encourage eco-efficiency and the reduction of industrial waste?*
- *Are there economic impacts for a sustainable city in dictating higher environmental standards and waste treatment?*
- *What is the role of industry in ensuring sustainable cities, and what incentives or standards are appropriate to achieve this?*
- *How can industry be encouraged to be more socially and environmentally responsible, and to work in partnerships with local communities?*

5. Develop sustainable transport networks, nodal complementarity and logistics.

Many Australian cities have been constructed around the automobile. This has created a culture heavily reliant on private automobile access. The potential problems of this reliance include: environmental impacts (such as urban sprawl, smog and air pollution); economic costs (from providing urban infrastructure across a more dispersed geographical area); and social impacts (including isolation, economic stratification of areas and reduced access to public services).

Sustainable transport logistics are vital to reversing the problems caused by automobile dependence and to providing cities which are equitable, accessible and economically viable.

Transport systems encompass more than the movement of people or commuters across the city. Transport logistics must also take into account the needs of businesses and industry to service the city and manage incoming and outgoing goods. The transport logistics of a sustainable city recognise the need for a more comprehensive network of complementary transport systems with transport nodes forming the focus of urban villages.

This transport network has multiple systems operating in a decentralised manner that enables a web of travel directions and nodal hubs of work, industrial, residential and recreational connections. Many major cities have been constructed around a feeder transport system that channels cars and public transport into the centre city – which is the traditional employment and commercial hub. The sustainable city must transform this ‘feeder’ mentality to a more nodal and decentralised network. However this transformation must take place alongside changes in residential planning patterns and employment centres.

Transport logistics must also ensure that alternative means of transport, such as train, tram, pedestrian or cycling, is well serviced and the infrastructure exists to facilitate interconnecting commuting travel (eg lockable bicycle sheds at transit nodes, workplaces with showering facilities, well lit pedestrian walkways which bypass major road crossings and a range of public transport systems which are complementary, safe and affordable).

The opportunity to secure the advantages offered by different nodes of transport needs to be pursued with measures to enhance their complementarity through coordination and integration.

The need for a complementary array of public transport systems is also underpinned by the possibilities of using renewable energy sources to power these vehicles, further reducing air emissions and reliance on conventional fuels.

Questions for Consideration

- *What initiatives can assist in the reduction of automobile dependence?*
- *Should new transport technologies, such as electric cars and buses, be promoted as alternative to conventional fuels?*
- *What are the features needed in new settlement areas to encourage more diverse and sustainable transport networks?*
- *What is the role of federal government in assisting metropolitan areas to restructure transport networks in line with more sustainable settlement patterns?*
- *What are the needs of transport systems for them to be equitable, accessible and economically viable?*
- *Is a more decentralised nodal type of transport network appropriate for commuter and traveller needs?*
- *What are the transport logistic needs of industry and how can these be managed in a sustainable city?*

6. Incorporate eco-efficiency principles into new buildings and housing

Australia has demonstrated capability and expertise in utilising eco-efficiency principles in design and construction. This capability and expertise must become mainstream if we are to transform existing built areas as well as new development into

models of sustainability. To meet the goals of reduced energy and water consumption and re-use and to increase the useability and liveability of commercial and residential premises, more innovative approaches to the development, construction, and refurbishment of buildings are needed.

In commercial premises, incorporating eco-efficiency principles may demand a greater partnered approach across lessees of a building. It will be important to establish the economics of green buildings to ensure that the knowledge about alternative more sustainable design principles and materials is more readily available through mainstream architects and construction companies. In residential premises, the economic impetus for eco-efficiency must also be recognised and the savings and the comfort of 'green designs' must be given a value in the marketplace.

In a sustainable city, better practices need to be incorporated into new construction and encouraged as part of major 'retro-fits' and renovations.

Questions for Consideration

- *How can green construction and refurbishment techniques be integrated into standard building practices?*
- *How can eco-efficiency innovations be promoted to achieve a market value in both commercial and residential buildings?*
- *What are the impediments to eco-efficiency principles being taken up across new housing developments and commercial areas?*
- *What type of incentives or standards for new developments might be appropriate to encourage more sustainable residential complexes?*
- *Are existing building standards and product labelling sufficient to enable informed consumer choices and to ensure that the use of eco-efficiency materials and designs are maximised?*

7. Develop urban plans that accommodate lifestyle and business opportunities

There are an increasing number of urban dwellers; however this increased population is not homogenous. Rather, the increase in city inhabitants is accompanied by a diversification of lifestyle preferences ranging from high density inner city apartment dwellers to the small acreage on city outskirts to self-contained village type suburban lifestyles.

In growth urban and suburban areas, a dichotomy of development is emerging that features both larger dwellings on smaller allotments and 'rural residential living' – both claiming lifestyle appeal. 'Empty nesters' and ageing communities continue to occupy large family homes and are reluctant to leave familiar neighbourhoods and valued services.

There are a number of possible planning scenarios that could shape our future cities. However, allowing cities to continue to plan without strategic forethought can only result in more dispersed cities characterised by economic stratification, high infrastructure costs, and inequitable access to and provision of public services. Possible planning designs include:

- The compact city which increases high density inner city living;
- The edge city which increase population density at selected outer nodes and increases investment in public transport and freeway networks which interconnect these nodes;
- The corridor city which encourages growth along city arterials and retains the inner city as the central hub with upgraded public transport radial links;
- The fringe city which expands to develop new centres on the outer regions of the city; and
- The ultra city which stimulates business centres in surrounding regional townships and provides high speed commuter linkages.

Integral to some of these possible designs are decentralised concentrations of residential and commercial developments, or 'urban hubs'. Urban hubs typically include a range of community and support facilities, recreational services, landscaping of public spaces and residential complexes catering for family and professional needs.

Depending on the design of the development and the degree of planning, urban hubs can be designed for self-sufficiency in the management of waste, water collection and re-use, and energy generation. If areas of developments are focussed around transit zones and connect to the larger city transport network, then automobile dependence can also be minimised.

Some savvy developers are already promoting lifestyle opportunities where subdivisional layout, house design and placement, services, public spaces and facilities are embraced as part of an integrated development.

Questions for Consideration

- ***What planning models and zones can we use to accommodate the different lifestyle needs and preferences of Australians in cities?***

- ***Are urban hubs and communities concentrated around public transit nodes an appropriate future model to suit Australian lifestyle needs?***
- ***How do we transform existing suburban and inner city developments into more sustainable forms of community living?***
- ***How do we ensure that further urban expansion occurs as planned community developments?***
- ***Are there dangers in developing decentralised cities with multiple urban hubs and how do we address these issues?***
- ***What community, commercial and biodiversity needs should be addressed in developing new urban centres?***

Sustainable Cities 2025: Case Studies

A sustainable and liveable city will require sound urban planning, affordable and sustainable buildings, a reduction in car dependency, provision of urban green zones and bushland, clean airways and waterways and an overall improvement in energy efficiencies. The difficulty of achieving this vision is the challenge of developing and implementing a holistic strategy that addresses the several components of a sustainable city.

National and internationally there are innovative examples of sustainability initiatives - although these examples predominantly focus on specific aspects of sustainability rather than a city-wide vision. However, some of these examples may provide models to assist in building a blueprint for a sustainable Australian city.

The following three case studies highlight examples of:

1. A sustainable commercial building in Melbourne.
2. A sustainable inner-city housing development in Adelaide.
3. A sustainable transportation strategy, which reduces automobile dependency, in Vancouver.

According to the United States Department of Energy's Center for Sustainable Development, buildings consume 40% of the world's total energy, 25% of its wood harvest and 16% of its water. Sustainable buildings, incorporating passive and active solar energy, rain water collection and grey water reuse, can provide environmental, social and economic benefits to both residential and commercial occupants.

The 60L Green Building in Melbourne and the Christie Walk housing area in Adelaide provide examples of developments that have incorporated sustainability features into their design, construction and operation.

With the exception of Americans, Australians rely on their cars more than any other nation and our cities have been designed around the automobile as the dominant form of transport. Automobile dependence is a key reason for Australians being among the highest air polluters per capita in the world.

Vancouver provides an example of an integrated transport strategy which has reduced automobile dependence by linking urban centres, providing access for bicycles and pedestrians and incorporating parklands and urban bushland into the city landscape.

1. 60L Green Building – A Sustainable Commercial Refurbishment

The 60L office building, completed in September 2002, is located in Carlton, Melbourne. It was developed by the Green Building Partnership and is a prototype for Australia's sustainable commercial building sector. Its innovative concept and design sets a high but economic and commercially achievable standard for others to follow.

In contrast with conventional buildings, the 60L Green Building has minimal environmental impact, and was built for a cost similar to that of a less-sustainable commercial building. Its design also guarantees significantly lower running and tenancy costs.

The project aimed to provide an environmentally healthy building for its occupants and also to raise awareness within the construction industry. Accordingly, the project deliberately used mainstream architect and construction companies to demonstrate how achievable it is to design and refurbish a sustainable inner-city commercial building.

Economic returns

Construction and refurbishment costs of the sustainable 60L Green Building are comparable to the standard construction and refurbishment costs. However, the 60L building delivers significant environmental benefits, comfort and health benefits to the building occupants and significantly reduced running costs. In comparison to a conventional office building, the 60L Green Building has:

- Expected energy savings of over 65%;
- Reduction in lighting costs of over 80%;
- Over 60% reduction in equipment, ventilation, heating and cooling costs;
- Approximately 100% reduction in annual carbon dioxide emissions; and
- 90% savings in average annual mains water consumption.

While some commercial buildings incorporate particular energy efficiency features, 60L is unique in achieving high environmental standards and efficiency in all areas of construction and operation. It also is unique in providing a workplace largely free of toxic emissions from furniture and fittings.

Construction materials

- Approximately 80% of the timber used in 60L is recycled. The remaining 20% is from plantation timber;
- All bricks used have been recycled and cleaned without acid;

- Reinforcing steel is from recycled sources;
- Galvanised steel has been used in preference to stainless steel which requires higher levels of energy in its production process;
- PVC use has been reduced by 50% and wherever possible low toxic materials have been used; and
- The concrete used has a 60% recycled component.
- Carpets are made from recycled and low-toxic materials.

Energy Consumption and Generation

60L maximises the use of thermal mass for heating and cooling. The building's computerised environmental management system automatically adjusts internal and external louvres to retain even temperatures.

The building incorporates double-glazing, low energy glass, and north and west windows for winter sun. It utilises light shelves, light wells and an atrium to provide natural lighting, supplemented by high efficiency fluorescent lights when required.

60L has rooftop photovoltaic arrays for electricity generation. Any additional energy requirements are purchased through a green-power scheme. The use of embodied energy in construction materials has been off-set by purpose-specific tree planting in western Victoria.

Water Management

60L uses 90% less mains water than a similar conventional building. Rainwater is collected, micro-filtered and UV sterilised for use within the building. Water-efficient showers are fitted in the building.

All waste water passes into an in-house biological sewage treatment plant after which it is used for toilet flushing, the rooftop and internal gardens. Excess water is discharged, as treated water, to the municipal sewage. The residual solid sewage waste is utilised on farms in western Victoria.

Alternative Transport and Green Spaces

The workplace facilitates walking and cycling by incorporating a bicycle storage area, on-site showers and change rooms.

A rooftop garden has been designed to enhance the aesthetics of the inner city and provide an outdoor space for employees. The garden uses native plants and is watered using on-site treated waste water.

2. Christie Walk – A Sustainable Housing Development

Christie Walk is a community housing development on a 2000 square metre block of land in inner-city Adelaide. It is being developed as a pilot project demonstrating how communities can provide sustainable inner city living through:

- Water and energy conservation;
- Material reuse and recycling; and
- Shared landscaped areas and community spaces.

Stages 1 and 2 of the project have been completed and stage 3 is underway. The project consists of 14 dwellings which include four linked three-storey townhouses, a three storey block of six apartments, four stand-alone cottages and a 'community house'. The land is owned by the Wirranendi development co-operative during construction and individual properties are sold on a community title. A range of dwelling types are represented in the project with differing configurations, orientations and construction systems to demonstrate the variations of environmental design to meet lifestyles choices and climatic conditions.

Each purchaser owns their own dwelling and also shares ownership and responsibility for the landscaped community areas. These areas include a community garden, and a 'cohouse' (community house) with a kitchen, small general purpose hall and a laundry. To date, properties in the development have sold well.

Construction Materials

Timbers are plantation or recycled. Floor decking is generally made from a compressed straw product, which is equivalent to particle board but contains no woodchips or formaldehyde. Paving, carports and feature elements incorporate bricks, stone, steel and timber retrieved from the demolition of pre-existing structures on the site.

All concrete in slabs and mass walls contains the maximum percentage of flyash permitted. Flyash is a waste product from power stations and its addition reduces the amount of new cement used in the construction (cement production is one of the largest single global contributors to greenhouse gas emissions).

All finishes, including paint and varnishes, are chosen on the basis of environmental and non-toxic criteria.

Energy Generation and Efficiency

Mains electricity is drawn from the grid but photovoltaic panels generate electricity for sale to the local energy utility. On completion it is expected that the site will be a net

energy exporter for much of the year as the design and efficiency of the dwellings means that energy requirements are minimal.

All dwellings have solar hot water and a shared system of banked solar panels. All new appliances have high energy efficiency ratings; companies with a recycling program were favoured when specifying appliances.

Heating, Cooling, Lighting and Insulation

Each house works as a 'thermal flue' allowing controlled release of warm air while drawing in filtered, cooled air from the vegetated, landscaped surroundings. Window placement and planned vegetation planting ensures that natural lighting is maximised. Most windows are double-glazed. Rooftop gardens provide a thermal buffer to the upper floor apartments.

The concrete slabs provide substantial internal mass, particularly to the cottages and apartments. External and internal walls are made from either an aerated concrete product or other materials which have high thermal and acoustic insulation properties. This places an additional thermal mass between the townhouses and also assists in noise reduction between dwellings.

The apartments use cross-ventilation and high thermal mass for cooling. Some ceiling fans are included to assist in maintaining air flow on still days. However there are no heaters or air conditioners and the expectation is that none will be needed to supplement the passive heating and cooling of the houses.

Water Management

All water shed by the roofs, balconies and other impervious surfaces is collected for use on site. After filtering, the water is used for irrigation and toilet flushing, reducing the total water importation to the site. An onsite chlorine-free sewage treatment system is being purchased. Composted solids will be taken to rural sites as fertiliser and the filtered effluent returned to the second-class water supply through the on-site stormwater system.

Access and Green Spaces

The development is designed to take advantage of its inner-urban location and maximise access to a range of public transport services. There is no internal traffic within the development and there is limited provision car parking.

Outdoor spaces encourage walking. Low water use plantings favour native species. Some exotics have been chosen where appropriate to suit passive design considerations.

3. City of Vancouver – A Sustainable Transport Strategy

Unlike many developed cities, Vancouver has evolved a transportation system which is not dominated by freeways. In the 1950s and 1960s, a community based movement fought and won its battle to keep freeways out of central and inner Vancouver. Since developing alternative transport strategies, Greater Vancouver has had high levels of transit use with 117 trips per person in 1991, compared to 63 trips per person which is the average for a large American city.

The accessibility of the city and the continued absence of large freeways and automobile-dominated transit routes have made Vancouver a leading example of a sustainable transportation system.

Strategies for a Sustainable Transport Network

In the past, Vancouver faced similar population settlement trends to most developed cities. Increasing numbers of city dwellers increased the geographical size of the city resulting in longer commuting distances, more traffic congestion in central city areas, deterioration in air quality and a shrinking proportion of open spaces.

Vancouver's sustainable transport strategy has managed to reverse or at least limit many of these trends. The strategy is based on:

- Reducing automobile access to some areas and introducing measures to slow traffic along commercial zones (such as speed restrictions, uncontrolled intersections and frequent pedestrian crossings);
- Facilitating the use of alternative modes of transport through different types of pedestrian and cycle ways;
- Implementing a range of interconnecting public transport systems (including diesel and electric trolley buses, Skytrains and suburban commuter rail systems) that network across the city and within the central city region;
- Introducing additional costs for city automobile usage through gasoline surcharges and parking fees;
- Developing mixed-use medium to high density developments along outer transit routes and in urban villages around Skytrain stations. Unlike traditional outer urban sprawl, these areas are well serviced by accessible transport systems and are therefore not automobile dependent; and
- Re-urbanising some inner city high rise areas by investing in interconnecting transit networks. Walking and cycling opportunities are also provided through these dense areas by zoning mixed land-use along the main street, building wide pathways and maintaining landscaped parklands.

Complementary Urban Development Strategies

In conjunction with the development of a sustainable transport network across the city, Vancouver has transformed the types of urban developments taking place.

Vancouver's Urban Containment Policy, introduced in 1990, designates certain land unavailable for urban development. This policy also encourages development at regional centres, based around the Skytrain network that enables walking and cycling within station precincts and provides good access to fast, frequent rail travel for longer trips.

Development has also been concentrated on publicly owned vacant sites, land severely impacted by the rail system, and land which is underutilized or derelict. By concentrating construction on these land types, local government has allayed community fears that the development was out of character for the local area or that redevelopment within the station precincts would compromise existing lifestyles. Any planning and rezoning has had the active involvement of the local community and any impacted neighbouring areas.

Over the 1990s, Vancouver also achieved strong re-urbanisation. Unlike the intensification of high density dwellings in many large cities, Vancouver has sought to implement sustainable re-urbanisation of inner areas through planned city developments that maximise community public spaces and provide access to interconnecting transport networks.

Complementary transport and urban development strategies have resulted in:

- The development of large-scale urban villages with good transit service and opportunities for walking or riding safely on segregated cycle systems to many destinations;
- The intensification of housing in the inner area through small-to-medium scale compact infill projects near good transit services (mostly electric trolley buses); and
- The integration of new mixed-use development in nodes around the city's Skytrain route.

Long Range Sustainable Transport Planning

Vancouver's long range planning for a sustainable transportation system focuses on strengthening transit networks and ensuring that new urban development is well serviced by transit routes.

The city seeks to increase transportation networks and choice by enhancing transit services and connections, controlling automobile use and providing pedestrian and cyclist priority access. Strategies to containing urban development include protecting the established green zone and concentrating 'complete' communities around interconnecting transit nodes.