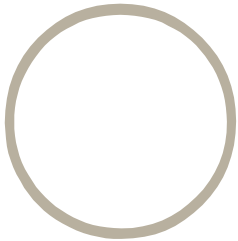




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The benefits and costs of alternative growth paths for Sydney



*Economic, social and environmental
impacts*



Prepared for

NSW Department of Planning



*Centre for International Economics
Canberra & Sydney*

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Executive summary

Introduction

In 2005 the New South Wales (NSW) Government projected that the population of the greater Sydney area would increase by 1.1 million to 5.3 million people in 2031 and released its *City of Cities; A Plan for Sydney's Future* (the Metropolitan Strategy). Population forecasts have now been increased substantially and Sydney's population is anticipated to expand to around 6 million people by 2036¹ or an annual increase of 57 000 people. This builds upon average growth of 43 000 people per year in the ten years to 2008.²

Increasing demand for housing is being driven not only by this rapid population growth, but also by other demographic factors, including an ageing population and rising household incomes, as well as changes in average household composition. The ageing of Sydney's population is likely to constitute a key driver of the trend to smaller households.

There has been substantial debate in policy circles (and the mainstream media) about where to place the additional population, in particular whether population growth should be accommodated in Greenfield areas on Sydney's fringe or in existing suburbs. Much of the debate in the mainstream media has focused on the role of the NSW Government and local councils. Issues such as the volume of land released in the fringe areas, the cost of developing new land and the perceived barriers imposed through the planning regulations have been raised as barriers to further development.

While government plays an important role in influencing development there are a much wider range of factors not within government control that influence the rate and location of development. The commercial feasibility of development – that is the ability for developers to make returns – will be a major factor that influences the amount and type of development. This takes account of the cost of developing in different locations – with cost differences only partly dependent on government

¹ NSW Department of Planning 2008, *New South Wales State and Regional Population Projections 2006-2036*, October.

² Australian Bureau of Statistics (ABS) 2009, Cat. no. 3218.0, *Regional Population Growth 2007-08*, Canberra.

policies and practices – and the price at which the developers can sell the final product, which depends on where people want to live. The NSW Government can influence commercial feasibility and hence the pace and pattern of development directly through its planning policies, as well as indirectly through infrastructure provision.

The Metropolitan Strategy

The Metropolitan Strategy is the key document that lays out the Government's strategic plan in relation to dealing with Sydney's future population growth. The Metropolitan Strategy is aimed at supporting continued economic growth while balancing social and environmental impacts. The Strategy is based on anticipated population, economic and demographic trends and has been developed with five aims: enhancing liveability, strengthening economic competitiveness, ensuring fairness, protecting the environment and improving governance.

In its 2006 State Plan, the NSW Government stated that approximately 70 per cent of the 640 000 new dwellings that were expected to be required by 2031 would most likely be located in existing urban areas and around 30 per cent in Greenfield sites.

This project

There are many alternative ways in which additional people could be accommodated in Sydney. These include, for example, the extent of development in Greenfield areas relative to infill areas. It could also include different options within infill areas such as the level of density required and whether the population should be located close to centres or transport routes. The choice between the different options depends on a range of factors such as the infrastructure costs required to support development, the environmental and social impacts of development, commercial feasibility, and the preferences of households for living in different areas and types of housing.

This project provides a strategic analysis of the costs and benefits of alternative possible development paths, as part of the upcoming review of the Metropolitan Strategy. The study considers 3 scenarios that aim to broadly show the costs and benefits associated with alternative options for accommodating population growth in Sydney. The chief distinction between various growth paths analysed is the difference in the assumed share of development that occurs in Greenfield areas on Sydney's fringe. We also consider different patterns of growth across local government areas, although it is not possible to fully explore the costs and benefits at this scale due to the limited available information.

The scenarios considered for this project are outlined in box 1.

1 Scenarios modelled in this study

The first scenario modeled is based on the 2005 Metropolitan Strategy:

- 30 per cent of new housing in land release areas;
- 70 per cent of new housing in existing urban areas, distributed with:
 - 20 per cent close to global centres, regional cities and specialized centres;
 - 10 per cent close to major centres;
 - 52 per cent close to town centres, villages and neighbourhood centres; and
 - 18 per cent not close to centres.³

The second scenario that we have modeled is focused on fringe Greenfield, with 50 per cent of new dwellings occurring on the fringe and 50 per cent as infill. There is physical capacity on Sydney's fringe to accommodate more people than the 30 per cent target in the 2005 Metropolitan Strategy, although the physical area available for development is constrained by factors such as topography, flood plain, national parks and water catchments.

The third scenario is focused on urban renewal, with the share of new dwellings in existing areas accounting for 90 per cent of new dwellings.

The final scenario considered in this project is one that is 'optimal', in having the least social net cost. While it is beyond the scope of this project to find this scenario in detail, we map out some elements of what this scenario looks like. This scenario arises out of the analysis rather than being specified prior to the analysis. All scenarios capture only limited change in urban redevelopment in areas closer to the CBD and coast.

Costs and benefits evaluated

In order to examine the costs and benefits of the alternative scenarios we utilize a modelling framework that has its foundations in welfare economic theory and incorporates the tradeoffs that exist between the alternative options. Under this framework the key focus is to examine those costs and benefits that vary between the alternative growth paths, recognising that there are some costs and benefits that are the same across all growth paths. The major areas of focus for the study are presented in the table below.

³ NSW Government's Metropolitan Strategy, *City of cities: A plan for Sydney's future*, Metropolitan Strategy supporting information, p. 141. See the Strategy for a definition of the different centre types.

2 Overview of items included in analysis

<i>Item</i>	<i>Description of item</i>
Transport costs including costs related to transport infrastructure and congestion	Government provision of transport services includes roads, heavy rail, light rail, buses ferries, cycleways and footpaths. Depending on the growth path, the types of transport that people use, the type of infrastructure that the NSW Government needs to invest in and the congestion costs associated with transport could all change. In addition to NSW Government costs, local councils also provide some transport infrastructure in local roads.
Physical infrastructure costs related to provision of services, such as electricity, water and wastewater	The cost of physical infrastructure arising out of alternative growth paths will reflect the extent of capacity in existing areas and the costs of upgrading in Greenfield versus Brownfield areas once capacity constraints are met. In most physical infrastructure categories, there is currently limited capacity (and significant expenditures on new capacity are occurring), reducing the cost differential between Greenfield and Brownfield.
Social infrastructure costs, including education, health, fire, open space and local government services;	At the NSW Government level, provision of social infrastructure extends to schools, TAFE colleges, hospitals, primary and community based services emergency services, parks and sporting facilities. Depending on the allocation of Sydney's increased population, the costs of providing these essential services will alter given cost characteristics specific to fringe and urban development. In addition to NSW Government costs, local councils also provide some social infrastructure including libraries, community centres and child care facilities.
Environmental impacts	There are many different environmental impacts arising from different urban growth paths. In some instances, the environmental impacts can be very particular to how growth is managed at a very localised area, while in other instances the environmental impacts from the scenarios considered in this study are relatively clear. We focus our attention only on these areas which includes GHG emissions, air pollution from transport, noise pollution from transport. Potential biodiversity impacts are also considered but in a qualitative manner.
Impacts on existing residents	A number of impacts on existing residents of housing people in different locations are quantified, including congestion impacts and pollution impacts, as discussed above. Qualitative assessment is also made for social costs of crowding of open space areas.
Transformation benefits	Transformation benefit relates to the value people place on living in different areas above and beyond the cost of providing dwellings in these places. This incorporates all private costs incurred and benefits received by households and developers in producing dwellings and making decisions about where to live.

Source: The CIE.

The findings

The modelling results for each of the different items incorporated into our analysis are presented below.

Transport

Transport costs are expected to be higher for Greenfield development than for existing areas. This reflects:

- the need to connect Greenfield areas into transport networks, through provision of transport options such as major roads, buses and rail; and
- higher costs related to congestion, or infrastructure to avoid congestion, for people living on Sydney's fringe.

For our scenarios, transport related costs are \$2.3 billion higher to 2036 for the 50/50 scenario relative to the 2005 Metropolitan Strategy (table 3). Transport costs are \$1.3 billion lower under the 90/10 scenario relative to the 2005 Metropolitan Strategy.

3 Transport infrastructure costs associated with each scenario

Cost item	2005	Focused on	Focused on	Deviations from	
	Metropolitan Strategy	fringe/Greenfield	urban renewal	Metropolitan Strategy	90/10
Ratio – Infill / Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
Connection of Greenfield	2 446	4 235	1 382	1 789	-1 065
Transport infrastructure/ congestion	11 057	11 599	10 786	542	-271
Total	13 503	15 835	12 167	2 331	-1 336
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
Connection of Greenfield	5 422	9 387	3 062	3 965	-2 360
Transport infrastructure/ congestion	24 506	25 708	23 904	1 202	-602
Total	29 928	35 095	26 966	5 167	-2 961

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

Estimates of transport related costs are subject to uncertainty in two key areas. Firstly, changes in employment patterns impact on transport demand. The approach used in this report allows for transport demand from a given local government area to increase in proportion to the number of people there. Secondly, there may be significant economies (or diseconomies) of scale in transport provision. If there are continued economies of scale then the infrastructure costs associated with higher density existing areas would be lower than estimated, further favouring an infill focused approach.

Physical infrastructure

Physical infrastructure costs, such as water and wastewater infrastructure, are higher for Greenfield development than for existing areas (table 4). Electricity costs do not vary much across scenarios as capacity in existing areas would be absorbed by the high expected population growth to 2016, which occurs in the same areas for all scenarios and the costs of the augmentations of existing infrastructure are expected to be similar to the costs of new infrastructure to service Greenfield areas.

Water and wastewater costs are estimated to be \$0.7 billion higher over the period 2011 to 2036 under a scenario where more development is focused in Greenfield areas relative to the 2005 Metropolitan Strategy. Focusing more development in existing areas is estimated to lower costs by \$0.7 billion relative to the 2005 Metropolitan Strategy.

4 Physical infrastructure costs associated with each scenario

<i>Cost item</i>	<i>2005 Metropolitan Strategy</i>	<i>Focused on fringe/ Greenfield</i>	<i>Focused on urban renewal</i>	<i>Deviations from Metropolitan Strategy</i>	
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
Electricity	1 903	1 919	1 898	16	-5
Water and wastewater	5 912	6 620	5 204	708	-708
Total	7 815	8 539	7 103	724	-713
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
Electricity	4 219	4 254	4 207	36	-11
Water and sewerage	13 103	14 672	11 535	1 568	-1 568
Total	17 322	18 926	15 742	1 604	-1 580

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

Social infrastructure

Social infrastructure costs are large under all scenarios at about \$18.5 billion to 2036 (in net present value terms, table 5). Differences in the urban growth path have small impacts in total on social infrastructure costs, reflecting the lack of additional capacity in most areas of social infrastructure. Education costs are estimated to be higher for growth paths focused in existing areas, as land costs constitute an important component of capital costs for schools, and the cost of upgrading can be higher than the costs of building a new school. Local council costs vary in the opposite way (these costs include physical and social infrastructure), with new areas tending to require more council investment.

In total, variations in social infrastructure costs across scenarios are small, with scenarios differing by less than \$150 million over the period to 2036.

5 Social infrastructure costs associated with each scenario

<i>Cost item</i>	<i>Deviations from Metropolitan Strategy</i>				
	<i>2005 Metropolitan Strategy</i>	<i>Focused on fringe/Greenfield</i>	<i>Focused on urban renewal</i>		
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
Education					
▪ Primary education	2 064	1 922	2 186	-142	122
▪ Secondary education	1 247	1 164	1 298	-84	51
Health	8 651	8 656	8 645	5	-5
Other (fire services)	103	99	108	-4	5
Local council infrastructure	6 529	6 695	6 419	167	-110
Total	18 593	18 535	18 657	-58	63
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
Education					
▪ Primary education	4 574	4 259	4 845	-315	271
▪ Secondary education	2 765	2 579	2 877	-186	113
Health	19 173	19 184	19 161	11	-11
Other (fire services)	228	219	240	-9	12
Local council infrastructure	14 470	14 839	14 226	370	-243
Total	41 209	41 080	41 350	-129	141

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

Environmental costs

The measurable environmental costs are lowest for a scenario that redevelops existing areas, rather than Greenfield areas (table 6). This reflects the lower energy use of dwelling types that would typically be built in existing areas and the lower transport use and car use in a higher density city. In total, we find that costs of green house gas (GHG) emissions, air pollution and noise pollution would be \$160 million lower over the period to 2036 under a scenario with 90 per cent of new dwellings built in existing areas compared with the scenario representing the 2005 Metropolitan Strategy. A strategy that accommodated more people in Greenfield areas on Sydney's fringe would have environmental costs \$279 million higher than the 2005 Metropolitan Strategy over the period to 2036.

6 Environmental costs associated with each scenario

Cost item	Deviations from Metropolitan Strategy				
	2005 Metropolitan Strategy	Focused on fringe/Greenfield	Focused on urban renewal	50/50	90/10
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
GHG emissions (relative to Metropolitan Strategy)	0	116	-116	116	-116
Air pollution	889	1 010	857	121	-33
Noise pollution	314	356	302	43	-12
Total	1 203	1 482	1 043	279	-160
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
GHG emissions (relative to Metropolitan Strategy)	0	257	-257	257	-257
Air pollution	1 971	2 238	1 898	267	-72
Noise pollution	695	790	669	95	-26
Total	2 666	3 285	2 311	619	-355

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

There are a number of less easily measured environmental costs that are also likely to be higher in Greenfield areas. These include costs from loss of biodiversity in the Cumberland Plain and potentially locating more people in areas where air pollution concentrates due to the topography and climate of the region, such as the Macarthur South area.

Impacts on existing residents

Development in most areas will impact on existing residents, sometimes in positive ways (such as through increasing provision of services and amenities in the area) and sometime in negative ways (such as through greater transport congestion). Impacts on existing residents related to pollution levels and traffic congestion have been quantified in other parts of this report. Levels of government services such as education and health have been held constant in evaluating growth paths.

Qualitative evidence suggests that there may be costs related to crowding of open space in inner city areas that have little option to provide more open space. These impacts, to some degree, are likely to be able to be mitigated through provision of higher open space quality. These types of costs are covered by local council expenditures considered above.

We are unable to quantify benefits and costs to existing residents from factors such as increased amenities or immediate neighbourhood impacts.

Transformation benefits

There are net benefits to be obtained by households and developers from developing in some new locations. Where they are present they reflect the difference between what households are willing to pay to live in a particular location versus the development and construction cost of the site. When present these net benefits are likely to be spread among developers, households and existing landowners. If absent, developers are unlikely to develop in the area as it is not commercially feasible, although lack of development can also reflect that some of the other costs such as physical and social infrastructure costs are borne by developers and ultimately home buyers.

Transformation benefits from an individual development consist of:

- gains to developers in profits in excess of the risks they take;
- gains to households from being able to buy a property that they prefer to others; and
- gains to existing landholders if they can get higher prices for their land than the value of the land in its alternative use (or the 'reservation price' they put upon it).

We estimate that transformation benefits are highest for the 2005 Metropolitan Strategy. Transformation benefits are slightly lower for the infill focused scenario relative to the 2005 Metropolitan Strategy. Transformation benefits are \$1.7 billion lower for a scenario that placed 50 per cent of dwellings in fringe Greenfield areas as there is not sufficient demand for that type of development.

These findings align with current market activity that is generating 80 per cent of new dwellings in existing areas and the views of developers about the limited attractiveness of development in the South West growth centre.

7 Transformation benefits associated with each scenario

<i>Item</i>	<i>2005 Metropolitan Strategy</i>	<i>Focused on fringe/Greenfield</i>	<i>Focused on urban renewal</i>
Ratio – Infill: Greenfield	70/30	50/50	90/10
	\$m	\$m	\$m
Transformation benefits relative to Scenario 1	0	-1 716	-1 351
	\$/dwelling	\$/dwelling	\$/dwelling
Transformation benefits relative to Scenario 1	0	-3 804	-2 994

Notes: The benefits presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

Combined impact

The summary measure including all of the costs and benefits identified above is the net benefits of each development path relative to the 2005 Metropolitan Strategy.⁴ The net benefits are measured relative to the base case, the 2005 Metropolitan Strategy, as we do not attempt to measure all the benefits and costs that do not change between scenarios. The net benefit is equal to the transformation benefits of the scenario less the difference between total costs of the scenario and the total costs of the 2005 Metropolitan Strategy.

The scenario focused on urban renewal has net benefits of \$0.8 billion relative to the 2005 Metropolitan Strategy (tables 8 and 9). The scenario focused on Greenfield development has net costs of \$5.0 billion relative to the 2005 Metropolitan Strategy. This reflects the additional physical and transport infrastructure and environmental costs required for this scenario but with no additional transformation benefit to households. That is, this scenario requires greater costs for government to produce dwellings that are less valued by households.

In per dwelling terms, the Greenfield focused scenario has net costs of \$11 000 per new dwelling. Urban renewal focused development has net benefits of approximately \$1700 per new dwelling. These differences between the scenarios are particularly significant given that the dwelling production for each scenario is presumed to be the same until 2016 with differences between scenarios after this point.

⁴ The purpose of the study is to compare different development paths so a number of benefits have not been included as they would be similar across scenarios, hence net costs are positive.

8 Costs and benefits of alternative growth paths

<i>Category</i>	<i>2005 Metropolitan Strategy</i>	<i>Focused on fringe/ Greenfield</i>	<i>Focused on urban renewal</i>	<i>Deviations from Metropolitan Strategy</i>	
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
Transport					
Connecting transport	2 446	4 235	1 382	1 789	-1 065
Major infrastructure/congestion	11 057	11 599	10 786	542	-271
Physical infrastructure					
Electricity	1 903	1 919	1 898	16	-5
Water and sewerage	5 912	6 620	5 204	708	-708
Social infrastructure					
Primary education	2 064	1 922	2 186	-142	122
Secondary education	1 247	1 164	1 298	-84	51
Health	8 651	8 656	8 645	5	-5
Other social infrastructure	103	99	108	-4	5
Local council	6 529	6 695	6 419	167	-110
Environmental					
GHG emissions (relative to Metropolitan Strategy)	0	116	-116	116	-116
Air pollution	889	1 010	857	121	-33
Noise pollution	314	356	302	43	-12
Total costs	41 115	44 391	38 969	3 276	-2 145
Transformation benefits relative to Scenario 1	0	-1 716	-1 351	-1 716	-1 351
Net benefits relative to Scenario 1				-4 992	795

Notes: The benefits and costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE.

9 Net benefits and total costs associated with each scenario

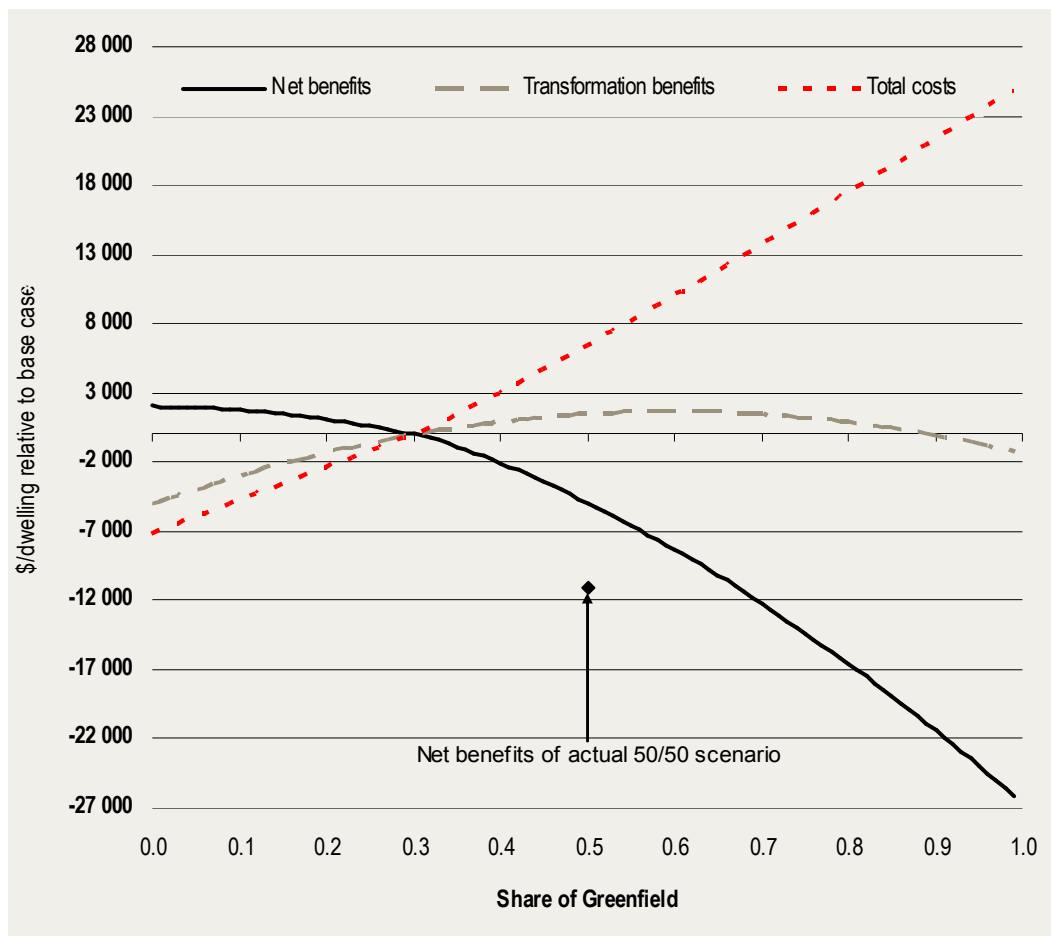
<i>Item (relative to Scenario 1)</i>	<i>2005 Metropolitan Strategy</i>	<i>Focused on fringe/Greenfield</i>	<i>Focused on urban renewal</i>
Ratio – Infill: Greenfield	70/30	50/50	90/10
	\$m	\$m	\$m
Transformation benefits	0	-1 716	-1 351
Total costs	0	3 276	-2 145
Net benefits	0	-4 992	795
	\$/dwelling	\$/dwelling	\$/dwelling
Transformation benefits	0	-3 804	-2 994
Total costs	0	7 260	-4 755
Net benefits	0	-11 064	1 761

Notes: The costs and benefits presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate. Net benefits is equal to transformation benefits less total costs.

Source: The CIE calculations.

It is also possible to trace how variations in the level of Greenfield development from zero to 100 per cent impact on the net benefits relative to the 2005 Metropolitan Strategy (chart 10). The net benefits are estimated to be positive when Greenfield development is less than the 2005 Metropolitan Strategy. The differences are relatively small from a strategy of zero per cent Greenfield to 30 per cent Greenfield and would be even smaller if particular Greenfield areas with the highest transformation benefit were the focus for development. As more Greenfield development is added, net benefits become more and more negative, reflecting both lower transformation benefits and higher total costs. Transformation benefits fall as households place lower value on locating in these areas and developers would find it difficult to sell properties (under current arrangements). Total costs rise as the transport, wastewater and environmental costs of Greenfield development are higher than infill development. A 100 per cent Greenfield scenario would have net costs of \$26 000 per dwelling relative to continuing with the 2005 Metropolitan Strategy, equivalent to \$11 billion in net present value terms to 2036, or a 28 per cent increase in costs.

10 Benefits and costs under different levels of Greenfield development



Data source: The CIE.

The benefits and costs are estimates for specific patterns of development within Greenfield and existing areas. There would be expected to be significant scope to increase transformation benefits and decrease costs in both Greenfield and existing areas through alternative dwelling allocations at a local government area level. For example, there is considerable variation in transformation benefits between different Greenfield areas and different existing suburbs. However, for some cost categories we cannot consider costs at this level of detail.

Comparison of findings to other studies

There are a number of previous studies of the costs of infill versus Greenfield development. In Sydney, Travers Morgan and Applied Economics conducted a study in 1991.⁵ This study used particular case studies to assess how costs and benefits changed for developing Greenfield areas at a higher density and how costs and benefits changed through mixing in some urban consolidation. In today's dollars, the study found that infrastructure costs would be \$36 000 per dwelling lower for urban consolidation compared with Greenfield development.⁶ We find smaller infrastructure cost differences, largely because the scale of the urban consolidation considered requires substantial infrastructure upgrades in existing areas. This can be seen in the large capital expenditure program of Energy Australia and capacity constraints in social services such as education and health. In 1991 the smaller scale urban consolidation assessed required little infrastructure upgrade.

Travers Morgan and Applied Economics found transformation benefits from urban consolidation for the particular case studies considered of \$20 000 per dwelling in today's dollars. We find that there are some existing areas with transformation benefits much higher than this, typically closer to the CBD and others with lower transformation benefits. This aligns with the stakeholder consultations that suggested there was a shift in preferences towards inner city living and is also reflected in the steeper declines in house prices from inner to outer areas observed by NSW Department of Planning.⁷

⁵ Travers Morgan and Applied Economics 1991, *Housing Costs Study No. 2: Evaluation of fringe development and urban consolidation*, prepared under the Australian Building Research Grants Scheme.

⁶ If building and construction indices were used to inflate the value instead of the CPI then this figure would be higher.

⁷ NSW Government's Metropolitan Strategy, *City of cities: A plan for Sydney's future*, Metropolitan Strategy supporting information, p. 125.

A second influential and widely cited study has been that of Trubka, Newman and Bilsborough 2008.⁸ This study found much higher differences between inner and outer development costs in Perth than found in this study. Some of these differences reflect the inclusion of elements in their study that should strictly be seen as private costs and considered as part of the choices people make about where they live. In terms of infrastructure costs, estimates are relatively similar for roads and water and wastewater. In Sydney, electricity costs were found not to vary much by the growth path as infill development would require upgrades. For Perth, Trubka et al. found that electricity costs were double in outer areas.

The biggest differences in infrastructure costs between Trubka et al and our findings were in social infrastructure. They found education costs of \$33 000 per dwelling for outer areas compared with only \$7000 in our study. From the figures provided by NSW Education, Trubka et al.'s findings seem implausibly high and may not reflect a least cost approach to providing education facilities. In Sydney, we found that education costs were lower in Greenfield areas both because of lower land costs for schools and lower costs of building schools anew versus extensive upgrading, combined with the lack of capacity in many existing areas. NSW Health indicated that for Sydney there would be little difference in overall costs for different growth paths, while for Perth outer areas were estimated to cost \$10 000 per dwelling more than inner areas. This could reflect the pattern of capacity availability in Perth.

The environmental impacts estimated by Trubka et al. for outer versus inner development are also much larger than we find. Part of this difference is due to the value placed on reductions in GHG emissions (they use \$170 per tonne of carbon while we use Australian Treasury estimates of the price of emissions under an emissions trading scheme, ranging from \$20 to \$64). Some part must also reflect differences in the level of GHG abated, which could reflect differences between transport in Perth and Sydney. Our findings were based on extensive analysis in Rickwood (2009)⁹ that found that even large changes in land use had relatively small impacts on GHG emissions from transport and dwellings. We also valued air pollution and noise pollution costs under each scenario.

Sensitivity Analysis

In considering the costs of alternative growth paths, there are many areas for which only partial or incomplete information is available. In other areas, assumptions are made about the future, which are by definition uncertain. For example, there could

⁸ Trubka, Newman and Bilsborough 2008, *Assessing the costs of alternative development paths in Australian Cities*, Curtin University Sustainability Institute, for Parsons Brinkerhoff.

⁹ Rickwood, P. 2009, *The impact of physical planning policy on household energy use and greenhouse emissions*, submitted for PhD to University of Technology Sydney, October.

be innovation in medium density development that significantly reduces the costs of this type of development, improvements in fuel and emissions technology in cars and in power stations or changes in the industry structure of Sydney. These would all have implications for the preferred growth path for Sydney.

While the conclusions drawn in this study are robust to substantial variations in the underlying assumptions there is considerable uncertainty particularly related to growth paths outside those scenarios assessed. For example, the most significant difference between the scenarios was the extent to which people located in the Central West relative to the Growth Centres. There is scope to consider development paths outside of this variation, as well as to link transformation benefits to the provision of additional transport infrastructure.

The results of the economic modelling were tested using variations in each parameter individually by +50 per cent and -50 per cent. The 90/10 scenario remained the preferred option for each of these changes. If there were multiple changes this would not necessarily be true, nor would it be true if there were 'fundamental' changes that would change the structure of the model such as variations in employment distribution, variations in economies of scale in transport provision and changes in people's preferences for different types of housing.

Conclusions

Sydney's future urban growth path will have important social costs and benefits. Providing the housing that people demand and place value on is an important driver of the social benefits, which have to be considered against environmental and infrastructure costs of accommodating population growth across Sydney.

How much Greenfield?

We find that there are a range of scenarios for the amount of Greenfield development on Sydney's fringe that are relatively similar in terms of their net benefits. These scenarios would lead to anywhere up to 30 per cent of new development occurring in Greenfield areas.

Growth paths where more than 30 per cent of new development occurs in Greenfield areas would result in higher infrastructure, social and environmental costs to provide housing for which people do not place as much value on (relative to costs) and which developers would find difficult to sell under current arrangements. The net costs under a 100 per cent Greenfield scenario relative to continuing with the 2005 Metropolitan Strategy are estimated at \$26 000 per dwelling. Of this difference, \$25 000 per dwelling is attributable to cost factors and the rest to locating people in Greenfield areas that would not value living there as highly as the costs of producing their dwelling.

There are a number of costs and benefits not estimated in this analysis, including biodiversity loss, productivity gains related to agglomeration and economies of scale in transport provision. These factors would also tend to favour building up existing areas.

Where in Sydney?

Sydney's future growth path could lead to more or less dwellings locating in particular subregions and local government areas. Understanding the commercial feasibility of development in alternative locations and the drivers of this is critical to thinking about subregional planning and housing targets.

Incorporating market and social costs and benefits

We have explicitly included market and social costs and benefits in assessing alternative growth paths. In doing so we have undertaken social appraisal of new development, which builds on the commercial appraisal process that is undertaken by developers.

In practice, much of the market information is better obtained through revealed actions of developers rather than estimation. Information on other costs, such as infrastructure provision to each area, is typically obtained through discussions with relevant NSW Government agencies and businesses. In order to effectively balance market and social benefits and costs NSW Department of Planning may need a process to integrate these decisions in an ongoing way.

Achieving the growth path

Deciding on a growth path will not guarantee that it will happen. This could mean that not enough development occurs to meet Sydney's housing requirements, pushing house prices up and moving people to other cities. Or it could mean that development does not occur in the places that were hoped. This is linked to how NSW Department of Planning and the NSW Government can influence the commercial feasibility of new development.

To achieve the growth path then requires adjustments to planning instruments such as levies, planning processes, zoning and development controls and possibly other mechanisms. We have not considered the changes necessary in this report to achieve each of the growth paths assessed.

One important aspect that is currently limiting the ability of Sydney to adapt to change is the high cost of moving. This includes significant government costs related to stamp duty. Other aspects that were raised in discussions that may limit the

specified growth path included the:

- importance of site fragmentation for a growth path focused on urban renewal;
- high cost of purchasing land in some areas. This reflected the high opportunity cost of the land and (in some circumstances) to sellers expectations which not reflect current market conditions;
- relatively higher cost of developing new sites. Much of the lower cost development options have already taken place and the unit cost of future development is likely to increase significantly. That is, much of the 'low hanging fruit' have already been picked; and
- willingness of developers to take on the planning risks (perceived or actual) that exist in certain LGAs.

PART 1

Managing Sydney's Growth

1 Introduction

Population changes in Sydney

The population of Sydney is anticipated to expand to around 6 million people by 2036 or 57 000 people per year.¹⁰ This builds upon average growth of 43 000 people per year in the ten years to 2008.¹¹ While around 70 per cent of the projected population growth derives from natural increase (more births than deaths), the city also draws large numbers of both domestic and overseas migrants.

Increasing demand for housing is being driven not only by this rapid population growth, but also by other demographic factors, including an ageing population and rising household incomes, as well as changes in average household composition.

The ageing of Sydney's population is likely to constitute a key driver of the trend to smaller households. The number of people aged 65 and over in Sydney is expected to increase by 111 per cent between 2006 and 2036, while the number of people aged 18 to 64 is expected to increase by only 21 per cent.¹² Increasing household affluence is also contributing to the increased demand for housing.

These demographic factors have contributed to changes in household composition trends, which are driving the decline in average household sizes. Single and two person households now comprise the majority of all homes and the trend towards proportionately more of these smaller households is likely to continue. In 2005, the NSW Government estimated that even if Sydney experienced zero population growth, an additional 190 000 new homes would be required to respond to demographic changes where fewer people are living in each home.¹³

Forecasts indicate a 40 per cent rise in Sydney's population by 2036, while average occupancy rates are anticipated to fall from 2.61 to 2.49 persons per private dwelling

¹⁰ NSW Department of Planning 2008, *New South Wales State and Regional Population Projections 2006-2036*, October.

¹¹ ABS, Cat. no. 3218.0, *Regional Population Growth 2007-08*, Australia.

¹² NSW Department of Planning projections.

¹³ NSW Government's Metropolitan Strategy, *City of cities: A plan for Sydney's future*, Metropolitan Strategy supporting information, p. 7.

over the same time period.¹⁴ As a result it is expected that a total of over 700 000 additional dwellings will be required in the Sydney area by 2036. Accommodating these extra households, along with associated employment and social opportunities, across both urban and fringe developments will present significant challenges for policymakers over coming decades.

Capacity for housing additional people in Sydney

While Sydney's population growth has been historically most distinct in fringe areas, existing centres have recorded the fastest pace of growth in for at least the last 30 years.¹⁵ Faced with even larger population increases and decreased average household sizes, policymakers must determine the most efficient means of responding to Sydney's increased housing needs. This may involve either increasing the housing density of existing centres or expanding the geographical reach of the city to Greenfield areas on Sydney's fringe.

Sydney has space to accommodate its growth in Greenfield areas on its fringe or in existing areas. On Sydney's fringe, there are areas that are physically capable of being developed, although these areas are limited by topography, flood plains, national parks and water catchments. The most feasible areas could accommodate 50 per cent of Sydney's expected population growth until 2036 at densities similar to those now being adopted for the Growth Centres.

The existing geographical confines of Sydney are sufficient to meet all of Sydney's increased housing needs. By increasing the average density of defined cities, centres, towns, villages and neighbourhoods to match that of a relatively higher density centre within each category, an ample stock of housing could be provided (box 1.1).

While Sydney has the physical capacity to develop in a variety of ways, the costs and benefits of different paths will differ markedly, as will the commercial feasibility of development. If all development was on the fringe, then areas that are high cost for infrastructure provision for reasons of topography may have to be used, or areas may have to be developed that have limited attraction for people as a place to live and for which developers could not, under current arrangements, make a profit. Similarly, focusing all development in existing areas while physically feasible may not be realisable if there is not demand for the types and density of housing that such a path would require.

¹⁴ NSW Department of Planning projections.

¹⁵ NSW Department of Planning 2010, *Metropolitan Development Program Report 2008-09*, p. 79.

1.1 Measuring Sydney's capacity for additional housing

The current Sydney Metropolitan area is substantial, covering some 12 000 square kilometres and encompassing 43 local government areas, although only part of this is able to be developed for residential housing. NSW Planning's METRIX tool indicates that existing boundaries are sufficient to meet increased housing demand where housing density is moderately increased in established centres and across Sydney's suburbs.

For example, in the table below we consider the current average density of different types of centres as defined by NSW Department of Planning and examples of higher density centres in each category. By moving all areas to the higher density category, which ranged from between 1.5 to 2.5 times the average density, 1.4 million additional dwellings could be accommodated (table). This would result in built forms similar to the examples of higher density centres.

This possible stock of housing is well in excess of Sydney's expected requirements out to 2036, and indicates that, at least in a physical sense, the capacity of Sydney to respond to increased population and housing requirements is ample. While physically feasible, such densities would not be commercially feasible across all areas of Sydney.

Additional dwellings given higher relative density

<i>Type of centre</i>	<i>Average density (dwellings/ha)</i>	<i>Updated density (dwellings/ha)</i>	<i>Additional dwellings</i>
Regional city	42	77	22 930
Major centre	37	91	63 818
Town	30	68	204 491
Village	24	53	145 969
Small village	23	49	174 921
Neighbourhood	16	31	206 832
Infill	14	26	625 192
Total			1 444 153

Source: The CIE analysis based on NSW Planning METRIX tool.

Urban renewal

Urban renewal involves changing existing areas, typically to increase their residential density or to make use of sites that were previously industrial. The scale of urban renewal projects can vary from small apartment blocks or townhouses to major redevelopments providing hundreds of additional dwellings.

There are many factors that determine the feasibility of urban renewal projects, impacting on the costs and the prices that can be obtained. Urban renewal is typically most feasible in areas close to the CBD where townhouses and apartments attract higher prices and where large sites in single ownership are available for redevelopment. This combination of factors has resulted in many inner-city industrial sites being redeveloped for housing.

Building costs are typically higher for higher density dwellings. The Urban Development Institute of Australia indicated that costs would range from \$800 to \$1500 per square metre of floor space for low rise to \$1200 to \$2500 per square metre for medium rise to over \$2500 per square metre for high rise.¹⁶ The Australian Bureau of Statistics reports similar per dwelling building costs for houses and other residential dwellings, despite the significantly larger floor space for houses.¹⁷

Another major cost constraint to urban renewal is the nature of ownership of the existing areas. Major sites owned by government or a single owner are less costly to develop than fragmented sites and offer economies of scale in urban renewal. Site fragmentation can be particularly costly for apartments that operate under Strata legislation requiring the approval of all owners for redevelopment to proceed.

NSW Department of Planning tracks major sites (proposed developments with 50 or more dwellings). In 2007-08 there were 59 000 dwellings projected from major sites in the short term (2007-08 to 2011-12) and 42 000 in the medium term (2012-13 to 2016-17).¹⁸ Major sites are expected to constitute about 50 per cent of dwelling production in existing areas.

Greenfield development

Greenfield development involves making areas that were previously undeveloped suitable for development (in this case urban residential development). Greenfield development involves connecting the site to urban services that were previously not available at that site (such as roads, open space and other social infrastructure), strategic planning to create communities and landscaping to make sites suitable for dwelling construction.

Most Greenfield development in Sydney is on the city's fringe, particularly the designated areas of the North West and South West Growth Centres discussed further below. However, there are also Greenfield sites within existing areas and Greenfield sites on the fringe outside of the Growth Centres. For some of these areas,

¹⁶ Urban Development Institute of Australia, Development Toolkit.

¹⁷ The CIE analysis of ABS, Cat. no. 8752.0, *Building Activity*, Canberra.

¹⁸ NSW Department of Planning, *Metropolitan Development Program 2007-08 Report*, p. 36.

the costs of connecting to the existing networks could be lower than for fringe Greenfield areas, as they are in closer proximity to existing networks.

For similar dwelling types, Greenfield development can typically occur at lower cost compared with infill development, reflecting lower building costs and land prices (per square metre).¹⁹ However, dwellings in Greenfield areas attract lower prices than similar dwellings closer to the CBD, and there are costs of connecting up infrastructure.

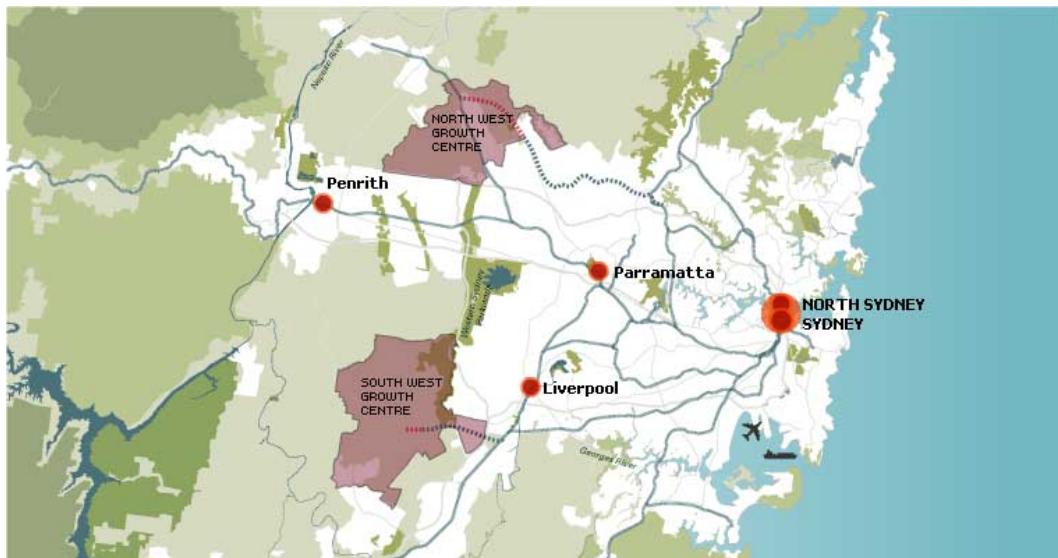
There is variation in the costs of development in different Greenfield areas and the prices people are willing to pay. Evidence from developers suggests that the North West Growth Centre could attract greater prices than the South West for instance.

For this project, the focus for estimating costs and benefits is on Greenfield development in the Growth Centres, as this is where the majority of Greenfield development is expected to be.

Overview of new growth areas

The North West and South West Growth Centres are located on Sydney's fringe as shown in chart 1.2. These Growth Centres are expected to accommodate around 181 000 new dwellings and land for employment for around half a million new residents over the next 25 years and beyond.²⁰

1.2 Location of growth centres



Source: Growth Centre Commission website: <http://www.gcc.nsw.gov.au/>.

¹⁹ The National Housing Supply Council 2010, *2nd State of Supply Report*, provides information for the cost of constructing dwellings throughout Australia. Table 6.4 of this report presents the costs relating to two bedroom units in infill areas and table 6.5 presents the costs of separate dwellings in Greenfield areas.

²⁰ Growth Centres Commission 2010, <http://www.gcc.nsw.gov.au/>, Accessed 17 March 2010.

South West Growth Centre

The South West Growth Centre (SWGC) is an area of around 17 000 hectares. It covers parts of the Liverpool, Camden and Campbelltown local government areas (LGAs) and is planned to accommodate around 110 000 homes or 300 000 people in the next 30 years.

The SWGC has been divided into 18 Precincts. Three of these Precincts: Oran Park, Turner Road and Edmondson Park have been rezoned for urban development. Two more precincts – Austral and Leppington North – have been released for urban development, and precinct planning for these is underway.

Oran Park and Turner Road are in the Camden LGA, while Edmondson Park is in the Liverpool and Campbelltown LGAs. The first rezoned Precincts are estimated to include around 19 000 new residences. The current status of these Precincts is summarised in table 1.3.

1.3 South West — Current status of released precincts

<i>Precinct</i>	<i>LGA</i>	<i>Area</i>	<i>Estimated new residences</i>	<i>Estimated new residents</i>	<i>Status</i>
		ha	no.	no.	
Edmondson Park	Liverpool	800	7 500	22 400	Already rezoned. Landowners can begin lodging Development Applications in the precinct.
Oran Park	Camden	1 119	7540	22 000	Rezoned in December 2007
Turner Road	Camden	536	4 020	11 000	Rezoned in December 2007
Leppington North		815	12 000	33 000	Precinct planning underway
Austral		930	8 000	22 000	Precinct planning underway

Source: Growth Centre Commission (2010), <http://www.gcc.nsw.gov.au/>.

North West Growth Centre

The North West Growth Centre (NWGC) is an area of around 10 000 hectares. It covers parts of the Blacktown, Baulkham Hills and Hawkesbury LGAs and is planned to accommodate around 70 000 new homes (approximately 200 000 residents) over the next 30 years.

The NWGC has been divided into 16 precincts. Five of these Precincts – Alex Avenue, Colebee, North Kellyville, Riverstone and Riverstone West – have already been rezoned. A further five precincts have been released, Area 20, Marsden Park Industrial, Schofields, Box Hill and Box Hill Industrial, and precinct planning for these precincts is currently underway.

The first rezoned precincts are estimated to include around 21,000 new residences (table 1.4). The Riverstone West Precinct has been zoned for a range of employment and industrial uses.

1.4 North West Growth Centre — first release precincts

<i>Precinct</i>	<i>LGA</i>	<i>Area</i>	<i>Estimated new residences</i>	<i>Estimated new residents</i>	<i>Status</i>
		ha	no.	no.	
Alex Avenue	Blacktown	420	6 300	18 000	Rezoned May 2010
Area 20	Blacktown	245	2 500	4 200	underway
Colebee	Blacktown	189	4 500	na	Already rezoned. Development began in 2007.
North Kellyville	Baulkham Hills	707	4 500	12 600	Precinct Plan gazetted December 2008.
Riverstone	Blacktown	1 149	9 000	27 000	Precinct Plan gazetted May 2010.
Riverstone West	Blacktown	285	employment lands	na	Precinct Plan gazetted August 2009.
Marsden Park Industrial	Blacktown	551	1 100 ^a	3 200	Draft Precinct Plan exhibited in 2010.
Box Hill	Baulkham Hills	764	10 000	28 000	Precinct Planning underway
Box Hill Industrial	Baulkham Hills	245	Employment lands		Precinct Planning underway
Schofields	Blacktown	424	5 000	14 000	Precinct Planning underway

^a Employment lands.

Source: Growth Centre Commission (2010), <http://www.gcc.nsw.gov.au/>.

This report

In its 2010 State Plan, the NSW Government stated that the Government would provide capacity for 445 000 of the 640 000 new dwellings that are expected to be required by 2031 (70 per cent) in existing urban areas and the remaining 195 000 (30 per cent) in Greenfield locations. There are many alternative ways in which additional people could be accommodated in Sydney.

The intention of this project is to undertake this cost-benefit analysis of the alternative growth paths. This study considers 3 scenarios that aim to broadly show the costs and benefits associated with alternative options for accommodating population growth in Sydney. The chief distinction between various growth paths is the share of development that occurs in Greenfield areas on Sydney's fringe. We also consider different patterns of growth across local government areas, although it is not possible to fully explore the costs and benefits at this scale due to the limited available information.

The extent to which detailed modelling can be undertaken is limited by the available information. Information at a detailed level of spatial disaggregation was not readily available for benefits and costs required for our analysis. Therefore, the extent to which we could undertake detailed modelling at an LGA level has been restricted.

Nevertheless, wherever possible we have sought to conduct modelling at an LGA or subregional basis.

Acknowledgements

Many people have given their assistance in producing this report. We would like to thank staff from NSW Department of Planning; staff from NSW Transport and Infrastructure, particularly the Bureau of Transport Statistics; Land and Property Management Authority and the Land Valuer General; NSW Department of Environment, Climate Change and Water; the Urban Development Institute of Australia; Property Council of Australia; Sydney Water; Integral Energy, Energy Australia; NSW Fire; NSW Education; NSW Health; NSW Ambulance; NSW Police; Landcom; Stockland; Lend Lease, Roads and Traffic Authority; Railcorp; NSW Housing; and NSW Treasury.

2 *Government and the market for development*

Where and how development occurs is a combination of market and government interactions. Planning regulations are effective in constraining development in particular areas but cannot make development go ahead in others. That is, planning tools are only one of the drivers of where development occurs. In this chapter we set out the major players and drivers of development across Sydney.

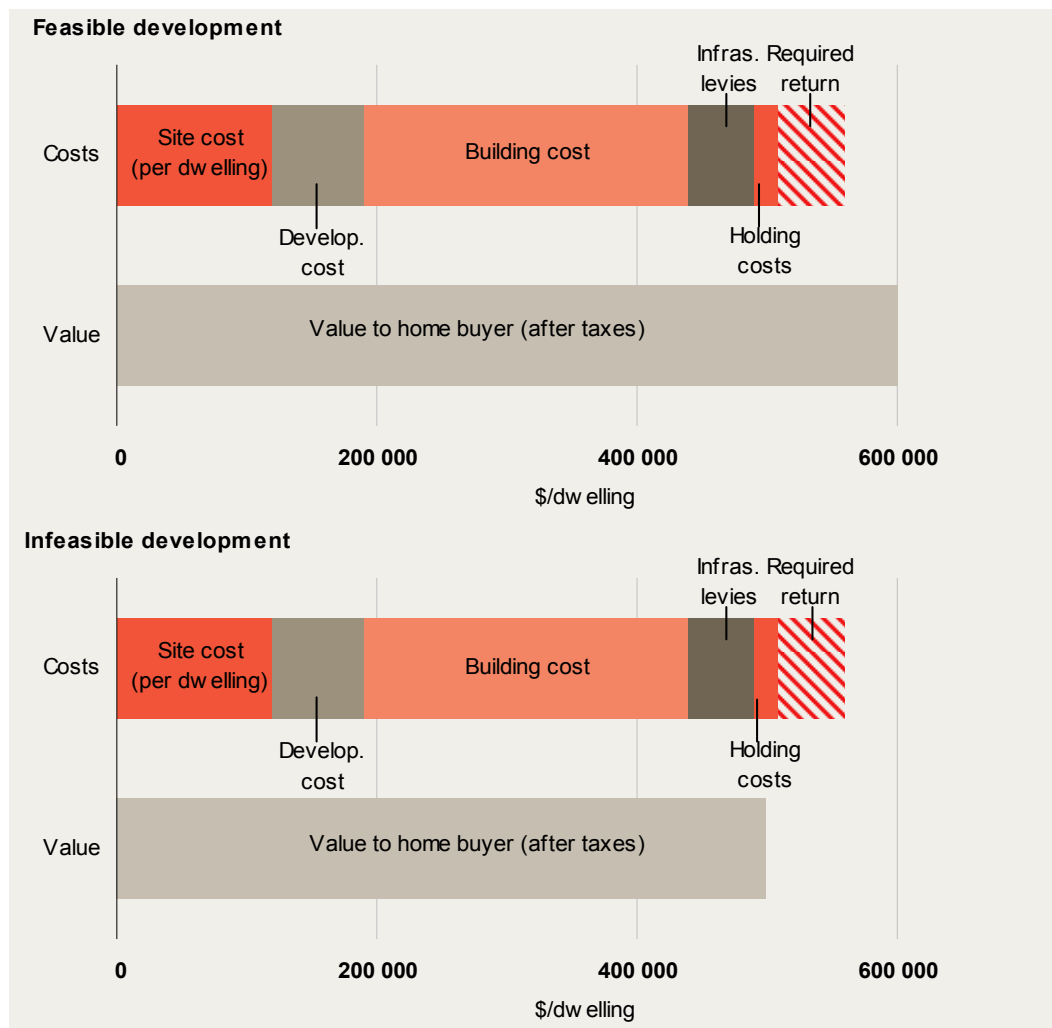
Why does development occur?

Development occurs because there is expected to be a buyer of the development (either of a developed lot or a dwelling) who can and will pay more than the costs of producing it, including a required profit/return component. Developers are the means of facilitating this, purchasing land and buildings and changing it to a product on which people place a higher value. Development is therefore fundamentally driven by the ability of developers to make profits (including a premium depending on the riskiness of the investment).

In considering whether or not to develop in Greenfield or in existing areas, developers consider the price they would have to pay for the site, the costs of development and building (if developing dwellings rather than lots), the holding costs associated with the difference between when costs are paid out and when they receive payment, government related costs and the risk and hence return required for their investment. The costs per dwelling are not uniform across Sydney and can vary significantly depending on the specific characteristics of the site. The costs per dwelling can also vary considerably depending on the scale of the project, particularly where there are significant fixed costs involved in developing the site.

Against these costs developers weigh the expected price that people will pay for the final product. A commercially feasible development is one in which a home buyer has a higher value than the total costs developers face, while an infeasible development is one in which the value to the home buyer is lower than the total costs (chart 2.1).

2.1 Development feasibility



Source: The CIE.

The value to a home buyer reflects a range of factors and is different for every person and family. It incorporates prices of existing houses, locational attributes (such as closeness to the beach), income levels and the characteristics of the dwelling (such as location/views, size and availability of services). It also reflects the ongoing costs of living in the location, related to transport, energy and other dwelling related costs. So, for example, households would be willing to pay more to locate in areas that have lower ongoing transport and energy costs (holding all other factors constant).

The feasibility of development will change depending on the amount of development undertaken in a location. For example, it may be feasible to develop 100 dwellings and make a profit, but it may not be possible to find buyers that can cover costs for the next 100 dwellings. This reflects both cost and value changes. Typically, we would expect that, at some point, there would be reductions in value as more development occurs, as the people who have the highest value for living in the location move there first and the sites with the best features are taken up.

Costs may also rise as more development is undertaken in a particular area if the lowest cost development sites are already taken up first.²¹

Further, the supply and demand for lots in a particular area is not isolated but is interdependent with the markets in other areas and with the market for existing dwellings. This means that regulations in one market influence the markets in other areas. For example, restrictions on zoning in one area, such as existing developed suburbs, would push up demand in other areas, such as the fringe, and vice versa.

Government and the development process

Governments, both NSW State and local, have significant direct and indirect influence on development through planning regulations and other policies. These effects operate through changing the costs and value of development and limits on whether or not development is allowed.

Governments can:

- change the costs of development in particular areas or in general. Development costs incorporate costs associated with obtaining planning approval, infrastructure levies (both state and local) and holding costs related to the length of time between purchase of a property and its sale. For Sydney, key policies that influence costs include:
 - planning approval processes;
 - State Infrastructure Contributions;
 - Local Infrastructure Contributions;
 - taxes, such as state property taxes;
 - other regulatory requirements such as Building Codes and Operational Health and Safety;
 - strata legislation and other possible methods of accommodating fragmented ownership;
- change the value of development in a particular area or in general. Government policies and actions that influence the value of a development include:
 - provision of infrastructure (and services), particularly transport infrastructure, and other infrastructure in Greenfield areas;
 - investments to improve amenity of the area;
 - provision of employment nearby through supply of land for employment and location of government employment;

²¹ This of course can be mirrored by 'threshold effects' where critical mass of development is required before some elements of developers' per lot costs fall.

- development controls that determine the specifications of a development;
- change the risk of development and the required returns for developers. The planning process may have greater clarity or uncertainty making development a more or less risky business proposition; and
- constrain whether or not a development is allowed to occur. Zoning regulations for instance can prohibit certain forms of development in particular areas.

A more detailed discussion of the NSW Planning environment is contained in appendix A.

The impacts of the NSW Government and local governments on development is asymmetric, in that government can effectively inhibit development but does not have a ready ability to create development (except through public housing and government development companies such as Landcom).²² For example, there are many areas in Sydney that are zoned for higher residential density that have not been developed to maximum allowable density.

Some of the government policies and actions set out above are likely to impact on development across all of Sydney relatively equally. For instance, planning approval processes apply to Greenfield and existing areas and could be more or less efficient in both.²³

But some policies and tools have very specific spatial impacts, in encouraging or discouraging development in a particular area. For example, State Infrastructure Contributions are targeted at Greenfield developments and local infrastructure contributions are also often higher for Greenfield development. Zoning regulations are also targeted at allowing specific areas for redevelopment whilst limiting the ability to redevelop others.

Basis for government involvement in development

The NSW Government and local governments are heavily involved in land use planning because of the broader social costs and benefits from development. These costs and benefits include:

- NSW Government infrastructure costs – new development can lead to additional infrastructure provision by the NSW Government and NSW Government businesses. Infrastructure provided by the NSW Government includes physical infrastructure such as water and sewerage and transport and social infrastructure

²² Governments could conceptually use tools to create development such as subsidies but do not typically do so.

²³ Although the application of the planning rules do vary between local governments and can influence the nature of development in that area.

such as schools and health facilities. In some cases developers contribute towards these costs through state infrastructure contributions or through in-kind contributions (table 2.2);²⁴

- local council infrastructure costs – new development can lead to additional infrastructure provision by local councils such as local roads, open space and recreational areas and stormwater management. These costs are often passed on to developers through local infrastructure contributions;
- other utility infrastructure costs – gas, electricity and telecommunications infrastructure may need to be upgraded as part of the development. Developers will pay for part of this although other users may also bear some of the costs;
- neighbourhood costs and benefits – existing residents may face costs from a new development such as aesthetic costs (for example, loss of view) or congestion costs. They could also benefit through greater amenities; and
- environmental costs – new developments may have differing environmental impacts such as air, noise and greenhouse gas pollution and impacts on biodiversity.

Table 2.2 below provides a summary of the costs involving a user-pays element in Sydney under the current arrangements.

2.2 User pays elements across existing and new areas

Category	Existing suburbs	New Growth areas
State Infrastructure contributions	Not paid	Currently discounted at \$11 000 per dwelling, rising to \$17 000 per dwelling from July 2011
Local Infrastructure contributions	Often applied at a rate of 1 per cent of development costs, although can also be charged on the basis of an assessment of additional infrastructure requirements	Currently capped at \$20 000 per dwelling except in Greenfield sites where the cap is \$30,000.
Public transport fares	Public transport fares tend to be a higher share of costs of the services in existing suburbs, particularly those nearer the CBD	Public transport fares tend to be a lower share of costs on the fringe
Road toll contributions	Applied in some cases	Applied in some cases
Congestion charging	Limited to Sydney Harbour Bridge	Limited to Sydney Harbour Bridge

Source: The CIE.

There is no necessary reason for the social costs (the costs to all residents in NSW) to equal the private costs (the costs to those making the decisions directly such as developers and people buying new dwellings). It is likely that they will differ in different ways in different areas. Seen in their best light, developer levies, local

²⁴ In certain circumstances, developers can also provide some part of the utility infrastructure which is then 'gifted' to the utility once the development is complete.

environment plans and developer approvals are mechanisms to attempt to better align social and private interests by putting a price either explicitly (levies) or implicitly (regulatory restrictions) on some of the costs that are not immediately borne by buyers and sellers, known as 'externalities'.

Planning systems have the ability to, in the presence of externalities, move development outcomes towards what is considered to be the social optimum. However, as with any form of regulation, there is a risk that regulatory failure will occur and outcomes will be further from the optimum than those of an unregulated market and can make areas of artificial scarcity where there are 'excess returns' that can be negotiated over by developers, existing landowners and home buyers.

An efficient planning system is one that brings together information on the social costs and benefits of new development together with market-based information. Incorporating market based information into planning decisions is an important element to try to avoid perverse outcomes from regulations that seek to address market failures in land use development.²⁵

Importantly, surety in longer term objectives and actions are critical in the development and planning arena. The long life span of infrastructure, as well as the inertia involved in population and employment movements means that changing development and planning goals midway through the process can be very costly.

The mechanisms by which planning systems bring together information on private costs and benefits and social costs and benefits include consultative processes used as part of development approval and price based mechanisms such as infrastructure contributions. Both approaches aim to incorporate information beyond that contained in market valuations. The consultative approach is likely to be better when social costs and benefits are more important and different developments have very different social costs and benefits. Incorporating social costs and benefits through developer charges is likely to be a better option when market feasibility is highly variable and social costs and benefits are relatively constant and able to be measured. Further discussion of the advantages of the alternative approaches is in box 2.3.

²⁵ Fels, A., et al. 2008, *Choice Free Zone*, Concept Economics, Kingston, ACT.

2.3 Quantity versus price mechanisms in planning

The NSW planning system uses quantity restrictions (zoning) and price mechanisms (such as developer charges).

The case for price versus quantity restrictions is based on the nature of the underlying market structures, such as the relative slopes of demand and costs curves for land, as well as areas of uncertainty, such as future population growth and location. Previous studies have identified situations in which quantity controls or price controls are likely to be more effective in maximising the economic value from development.²⁶ Quantity controls are expected to be preferred under the following conditions, with price controls preferred otherwise.

- Where there is a discontinuous 'benefits curve' from land use. Such discontinuities, or thresholds, are prominently evident with traffic congestion for example, where additional development in a given area creates a disproportionately large impact on the value of living in the area.
- Where the supply of land is relatively elastic, in which case, errors calculating the amount of land to be released under zoning controls will not have a significant price effect.
- Where there is a high degree of coordination required across developments and developers are not able to work at a sufficiently large scale to internalise these coordination issues.

The less observable costs of quantity restrictions arise when rezoning applications are not responsive enough to allow for economically efficient development in a given area, thus forcing its relocation to less restrictive areas. Once this relocation has occurred, the sunk cost nature of development costs, that is, generally unrecoverable, means that the inefficiency is unlikely to be rectified if zoning restrictions are eased in the future.

Key points

The urban growth of Sydney will depend on the interaction of government policies and actions and the market for development. While land use planning and other planning instruments can have significant impacts on urban development, they cannot determine by themselves the pattern of growth in Sydney. This study does not evaluate the magnitude of the influence that NSW Government instruments could have on where and how Sydney grows. Its focus is on the effects of different

²⁶ Netzer, D. (ed.) 2003, *The property tax, land use and land use regulation*, Edward Elgar, Northampton, Massachusetts, USA and Fels, A. et al. 2008 *Choice Free Zone*, Concept Economics, Kingston, ACT, Australia.

growth paths. (The different scenarios considered would, of course, involve different government approaches and combinations of market activity and regulatory intervention but they are not considered explicitly here.)

3 *Scenarios for Sydney's growth*

There are many ways in which additional people could be accommodated in Sydney. The choice between the different options depends on a range of factors such as the cost of development, the preferences of consumers to live in these areas and their willingness to pay to live there. This chapter outlines some of these alternatives and the specific scenarios that have been considered in this study.

Alternative options to accommodate additional people

The range of options to accommodate future population growth in Sydney can be broadly divided into the following categories:

- Greenfield development on Sydney's fringe – accommodating people through expanding the geographic size of Sydney, using areas such as the North West and South West growth centres;
- infill development – accommodating people in existing suburbs through increasing the density of dwellings. This involves developing undeveloped areas within Sydney's boundaries, as well as redeveloping existing dwellings, such as houses, into higher density, such as apartments. Within infill development there are many options based on where people are accommodated. These include:
 - whether higher density predominantly occurs close to 'centres', where centres are areas providing some levels of service and can vary from large centres such as Chatswood to small centres such as Bondi or Granville;
 - whether higher density predominantly occurs along current or potential public transport routes, such as a new metro, known as transit oriented development; or
 - whether higher density is spread evenly around existing suburbs.

The NSW Department of Planning has defined centres to allow these types of infill development to be categorised. These are set out in table 3.1. Over time, some centres may grow and change and become identified under a different category.

3.1 Types of urban centres

Type of centre	Definition	Examples
Global Centre	The main focus for national and international business	Sydney CBD and North Sydney
Regional Cities	Areas with a full range of business, government, retail, cultural, entertainment and recreational activities	Parramatta, Liverpool and Penrith
Specialised centres	Areas containing major airports, ports, hospitals, universities and research and business activities	Macquarie Park, Port Botany, Sydney Airport
Major Centres	Major shopping and business centre for the surrounding area	Bankstown, Bondi Junction, Campbelltown, Chatswood
Town centres, villages and neighbourhood centres	Small to medium groups of shops. Living close to centre is considered as 800 metres from a town centre, 400–600 metres from a village and 200 metres from a neighbourhood centre	Town centre — Bondi, Cabramatta Village — Bronte, Granville and Oatley

Source: NSW Government's Metropolitan Strategy 2005, supporting information (pages 92 and 130).

Scenarios considered in this study

This study considers 3 scenarios that aim to broadly show the costs and benefits associated with alternative options for accommodating population growth in Sydney. The chief distinction between various growth paths is the share of development that occurs in Greenfield areas on Sydney's fringe, that is, the New Growth Centres.²⁷ We also consider different patterns of growth across local government areas, although it is not possible to fully explore the costs and benefits at this scale due to the limited available information.

Changing the pattern of urban development cannot happen overnight. Therefore, regardless of the targets chosen and the mechanisms to achieve those targets, the next few years are not likely to be affected. To capture this, we have maintained similar dwelling projections for each scenario until 2016 and then changed development patterns from then on until 2036.

The scenarios can say little about specific aspects of development, such as the type of development that would occur in each area and specific clustering around centres and transport nodes as no data was able to be sourced at this level of spatial disaggregation. We discuss these issues further in chapter 12.

Finally, Sydney's growth is about much more than just urban residential development. The complementary patterns of development of employment, retail and other land types will have significant influence on the costs and benefits of urban

²⁷ Note that there are areas that are Greenfield that are not on the fringe and areas that are Brownfield that are on Sydney's fringe.

development. The location of employment is particularly important as it will influence demand for transport. The NSW Government can influence the location of employment, such as the location of NSW Government employees, decisions about employment land and provision of infrastructure. But there are other influences on where people work, such as the nature of the sectors that grow and decline in Sydney over the next 30 years and the different tendencies of these sectors to favour centralised versus decentralised employment. For example, manufacturing is more likely to locate on the fringe relative to sectors such as financial and business services.

Even with employment change there are significant impediments to people moving to alternative locations closer to work to reduce transport demand. These include personal networks in current areas, costs of moving and stamp duty costs.

As much as is possible, we consider that people living in particular areas in the future will make similar travel decisions as people living in those areas do now.

Scenario 1 – the 2005 Metropolitan Strategy

The 2005 Metropolitan Strategy aims for:

- 30 per cent of new housing in land release areas, of which 80 per cent would be around new centres;
- 70 per cent of new housing in existing urban areas, distributed;
 - 20 per cent close to global centres, regional cities and specialised centres;
 - 10 per cent close to major centres;
 - 52 per cent close to town centres, villages and neighbourhood centres; and
 - 18 per cent not close to centres.²⁸

The 2005 Metropolitan Strategy also sets out subregional growth targets (table 3.2). These are used to allocate population growth across Sydney's local government areas.

²⁸ NSW Government's Metropolitan Strategy, *City of cities: A plan for Sydney's future*, Metropolitan Strategy supporting information, p. 141.

3.2 Subregional growth targets for Metropolitan Strategy scenario

<i>Subregion</i>	<i>Number of new dwellings in existing areas 2006 to 2036</i>		<i>Proportion of new dwellings in existing areas</i>
		no.	%
Sydney City		61 000	7.9
East		23 000	3.0
South		58 000	7.5
Inner West		35 000	4.6
Inner North		44 000	5.7
North		29 000	3.8
North East		29 000	3.8
Central West		96 000	12.5
North West		169 000	22.0
South West		155 000	20.2
Central Coast		70 000	9.1
Total		769 000	100.0

Source: Draft NSW Metropolitan Strategy 2010.

Scenario 2 – focused on fringe

There is physical capacity in Greenfield areas on Sydney's fringe to accommodate more people than the 30 per cent target in the Metropolitan Strategy. The areas most suitable for urban development due to their topography and location could accommodate 50 per cent of Sydney's expected housing growth to 2036, at the current densities expected in fringe areas.

The exact proportion of Sydney's growth that would occur on the fringe under plausible NSW Government policies is not known. Other cities offer differing examples. In Melbourne, 47 per cent of new dwellings required from 2006 to 2026 are expected to be in growth areas, although Melbourne has fewer physical constraints on fringe development than Sydney.²⁹ In some US cities, growth is even more focused on the fringe.

For this study, the scenario that we have modeled is 50 per cent of new dwellings occurring on the fringe and 50 per cent as infill development. The NSW Department of Planning provided the projections of dwellings for this scenario. The scenario was constructed by assuming that all areas currently identified would be built out (the remainder of the Growth Centres not yet released plus the North Wyong Area), including bringing forward the timing of their development, and then including seven additional areas to be developed based on the NSW Department of Planning's previous urban capability assessments. These include lands at Scheyville, Londonderry, Cobbity, Cawdor and Macarthur South and small areas in the North East and South subregions. For this study it was not assumed that the future of the

²⁹ Urban Development Institute of Australia, 2009 *State of the Land*, p. 31.

Badgerys Creek Airport site and any consequences of decisions on that had been determined.

Scenario 3 – urban focused

Over the past five years, 80 to 90 per cent of Sydney's dwelling production has been in existing areas. We consider a scenario similar to this, whereby 90 per cent of new dwelling production continues to be in existing areas.

The local government area dwelling projections for this scenario are based on the projections from Scenario 1 (Metropolitan Strategy). They scale up existing areas in proportion to reach 90 per cent and scale down Greenfield areas in proportion. For example, under the Metropolitan Strategy the Canada Bay local government area accommodates about 1 per cent of dwellings in existing areas. For scenario 3 there are more dwellings in total accommodated in existing areas. We allocate the same proportion of these dwellings to each local government area – that is, 1 per cent to Canada Bay.

This scenario is therefore considering incremental shifts from Scenario 1 rather than major changes such as focusing on only one growth centre or shifting population growth closer to the coast.

Scenario 4 – least cost

There is a scenario for development that is 'optimal', in having the least social cost. While it is beyond the scope of this project to find this scenario in detail, for the fourth scenario we use a rough method to approximate this optimal scenario. This scenario arises out of the analysis rather than being specified prior to the analysis.

The social least cost scenario is a complex interaction of the benefits and costs of alternative growth paths and how these costs and benefits change as the area accommodates more people.

Why these scenarios?

The scenarios were chosen with the aim of learning the most about how costs and benefits change from different urban growth strategies, given the time available for the project. They aim to answer questions about the different costs and benefits of alternative growth paths at a high level, such as the difference between fringe Greenfield and infill development.

Comparison of scenarios

The scenarios that we consider encompass relatively significant changes in the allocation of new development to Greenfield areas versus existing areas. In terms of the subregional allocation of people, the changes are much smaller (table 3.3). In allocating more people to Greenfield areas this tends to be at the expense of less new dwellings in the Central West. The scenarios capture only relatively incremental changes in the level of redevelopment of the Sydney subregion, North East, East, North, Inner North, Inner West and South, compared with the variation in other subregions.

3.3 Share of dwelling growth from 2006 to 2036 in each subregion

<i>Subregion</i>	<i>Scenario 1</i>	<i>Scenario 2</i>	<i>Scenario 3</i>
Ratio: Infill: Greenfield	70:30	50:50	90:10
	%	%	%
Sydney	7.9	6.1	9.4
East	3.0	2.9	3.4
South	7.5	6.1	8.8
Inner West	4.6	4.1	5.3
Inner North	5.7	4.3	6.8
North	3.8	3.2	4.4
North East	3.8	3.8	4.5
Central West	12.5	7.7	14.5
North West	22.0	24.3	17.9
South West	20.2	28.4	15.8
Central Coast	9.1	9.1	9.1
Total	100.0	100.0	100.0

Source: The CIE.

Feasibility of scenarios

For the scenarios that we model to actually happen there would have to be changes to the instruments NSW Department of Planning and the NSW Government have available to influence urban growth such as developer levies and planning approval processes. These instruments were set out in chapter 2 and appendix A.

As stated above, this project does not consider the changes in policy required for the different scenarios to occur. We do consider broad issues of feasibility that policy changes would have to address. These feasibility issues have several components.

- Physical feasibility – is it physically possible to house the number of people required in our scenarios in the areas specified?
- Commercial feasibility – how far away is what developers and households choose to do under current arrangements from what they would need to do for the scenario to happen?

- Policy feasibility – are new policies or changes to existing policies required to advance certain development paths?

All scenarios chosen for this study are physically feasible for the period to 2036, within the primary constraints on Sydney (such as the water catchment area, national parks, flood plains and areas of poor topography). For example, the 50/50 scenario could be accommodated in fringe areas including (amongst others) the North West and South West Growth Centres and Macarthur South.

Within existing areas, there is also considerable capacity for housing additional people. The average density across Sydney is about 21 people per hectare, compared with London at 51 people per hectare or Paris at 36 people per hectare.³⁰ There are also large areas of residential land that have been zoned for denser development but that have not yet been redeveloped.

The commercial feasibility of the scenarios chosen for this study will depend on the range of policies that the NSW Government and NSW Department of Planning choose to undertake. All scenarios would likely require changes in behaviour from current patterns. Currently 80–90 per cent of new development is occurring in infill areas. About half of the infill development is around centres and half in other areas.

We have measured to some extent the commercial feasibility of each alternative scenario through factoring in the value that people obtain from a given location. This is akin to the process developers go through in deciding on whether or not to proceed with a development, except that we allow development to occur even if it would not meet commercial feasibility requirements, and consider the gap for commercial feasibility as a cost to society.

Discussions with developers and developer groups suggested that planning rules at both the state and local government level are a crucial part of developer decisions impacting on both the cost structure of development in alternative areas and the risks of such development. As such, planning changes, along with changes in government infrastructure provision could substantially change the way that Sydney grows.

Other site specific issues such as the nature of the land ownership in potential new development areas can also significantly influence the commercial feasibility of the different options. For example, areas where there is a large number of landowners (typically referred to as ‘fragmented ownership’) can influence a developer’s decision to invest in an area. The scale of the possible development is another factor that can influence the developer’s decisions. This is particularly relevant where there is a large fixed cost associated with the development. Typically a larger scale

³⁰ City Mayors, <http://www.citymayors.com/statistics/largest-cities-density-125.html>, Accessed 11 March 2010.

development would be required in this instance in order for the developer to make the required return on the investment.

Other factors raised by developers that hinder the commercial feasibility include:

- the upfront costs of land purchases and the extent to which landholders expectations do not reflect current market conditions; and
- the upfront infrastructure contributions required to be paid.

4 *Framework for estimating benefits and costs*

The benefits and costs of alternative growth paths will comprise benefits to households (and developers), costs to households and costs to other groups such as the NSW Government and local governments, utilities (and their customers) and broader environmental costs.

There are many ways of thinking about what could happen under alternative growth paths. For example, if a growth path is focused on increasing density in existing areas, then there may be less need for infrastructure upgrades, at least initially. Over time, as any excess capacity in service delivery within an area is absorbed, infrastructure upgrades could be required to maintain services, and these could come at a high cost. Or services could be allowed to deteriorate with negative social implications, or provided in a changed form, such as higher density schools.

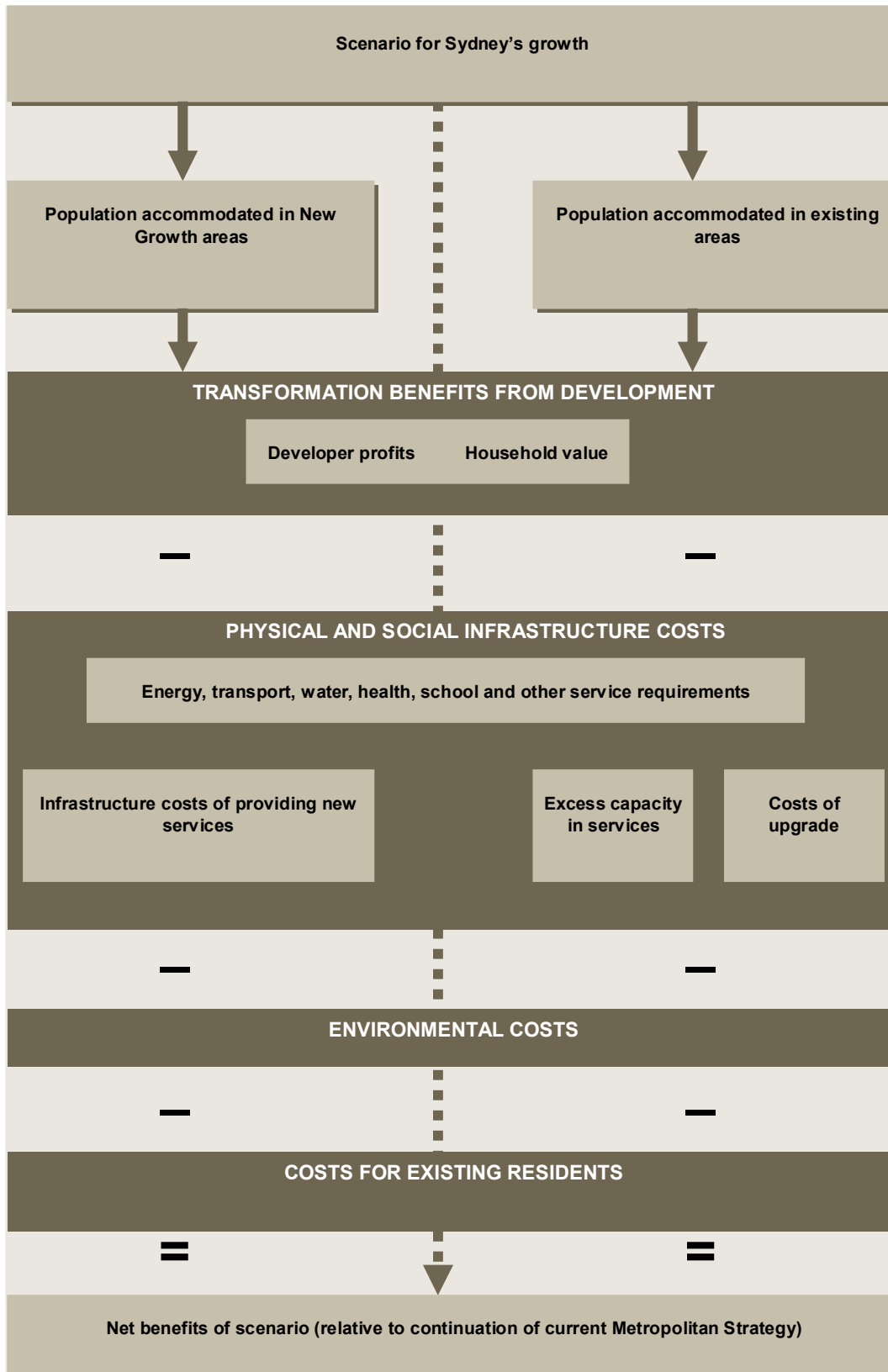
These complexities require a robust economic evaluation framework to ensure that benefits and costs are not double counted and to appropriately value alternative growth paths for Sydney. This chapter sets out the evaluation framework used in this report.

Overview of the framework

The evaluation framework captures four types of costs and benefits of an urban growth path (chart 4.1).

1. Physical and social infrastructure costs – these are financial costs to maintain services for electricity, water and wastewater, transport, health, education, emergency services and council services.
2. Transformation benefits – this is the difference between the value people place on development in a given location and the costs of creating the development. This is most akin to a commercial appraisal undertaken by developers involving consideration of the price they can sell for and the costs of producing the dwelling or lot.
3. Environmental costs – these are costs borne widely across Sydney (and further afield) from GHG emissions, air and noise pollution and impacts on biodiversity.
4. Impacts on existing residents – these are impacts such as congestion on roads, reduced availability of open space (if more is open space is not provided) and aesthetic impacts on the neighbourhood.

4.1 Framework for estimating costs and benefits



Source: The CIE.

These benefits and costs are added together in the following way.

$$\begin{aligned} \text{Net benefits} &= \text{transformation benefits} - \text{total costs} \\ &= \text{transformation benefits} - \text{physical and social infrastructure costs} - \\ &\quad \text{environmental costs} - \text{existing resident costs} \end{aligned}$$

The overall outcome from the framework is the net benefit of accommodating alternative growth paths for Sydney relative to the baseline of continuing with the 2005 Metropolitan Strategy. It is important to recognize that this study is not measuring the net benefits or costs of population growth *per se*, but the net benefits or costs of accommodating population growth in different ways. There are many benefits and costs of population growth not considered in this study as they would stay roughly constant under alternative growth paths.

In some ways, this framework is akin to undertaking a *social appraisal* for each new development, in a similar way as developers undertake a commercial appraisal, and aggregating these across all developments. An example of the social appraisal process is shown in chart 4.2. The social benefit of a new development is the value to home buyers and any benefits to the area such as improved amenities. The costs include:

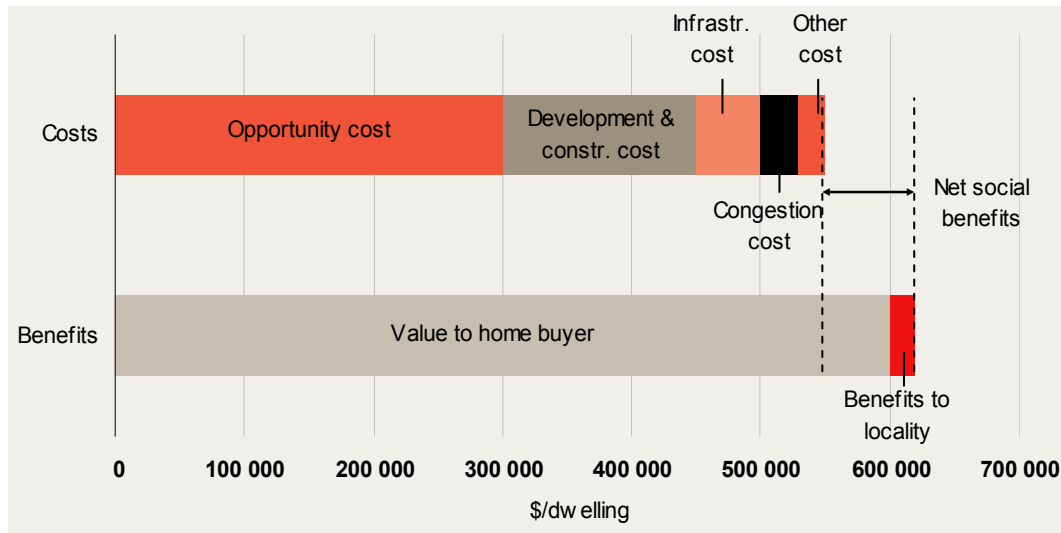
- the opportunity cost of the site or land – what is its value in its current use and for its best possible use;
- the development and constructions costs, including a return to developers and holding costs;
- infrastructure costs, including costs for providing physical and social infrastructure;
- congestion costs, applicable mainly to transport but also potentially to areas such as parks and services if additional open space is not provided; and
- other costs, such as aesthetic costs to neighbours and environmental costs.

A new development satisfies a commercial appraisal process if developers can recover their costs and make a margin. Similarly, a new development satisfies a social appraisal if its total social benefits exceed its total social costs.

This study does not include all benefits and costs of new development. Instead, we focus on those benefits and costs that are expected to change with a different growth path that accommodates a similar number of people. This means for instance that we do not consider benefits related to higher government revenues from taxation as this is considered to remain the same under each scenario.³¹

³¹ It is plausible that a residential growth path could impact on either the amount of hours worked or the productivity of the labour force and hence have significant impacts on state

4.2 Social appraisal of new development



Source: The CIE.

There are a number of areas where a full social appraisal of alternative growth paths is limited by the information available and timeframes for this study. In table 4.3 we set out included and excluded costs and benefits.

For the categories that have been excluded, there is typically insufficient evidence linking the broad growth path for Sydney with outcomes and hence benefits and costs.

A good example is affordable housing. Firstly, each growth path could have different implications for the average dwelling price and share of dwellings below a particular threshold. There is no information available to model how Sydney's dwelling prices would be affected by a particular growth path. Secondly, specific affordable housing policies that target particular groups would have different effectiveness under each growth path. For example, current policies providing a floor space bonus would be more effective under a higher density scenario as a floor space bonus typically has no value out in Greenfield areas. But this policy would have the effect of raising prices for people outside the targeted group. Finally, the general costs associated with development (including government imposed costs) and the particular policies for affordable housing will have a much bigger impact on general house prices and the provision of affordable housing than the scenarios that we consider. Each scenario we consider has dwelling production continuing to occur across all areas.

For similar reasons a number of other types of costs and benefits are excluded. In large part this reflects the timeframes and limited resources available for the project

government taxes. Similarly, property taxes could change with each growth path. Both these areas are beyond the scope of this report.

and hence the need to prioritise to major cost and benefit items that vary across growth paths. In other areas, exclusions and limitations reflect the paucity of data available to link land use planning to outcomes or the greater importance of other policy instruments.

The methods used to evaluate each of the areas that are included in this study are discussed in more detail below.

4.3 Included and excluded elements of benefit–cost analysis

<i>Included</i>	<i>Excluded or not quantified</i>
Physical infrastructure costs of housing people in different locations incurred by NSW Government, local councils and utilities (and shared amongst utilities customers)	Changes in government (NSW and local) revenues from housing people in different locations
Social infrastructure costs of housing people in different locations incurred by NSW Government and local councils	Ongoing costs to government (NSW and local) from housing people in different locations are generally not included
Environmental impacts of housing people in different locations (GHG emissions, air pollution, noise pollution)	Productivity effects arising through differences in agglomeration in employment
Private value of agricultural land on Sydney's fringe	Social impacts such as crime arising from different urban patterns
Private costs of areas affected by climate change or that will incur adaptation costs in response to climate change such as higher temperatures and rising sea levels to the extent factored into property values	Additional social value of agriculture on Sydney's fringe has not been factored in. There is no robust quantitative evidence about the additional social value of agricultural land on Sydney fringe ³²
A number of impacts on existing residents of housing people in different locations are quantified, including congestion impacts and pollution impacts. Open space crowding is considered but not quantified.	Costs of climate change and climate change adaptation incurred by government and infrastructure providers or not factored into private expectations
Private net benefits arising from the transformation value of a location above the costs of developing the area. This takes account of a range of factors reflected in house prices including private costs of living in an area (such as rates, transportation costs, electricity costs)	In some areas impacts on existing residents have not been quantified. These include benefits from improved amenities as an area becomes more densely settled and costs such as aesthetic costs on neighbours. There is no evidence to attribute different values for each scenario, although discussions suggested that costs could be mitigated under most scenarios with appropriate planning.
	Biodiversity impacts of each growth path are discussed but not quantified. Water quality impacts are not quantified
	Value from social housing, costs of provision and costs on neighbouring areas
	Social value from affordable housing. Provision of affordable housing will depend on factors other than the broad growth path such as the particular policy settings and overall planning costs and supply of land.

Source: The CIE.

³² Appendix E has a further discussion on this.

Physical and social infrastructure costs

Alternative growth paths require different investments in physical infrastructure, such as roads and electricity networks, and social infrastructure, such as education and health. These investments are currently incurred by the NSW Government, local councils, developers, utilities and ultimately by households.

The investments made in physical and social infrastructure will be of a different type and of a different size for alternative growth paths. In new areas, entirely new infrastructure may be built and for some types of infrastructure, land will have to be purchased. For existing areas, investments may be to upgrade existing facilities or to expand facilities, otherwise facilities may become more congested.

For this study, infrastructure costs of new areas are drawn from estimates by government and the relevant utilities. Estimating physical and social infrastructure costs in existing areas is more difficult, and likely to vary considerably in per dwelling terms depending on the amount of people accommodated in an area. Where there is existing capacity, there will be no costs for some expansion. However, once capacity constraints are met upgrades can be more expensive than on the fringe. Evidence on these constraints and costs are obtained from government and utilities. For existing areas, costs of upgrading are reflective of Sydney average per dwelling costs rather than adjusted for each region (unless utilities can readily provide detailed information on the cost of upgrading to meet different levels of population increase in different areas).³³

It is also important not to double count infrastructure and congestion costs. For instance, accommodating people in existing areas could:

1. lead to more students being educated in the same schools – this would require building the school up, building over playgrounds or sports grounds or increasing class sizes, and would reduce the value parents and children placed on going to that school. This would be a social cost; or
2. lead to investment to buy out neighbouring properties and expand the school – this would be a financial cost incurred by the NSW Government and then paid for through taxes.

Both options are plausible responses to higher density. Ideally, which occurs would reflect the social least cost. It is beyond this study to estimate the social least cost across many types of infrastructure. Instead, we take an approach of maintaining existing standards imposed on the different types of physical and social infrastructure except for transport. The approach includes the following.

³³ Where information is available, costs are adjusted to reflect social costs rather than purely financial costs (for instance road closures impose costs on existing residents while the road is being upgraded).

- Quality of schooling – we have assumed that the NSW Government would fund new schools, land and teachers to keep class sizes below levels set in their standards and enrolments below maximum enrolments set for each school.
- Quality of health services – we have assumed that the NSW Government would fund new health services to keep beds per population and other aspects of health service quality constant.
- Other social infrastructure – we have assumed that other infrastructure would be funded to ensure indicators of use are below the maxima set by the NSW Government.
- Environmental standards – we have assumed that sewage treatment plants would be upgraded so that they continue to meet environmental standards imposed by regulations.
- Electricity service standards – we have assumed that electricity companies maintain the quality of service (blackouts, brownouts) of the current network.

For transport, there will be changes in financial costs and changes in social costs, such as congestion, from alternative growth paths. This is because it is not possible to provide infrastructure that exactly maintains service standards in transport in every area and for every household, unlike for other services. We have included financial costs of connecting Greenfield areas to transport networks, and considered infrastructure costs to avoid congestion arising from alternative growth scenarios. In doing this, we recognise that there is limited information that we can draw on linking the costs of potential future transport infrastructure projects and their benefits (such as avoided congestion) across a mix of infrastructure projects and for alternative land use scenarios. This is because the value of a transport infrastructure project will typically be different depending on the other projects that are undertaken and the expected population catchment using the infrastructure.

4.4 Standards applied in this study

Area	Name of standard
Sydney Water	Environment Protection Licence, Operating Licence
Energy Australia	Distribution Network Service Provider Licence
Integral Energy	Distribution Network Service Provider Licence
Telstra	Universal Service Obligation
Public schools	Maximum enrolments
Sewage	Environment Protection Licences

Source: Various.

Environmental costs

Accommodating more people in Sydney will have environmental costs regardless of how it is achieved. More people will generate more sewage, more energy use in homes and more transport. In addition, developing new areas could have implications for biodiversity and other environmental impacts.

Some of these costs are able to be valued, such as the costs of GHG emissions and air pollution. Others are considered qualitatively in this study.

- GHG emissions are valued in the home and through transport use based on previous estimates of the impact of land use patterns on energy use.³⁴
- Air pollution is calculated for transport use through considering the impact of the growth path on the amount of air pollution and applying estimates of the cost of air pollution from previous studies.
- Noise pollution is estimated using estimates of car kilometres, bus kilometres and train kilometres and the varying noise levels of each mode of transport.
- Biodiversity impacts on the fringe and in high environmental value zones within the existing areas. Biodiversity impacts can be considered but not valued.

For air pollution and noise pollution we use standard values that do not vary with the scenario. This does not fully account for pollution costs as pollution may concentrate in particular areas due to topographical features, and locating people in these areas would have worse health outcomes.

Impacts on existing residents

Existing residents can be impacted in many ways from alternative growth strategies. These effects are classified in general as congestion effects, amenity effects and aesthetic effects.

- Congestion effects. Higher density in existing areas can increase congestion of all services. For instance schools could get more crowded, travel could take longer or be more crowded and hospital waiting lists could rise. In most areas these effects are not included in this study as we instead adopt the approach of considering the costs required to maintain existing service standards. For transport, there will inevitably be some changes in congestion. We therefore value any changes in congestion that will occur despite changes in the provision of transport infrastructure.
- Amenity effects. Higher density can bring greater amenities such as cafes, shops and recreational opportunities that are valuable to existing residents, and allow

³⁴ Additional costs of adapting to the effects of climate change (e.g. additional infrastructure costs) are not considered in our analysis.

for better funding of local council infrastructure through economies of scale. It can also crowd existing amenities such as parks and other areas of open space.

- Aesthetic effects. Higher density living can impact on the aesthetic value of an area. For instance, higher density could reduce the views from neighbouring properties and even the entire suburb. It has been very difficult to ascertain the magnitude of these effects. Discussions with stakeholder suggested impacts on immediate properties of a very poorly managed medium to high density building could be up to 20 per cent of the property value. The NSW Department of Planning Stakeholder Forum suggested that impacts on existing residents of medium density development ranging from townhouses to up to 3 storey apartments near transport nodes would have minimal negative impacts on existing residents.³⁵ These effects could differ across different areas, with anecdotal evidence suggesting these effects could be higher where density change imposed greater changes to local urban character. These effects will also differ depending on the exact nature of the development considered.

There are other potential impacts such as crime that are not considered in this study. There is not a direct link between different density of development and crime. Often it requires an understanding of the local issues and the specific nature of the development being proposed. This would require detailed case by case analysis of specific types of development in particular suburbs, which is beyond the scope of this study.

Transformation benefits

There are net benefits to be obtained by households and developers from developing in some new locations. Where they are present they reflect the difference between what households are willing to pay to live in a particular location versus the development and construction cost of the site. When present these net benefits are likely to be spread among developers, households and existing landowners. If absent, developers are unlikely to develop in the area as it is not commercially feasible, although lack of development can also reflect that some of the other costs such as physical and social infrastructure costs are borne by developers and ultimately home buyers.

Transformation benefits from an individual development consist of:

- gains to developers in profits in excess of the risks they take – producer surplus;
- gains to households from being able to buy a property that they prefer to others;
- and

³⁵ NSW Department of Planning 2010, *Sydney Towards 2036*, Metropolitan Strategy Review Key Stakeholders Forum, 9th April.

- gains to existing landholders if they can get higher prices for their land than the value of the land in its alternative use (or the 'reservation price' they put upon it).

The presence of net benefits to all three of these groups is what drives the development process. But the presence of net benefits to these groups does not necessarily mean that the development is *socially* beneficial, as there are other costs that need to be factored in, that are not accounted for or only partly accounted for in private decisions (through the imposition of levies etc). These other social costs are discussed below.

For a number of reasons, there may be a difference in the transformation benefits of development in different geographical areas. This may reflect local council and NSW Government planning policies and infrastructure provision and rigidities in markets - for example if price expectations of sellers only change after long lags.

Unlike physical and social infrastructure *costs*, estimating transformation *benefits* is difficult. This is because:

- these benefits are not directly observable;
- it is not feasible to undertake a commercial appraisal for every possible development site around Sydney, including finding the optimal type of development on that site; and
- the current pattern of development activity incorporates factors outside of the transformation value of a location to households and costs to developers. It includes developer levies, costs of the planning process and differences in infrastructure provision. These are unevenly applied across different areas making it difficult to discern where transformation value is high and low.

Previous studies have adopted different approaches to incorporating transformation benefits of different locations. Some studies have included and estimated some of the costs directly – for instance including costs of owning cars for fringe dwellings.³⁶ Including some private costs and benefits but not others is likely to bias estimates of the cost of different urban growth paths. For instance, including car costs but not considering the lower opportunity cost of undeveloped land at the fringe biases findings towards infill development rather than fringe development. Other studies have used more robust approaches, such as estimating transformation benefits by subtracting the cost of development and construction and opportunity cost of land

³⁶ For example, Trubka, Newman and Bilsborough 2008, *Assessing the costs of alternative development paths in Australian Cities*, Curtin University Sustainability Institute, for Parsons Brinkerhoff., incorporated costs related to car travel, while not including all the other costs and benefits of different locations.

from house prices in neighbouring areas.³⁷ Doing this involves discussions with real estate agents and developers. While conceptually robust, this approach has tended to be much simplified in practice due to data constraints.

The best approach is to use land value uplift attributable to rezoning. This is the approach used in this study, based on property value information provided by NSW Land and Property Management Authority. These estimates were backed up by discussions with developers and consideration of market conditions.

Summary

The framework used in this study combines the financial costs incurred by governments, and estimates of the social and environmental costs of new development with the estimated benefits attributable to developing in alternative locations. It aims to encompass all costs to provide strategic guidance as to the 'best' growth path for Sydney.

³⁷ Travers Morgan and Applied Economics 1991, *Housing Costs Study No. 2: Evaluation of fringe development and urban consolidation*, prepared under the Australian Building Research Grants Scheme.

PART 2

*The benefits and costs of
alternative growth paths*

5 *Overview of analysis*

Economic modelling of the social, economic and environmental costs and benefits of alternative growth paths requires information at a sufficiently detailed spatial level to address the relevant questions. It also requires that some assumptions be made as to the complementary investments for each scenario modelled. This chapter sets out an overview of the economic model and the basis for these inputs.

Overview of the model

The model developed for this project incorporates a detailed breakdown of the economic costs and benefits of the alternative growth strategies as discussed above. It allows estimation of the costs and benefits for any alternative path based on distribution of population by local government area and share in Greenfield and in existing areas.

Welfare measures

The best growth path can be measured using a number of indicators of welfare. These include, from the most inclusive to the least inclusive:

- net benefits relative to the 2005 Metropolitan Strategy – this is a measure of the transformation benefits less total costs of a growth path relative to a growth path that matches the 2005 Metropolitan Strategy; and
- total cost – this is a measure of all costs (social and financial) but does not include transformation benefits or costs. Transformation benefit or cost is the most uncertain of the estimated components of the model. This measure allows testing of whether conclusions change in the absence of transformation benefits.

All measures are reported in present value terms to 2010. This means that future values are discounted because future benefits and costs are weighted less highly than current benefits and costs. For the main analysis we use a discount rate of 7 per cent as per NSW Treasury Guidelines. In the sensitivity analysis we test impact of alternative discount rates.

Disaggregation

The model has been developed at a local government area level of disaggregation. This allows testing of the implications of sharing development in different ways

around these LGAs, as well as the share of Greenfield. Information is available in most categories at the LGA level. Costs and benefits related to education, fire, transformation and congestion and transport were estimated at a local government area. Costs of infrastructure provided by local councils were estimated for subregional areas. NSW Health advised that health infrastructure costs are not expected to vary much across scenarios because of the large catchments for health provision. Electricity capacity was estimated at the local government area but the costs of augmentation were estimated on an aggregated basis. Water and wastewater costs were only differentiated between Greenfield and existing areas. Some environmental costs were estimated at the local government area level, while others were only differentiated between Greenfield and existing area development.

Data at a smaller level of aggregation (such as suburb or centres) was not able to be provided. This means that it is not possible to address the implications at a smaller scale than the LGA. In many cases, smaller scales than this will not be relevant as infrastructure can be provided at a particular catchment level (such as fire, ambulance, health and education). For physical infrastructure, there will be changes from reallocating, most particularly for transport, for which highly localised congestion impacts can be important.

Timing of infrastructure expenditure

Infrastructure expenditure can be relatively lumpy, particularly for major transport projects. We have smoothed infrastructure spending to account for the ability to scale up and down infrastructure investment depending on projections of population. For example, sewerage treatment plants can be staged rather than put in at once and not all roads in a Growth Centre are required to be constructed up-front but are staged as part of the precinct plans.

Cost and value changes

There are a number of points at which major cost changes occur within each LGA and for Greenfield development that are included as assumptions in the model.

- When the Growth Centres' population targets are met, costs for the different infrastructure items change to reflect costs for Macarthur South. This typically means much more costly infrastructure.
- When capacity in existing infrastructure is used up in existing areas, costs increase from zero to the smoothed costs of upgrading infrastructure in that local government area.
- As development occurs within a local government area, the value of new dwellings declines slowly as people who place a lower value on the area locate

there and the costs rise, for example as major sites are used up.³⁸ These two factors mean that transformation benefits tend to be lower if more development has already occurred in an area.

- As development occurs within an area, congestion rises according to a non-linear relationship derived from analysis conducted by the NSW Bureau of Transport Statistics.³⁹ This relationship means that congestion costs increase more than proportionately to the increase in population.

Operating costs of utility services in infill versus the fringe

We have assumed that the operating costs associated with most utility services do not differ between the fringe and infill developments. In practice there may be some minor differences in operating costs. For physical infrastructure these could include higher maintenance expenditure because the network is larger due to an expansion to Greenfield areas, or higher maintenance expenditure because the existing network has greater use. The information is not available to quantify these differences although we expect that they would be small relative to the differences in capital expenditure.

In areas such as social infrastructure, there could also be differences in operating expenditures if social infrastructure had capacity. This would be the case if there were teachers teaching classrooms that were half full, for example. However, agencies can respond to need through changing these sorts of operating expenditures and hence we would not expect major differences between different scenarios.

The only area where we calculate operating costs is in fire services. In some instances, fire services could cope with additional population and incidents without any need for new buildings or new fire brigade teams, while in others new teams and buildings would be required. This reflects that a fire station is often required in areas where there are few incidents in order to be able to get to a potential incident within a short period of time.

Scenarios modeled

The modelling has been undertaken using three alternative growth paths. These include:

- the 2005 Metropolitan Strategy, which accommodate approximately 30 per cent of new people in Greenfield areas;

³⁸ This relationship may not be monotonic, meaning that beyond a certain point the marginal value of new dwellings may be negative.

³⁹ Bureau of Transport and Regional Economics 2007, 'Estimating urban traffic and congestion cost trends for Australian cities', Working Paper no. 71.

- accommodating 50 per cent of new people in Greenfield areas on Sydney's fringe;
- accommodating 10 per cent of new people in Greenfield areas on Sydney's; and
- an approximate least cost development strategy that resulted from analysis conducted as part of the project.

These scenarios are set out in more detail in chapter 3.

This study has not modeled the impacts of alternative population projections. Without a consideration of the benefits that arise from additional population it would not be possible to undertake meaningful analysis of these issues.

Complementary investments

A number of infrastructure investments have already been factored into plans such as the draft Metropolitan Transport Plan and capital expenditure plans of electricity companies. These investments provide additional capacity.

Different future growth paths would generate different paths for investment. For example, electricity companies are catering for expected growth when they put forward their capital expenditure plans to the Australian Energy Regulator. Changes in expected growth may shift the optimal investment strategy, even in the near term.

To deal with this we assume that differences in where dwellings are built do not emerge until 2016. That is, there is a common growth trajectory – the current one – until 2016. This reduces issues from near term capital expenditure plans.

Similarly, discussion with NSW Transport and Infrastructure indicated that the 10 year infrastructure plan would not be changed by the scenarios considered in this report, as the infrastructure could be supported on the basis of current demand alone. We discuss transport issues further in chapter 6.

There are also ways in which costs may be impacted through adaptation to growth, particularly to higher density. For example, use of public parks as school playgrounds at times of the day when parks are typically underutilised could reduce the average infrastructure costs of maintaining education services. There may be innovative ways to build higher density schools while maintaining the open space that parents and children value. The extent to which these types of innovation could change the financial and social costs of each scenario has not been factored into the analysis.

Employment

The location of centres of employment will be a central assumption for the transport costs of alternative growth paths. If employment is located closer to where people live then transport demand will be lower and costs associated with transport will

also be lower. Similarly, if more people work in jobs in which they can work from home, transport demand would also fall providing capacity (or lessening overcapacity) on transport networks.

It is difficult *ex ante* to identify how employment will respond to changing residential development and changes in land use regulation for commercial and industrial purposes. Horridge (1999) used a general equilibrium framework that incorporated employment changes in response to changes in urban development patterns.⁴⁰ This highlighted some of the longer run effects that should be considered in urban planning debates, such as the likelihood of businesses setting up in the fringe. It is not possible within this study to replicate the general equilibrium modelling of these effects. We take the approach of considering that travel patterns of new residents – including travel to work – will be similar to those of existing residents. This means that the spatial pattern of employment changes with each scenario, but not to the extent that might be considered if significant industrial changes occurred in response to changing location of labour.

Reporting of results

The rest of this section reports the analysis and findings for the costs and benefits for each growth path, according to the category of costs and benefits. The body of each chapter reports the underlying information and results are presented in a summary at the end of each chapter.

⁴⁰ Horridge, M. 1999, 'A General Equilibrium Model of Australia's Premier City', Centre of Policy Studies Preliminary Working Papers, no. IP-74.

6 *Transport*

Government provision of transport services includes roads, heavy rail, light rail, buses, ferries, cycleways and footpaths. Depending on the growth path, the types of transport that people use, the type of infrastructure that the NSW Government needs to invest in and the congestion costs associated with transport could all change. In addition to NSW Government costs, local councils also provide some transport infrastructure in local roads.

The costs of both transport infrastructure spending and congestion are large. The NSW Metropolitan Transport Plan expects transport infrastructure spending of \$50 billion in the next 10 years, mostly in Sydney. The Bureau of Transport and Regional Economics estimates congestion costs for Sydney of \$4.9 billion per year in 2010 rising to \$7.8 billion per year in 2020.⁴¹ However, many of these costs will occur regardless of Sydney's growth path.

There is no clear guide as to whether total transport costs (congestion and infrastructure) will be higher in a growth path focused on fringe or in existing areas. This was recently noted by Australian Treasury.

...greater population density and rising demand can eventually result in significant congestion costs. At a certain point, these costs will offset the benefits of the economies of scale.⁴²

This chapter sets out our approach for considering transport costs and estimates for each scenario.

Basis of approach

The approach that we have taken to transport costs, which is explained in detail in the sections below, is as follows.

⁴¹ Bureau of Transport and Regional Economics 2007, 'Estimating urban traffic and congestion cost trends for Australian cities', Working Paper no. 71.

⁴² Speech by Jim Murphy, Executive Director Markets Group, Australian Treasury, 'An overview of transport investment and government policy', *Urban Transport World Australia 2010*, Sydney, Tuesday, 23 February 2010.

- Existing transport patterns and travel times from the NSW Bureau of Transport Statistics' Strategic Travel Model suggest that people on Sydney's fringe face higher congestion costs in total and travel further.⁴³
- Any increase in population will lead to either higher congestion or require infrastructure expenditure or demand-side programs to mitigate congestion.
- Greenfield areas require connection to existing transport systems, such as roads and rail systems. We incorporate costs of connecting Greenfield areas to provide a similar level of provision as current areas within the same local government area.
- In the absence of expenditure on infrastructure, congestion and its costs will rise as population increases. This can be seen as capturing do nothing conditions. We estimate the costs of doing nothing for each scenario using a high level approach cross-checked against modelling undertaken by the NSW Bureau of Transport Statistics.
- Major transport infrastructure expenditure will mitigate some of the congestion costs that would arise under do nothing conditions.
 - Many transport infrastructure investments will occur under all scenarios that we consider. NSW Transport and Infrastructure has advised that the infrastructure projects for the next 10 years set out in the Metropolitan Transport Plan would occur under each scenario.
 - Transport infrastructure projects will mitigate congestion costs, although the magnitude of this is unclear.
 - Infrastructure may be more or less effective in avoiding congestion depending on the scenario. This will reflect economies of scale in transport and the planning for transport changes across Sydney.
 - We allow for each dollar of infrastructure to mitigate two dollars of congestion costs for each scenario. This is a conservative estimate relative to publicly available economic appraisals discussed further below. We do not vary the efficacy of infrastructure by scenario given the absence of information on which to form plausible estimates.

Existing transport patterns

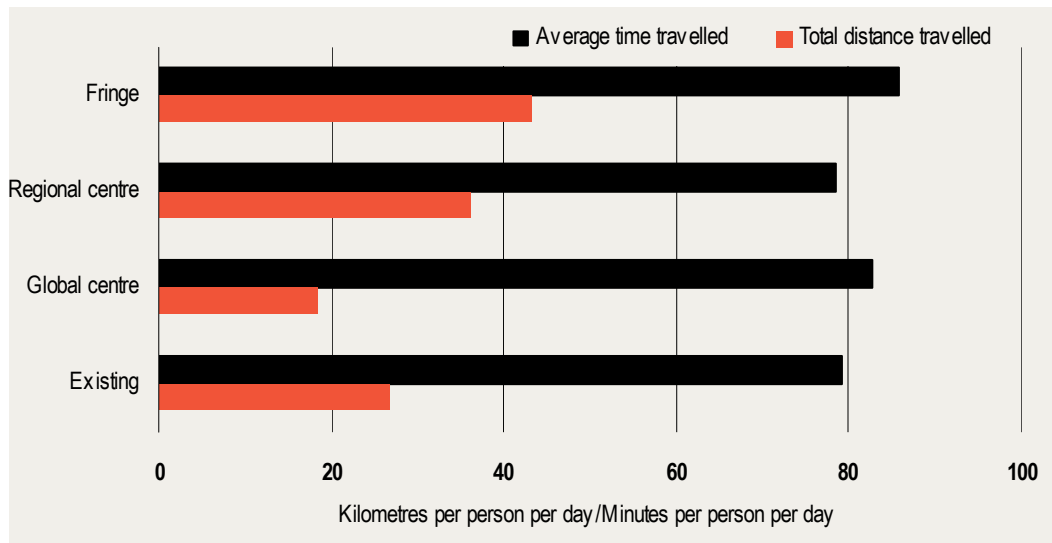
Patterns of transport use vary across Sydney in ways that are expected, given the availability of transport options and time costs of travel. People living further from the CBD tend to travel further on average than those close to the CBD (chart 6.1). However, travel times are relatively similar across different regions, as people who

⁴³ The Strategic Travel model is a zone level transport model operated by the NSW Bureau of Transport Statistics, which is designed for the evaluation of transport policy and planning options.

face lower time costs of travel choose to travel further, and people on the fringe typically travel on less congested roads and walk less.

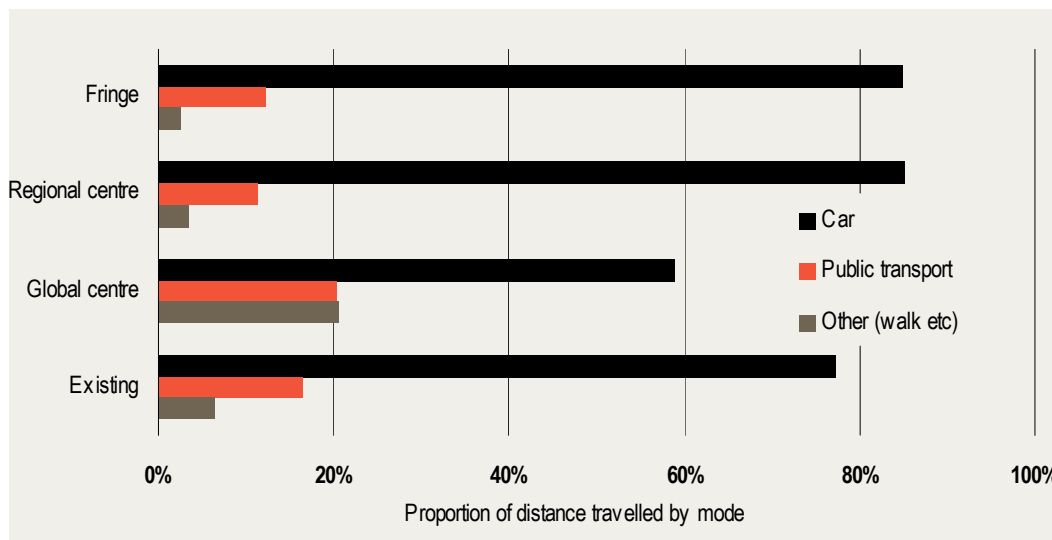
Mode shares also follow the pattern that would be expected given transport availability, with greater use of cars for areas further from the CBD (chart 6.2). However, in all LGAs, the vast majority of the distance travelled is by car.

6.1 Current average daily transport patterns in Sydney’s regions 2008



Note: Fringe is defined as Camden, Campbelltown and Baulkham Hills. Regional centres are Parramatta, Penrith and Liverpool. Global centres are Sydney and North Sydney and Existing is all other current areas.
 Data sources: 2008 Household Travel Survey, Key Transport Indicators by Local Government Area of Residence (LGA) by Subregion, 2008 data provided by Transport Data Centre.

6.2 Mode shares in Sydney’s regions 2008



Note: Fringe is defined as Camden, Campbelltown and Baulkham Hills. Regional centres are Parramatta, Penrith and Liverpool. Global centres are Sydney and North Sydney and Existing is all other current areas.
 Data sources: 2008 Household Travel Survey, Key Transport Indicators by Local Government Area of Residence (LGA) by Subregion, 2008 data provided by Transport Data Centre.

The most obvious congestion in transport systems occurs during peak periods and for trips to work, particularly to the CBD. Across Sydney in 2006, a quarter of journeys to work began and finished in the same statistical local area, about a quarter finished in the Sydney local government area (which includes the CBD) and the rest involved travel between other statistical local areas. For fringe areas, more of the journeys to work stayed within the same statistical local area (29 per cent), while less finished in the Sydney LGA (7 per cent).

For future fringe areas, the transport patterns for work journeys will depend on where employment is located. The share of employment that occurs locally could also change through time as businesses take advantage of better availability of labour on the fringe. It is likely that these patterns would be similar to those in other fringe areas, although this would also depend on transport availability. Travel patterns in existing areas on Sydney's fringe (and the rest of Sydney) are shown in table 6.3.

6.3 Destinations for journeys from existing fringe areas

Statistical local area	No. of trips/day	Sydney					
		Own SLA	LGA	Liverpool	Parramatta	Penrith	Other ^a
	no.	%	%	%	%	%	%
Baulkham Hills – North	26 333	19	7	1	8	1	10
Camden	24 631	28	6	9	2	1	12
Campbelltown – South	30 736	26	9	8	3	1	12
Hawkesbury	29 575	47	3	1	4	7	12
Hornsby – North	33 330	19	13	0	4	0	9
Penrith – West	39 289	32	6	1	7	43	12
Wollondilly	19 301	30	3	6	2	4	16
Rest of Sydney	1 559 979	21	21	3	5	2	11

^a Other includes outside Sydney, no fixed address, no stated and NSW undefined.
Source: Transport Data Centre (2006), Journey to Work dataset.

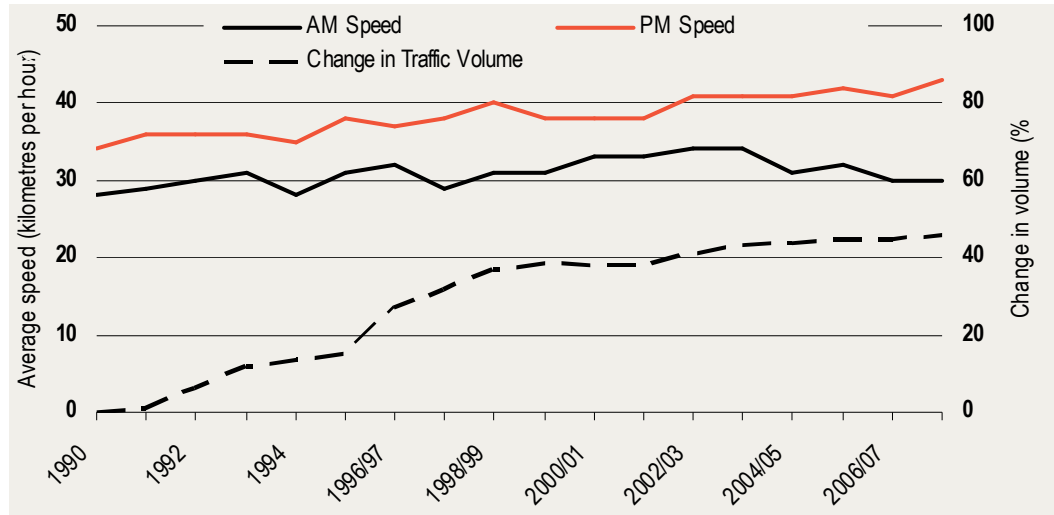
Capacity in Sydney's transport network

For commuter travel in Sydney, most roads into major employment centres are congested during peak times. This means that additional population growth in most areas is likely to lead to greater congestion, although there are varying levels of congestion costs for locating people and employment in different areas.

Average speeds during peak times for major routes into Sydney's CBD have remained relatively constant since 1990 for AM times and have risen for PM times despite a 46 per cent increase in volumes (chart 6.4). This suggests that either road infrastructure has increased as much as demand for road travel or that people substitute away from roads that drop below threshold speeds (either to public transport, to different times of day or to alternative journeys). There are differences in speeds for different roads, with average speeds ranging from 24 kilometres per

hour to 35 kilometres per hour for the morning peak across the seven routes reported by the RTA.⁴⁴

6.4 Average speeds into Sydney’s CBD on major routes



^a Covers 7 major routes into Sydney’s CBD — Princes Highway; F3, Pacific Highway, Gore Hill Freeway, Sydney Harbour Bridge; M4, Parramatta Road, City West Link; Victoria Road; M5, Southern Cross Drive, Eastern Distributor; M2, Lane Cove Tunnel, Gore Hill Freeway and Sydney Harbour Tunnel; Pittwater, Spit and Military Roads, Warringah Freeway, Harbour Tunnel.
 Data source: Roads and Traffic Authority.

For public transport services, there are areas where there is additional capacity, although mostly outside of peak times. Nearly all city train services are fully loaded during peak times, reaching more than 120 per cent of seating capacity (chart 6.5). This data hides some complexities as slow trains may not be full while fast trains are over-capacity.

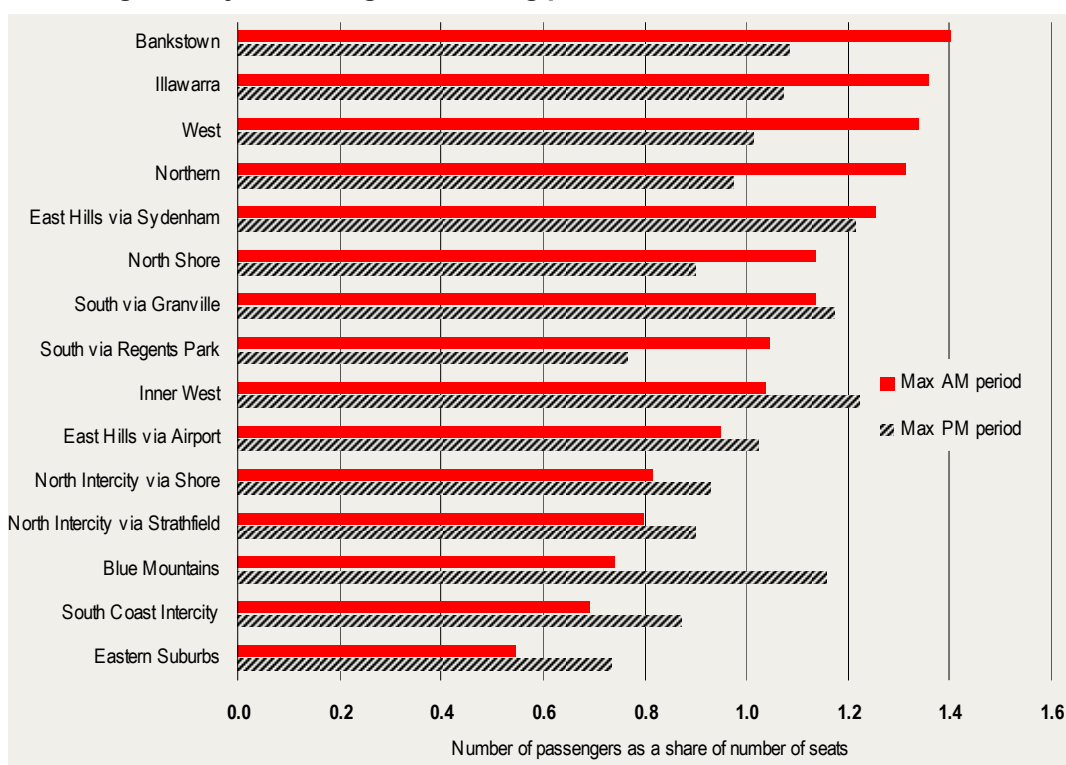
There are few areas where there is significant spare capacity on trains in existing areas. The Eastern Suburbs line is the exception, with trains only 50 per cent to 70 per cent full reflecting that the line captures only 3 residential stations (Kings Cross, Edgecliff and Bondi Junction). Other lines with capacity are intercity lines.

There may also be some ability to adjust the timetable to accommodate more trains, particularly once projects such as rail clearways are completed, providing additional capacity.⁴⁵

⁴⁴ RTA, Travel speeds in the Sydney Metropolitan Area.

⁴⁵ CityRail, <http://www.cityrail.info/news/projects/clearways/>, Accessed 23 February 2010.

6.5 Usage of CityRail during the morning peak



^a Peak period measured for each line can be slightly different. Typically AM peak is 6.00 am to 9.30 am and PM peak is 3.00 p.m. to 7.00 p.m. The maximum is the maximum passengers to seating capacity across half hourly periods within the peak times.

Data source: CityRail, October 2009 Survey.

Costs of transport infrastructure

Transport infrastructure is expensive. Projects in the draft Metropolitan Transport Plan are budgeted for \$50 billion over the next 10 years. This includes funding of major projects such as new rail extensions, as well as upgrades of roads around growth centres. More development on Sydney's fringe would require greater transport infrastructure spending, as people in fringe areas travel further on average.

For a given growth path, there are many different possible expenditure levels on transport infrastructure. The optimal amount of expenditure balances congestion costs and infrastructure costs. It is beyond the scope of this report to analyse multiple patterns of projects to determine optimal expenditure.

NSW Transport and Infrastructure expects that all of the spending commitments in the Draft Metropolitan Transport Plan would be undertaken regardless of the scenario. This is not surprising as the scenarios only diverge in 2016 and there is significant demand for these transport improvements now without considering future demand. Beyond the 10 year horizon the set of projects and their timing would change.

Due to information limitations, rather than factoring in changes in major transport infrastructure, we instead consider changes in congestion were there to be no investment in additional transport infrastructure. Both congestion and infrastructure spending will be linked to transport demand. However, congestion costs likely overstate the transport costs relative to the infrastructure spending that would alleviate these congestion costs.

Our method requires estimates of transport infrastructure costs in Greenfield areas, to give these areas a similar level of service as the LGA in which they sit. These estimates are considered below.

Cost of connecting Greenfield areas

The cost of putting in transport infrastructure in fringe areas was considered as part of assessing the level of the State Infrastructure Contribution. For this, road costs of fringe development were estimated at \$2.9 billion for the North West and South West Growth Centres in 2008 to provide for 12 thousand hectares of net developable area (or 160 000 dwellings at the time).⁴⁶ This amounts to costs for land and construction of major roads within these fringe development areas of \$18 000 per dwelling.

In addition to road costs, there were rail costs and bus costs to provide public transport to these areas. These were calculated at \$1.1 billion for rail and \$0.4 billion for buses, or \$9000 per dwelling (combined).

If additional growth areas were required road costs could be higher, such as in Macarthur South. Previous rough estimates of the total transport costs of Macarthur South are in the order of 150 per cent higher on a per dwelling basis than those in the North West and South West.⁴⁷

Congestion costs with no major additional infrastructure

The cost of doing nothing in transport infrastructure is higher congestion costs. Congestion costs include longer times for people to undertake their journeys, switching journeys to less preferred but closer destinations, business costs associated with slower movement of goods and people, additional air pollution and additional fuel use. The Bureau of Infrastructure, Transport and Regional Economics (BITRE)

⁴⁶ Growth Centres Commission 2008, Special Infrastructure Contribution practice note, November 2008.

⁴⁷ Extracts from consultant study of Macarthur South based on agency costing provided by NSW Planning.

estimates that the avoidable congestion costs in Sydney will be \$4.9 billion in 2010, rising to \$7.8 billion in 2020.⁴⁸

The congestion effects of different growth paths are complex. More people on the fringe is likely to mean more travel (in terms of distance) but also more roads available for travel and a greater share of travel in less congested areas. Whether accommodating people on the fringe has greater congestion costs than accommodating people in existing areas will be dependent on employment patterns as well, particularly whether businesses relocate to fringe areas.

There are a number of approaches to modelling the congestion costs associated with alternative growth paths:

- **Aggregate modelling.** Aggregate modelling involves estimating relationships between volume, capacity and time of travel at a Sydney-wide level and then applying value of time, fuel use and air pollution estimates to these relationships. This is the approach used in the BITRE's estimates.
- **Detailed spatial modelling.** Detailed modelling involves considering a detailed spatial model of transport choices, population and employment. This modelling allows better consideration of transport bottlenecks and specific areas where congestion is high.

These methods have advantages and disadvantages. For the purposes of a strategic exercise, as is conducted in this paper, the first is simpler and more easily applicable to alternative scenarios. Using this method, transport infrastructure changes cannot be readily considered. Aggregate modelling may not be as accurate as a detailed modelling exercise because of transport bottlenecks and specific points of congestion. Detailed modelling has high information and resource requirements, particularly if a large number of possible scenarios and time points are to be considered.

An alternative hybrid approach is to consider modelling at the local government area level. Under this approach, congestion costs are estimated for people travelling from each LGA now and then scaled up using the number of additional people moving to the LGA and the relationship between congestion costs and volume. This is the approach used for this study and set out in detail in attachment C. As a cross check on this approach, the NSW Bureau of Transport Statistics has undertaken detailed modelling of congestion in 2036 for the scenario reflecting the Metropolitan Strategy and the 50/50 scenario. These results are presented later in this chapter.

Currently, congestion is estimated to be highest in fringe areas. The average delay across Sydney per day for road use (including car drives, car passengers and bus

⁴⁸ Bureau of Transport and Regional Economics 2007, 'Estimating urban traffic and congestion cost trends for Australian cities', Working Paper no. 71. Avoidable costs of congestion are dead weight losses of doing nothing relative the socially optimal level of congestion.

users) is around 8 minutes per person. There is wide variation around this with people in some LGAs facing average delays of twice this amount and others of less than half. Table 6.6 sets out some of the highest and lowest delay local government areas. Part of these delay statistics reflect that people close to the CBD have adjusted their transport mode to avoid congestion, such as walking or using rail rather than road.

6.6 Average delays for road use

<i>Low delay LGAs</i>		<i>High delay LGAs</i>	
<i>LGA</i>	<i>Average delay</i>	<i>LGA</i>	<i>Average delay</i>
	minutes/person/day		minutes/person/day
Sydney	3.2	Sutherland Shire	13.9
Marrickville	3.8	Camden	12.4
Randwick	3.8	Baulkham Hills	11.8
Woollahra	3.8	Hornsby	11.0
Waverley	4.0	Campbelltown	10.6

Note: Estimates are for the entire population, which includes people who undertake no travel.

Source: The CIE adjusted estimates based on information provided by NSW Transport Data Centre.

The relationship between transport demand and congestion is non-linear. The first 10 per cent increase in transport demand might lead to congestion costs rising by \$1 billion, while the next 10 per cent increase would lead to costs rising by slightly more. At an aggregate level for Sydney, the Bureau of Transport and Regional Economics considers that a 10 per cent increase in vehicle kilometers travelled would increase congestion costs by 26 per cent.⁴⁹ A better measure that links population growth and congested time, defined as time lost due to congested roads, is available from the modelling conducted by the NSW Bureau of Transport Statistics for this report. Their modelling finds that a 31 per cent population increase from 2011 to 2036 would likely increase the amount of congested time by around 50-60 per cent, depending on where the population is accommodated and the spatial distribution of employment and allowing for some increase in infrastructure. We apply a scaling up factor of 1.8 based on this analysis.

Our estimate of congestion costs is calculated as follows.

- The Bureau of Transport and Regional Economics estimate of the avoidable costs of congestion for 2006 (\$4.0 billion) is allocated to Sydney's 43 LGAs according to congested time estimates from the Strategic Transport Model.
- For each LGA, congestion costs rise as more people live in the LGA. For a 10 per cent increase in population within the LGA, congestion costs rise by 18 per cent, as discussed above.

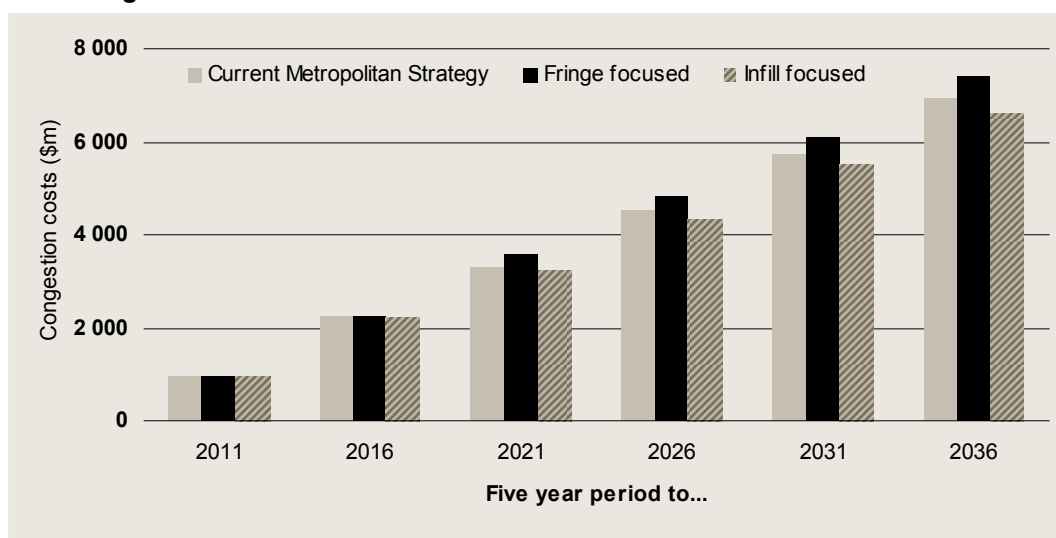
⁴⁹ Bureau of Transport and Regional Economics 2007, 'Estimating urban traffic and congestion cost trends for Australian cities', Working Paper no. 71.

- The congestion costs for each scenario at each point in time are the sum of congestion costs across each LGA relative to congestion costs in 2006.

Implicit in this approach is that future employment patterns for people living within each LGA remain fairly similar. For example if 10 per cent of employed people from Campbelltown work in Sydney's CBD at the moment then 10 per cent of additional people in Campbelltown will also work in Sydney's CBD.

Using this approach, the congestion costs under each scenario are shown in chart 6.7. Congestion costs are estimated to be higher for the fringe focused scenario. This reflects that people in these areas tend to travel further and currently face longer travel delays on average. A large part of these delays reflects journeys into Sydney's CBD.

6.7 Congestion costs relative to 2006 under each scenario



Data source: The CIE calculations as set out within the report.

Infrastructure and avoided congestion costs

Actual congestion costs will not be as high as under do nothing conditions. Transport infrastructure investment can mitigate some of the congestion costs, although at financial cost.

The Metropolitan Transport Plan sets out a draft of the transport projects that would occur in Sydney (and NSW) over the next 10 years (box 6.8). NSW Transport and Infrastructure has indicated that these projects would likely be undertaken under any scenario.

We do not have infrastructure lists beyond this timeframe or in addition to the Metropolitan Transport Plan for each scenario that have been based on sound assessment of the social costs and benefits of each transport infrastructure project.

6.8 Metropolitan Transport Plan

The NSW Metropolitan Transport Plan was released in early 2010. It sets out projects that will be funded over the next 10 years to align with the dwelling and employment targets set out in the Metropolitan Strategy. Some of the key commitments in the next 10 years include:

- extra line extensions for more platforms at busy CBD stations, delivering more trains and faster services for Western Sydney;
- an expanded rail system to South West Sydney and commencement of construction of the North West Rail Link;
- light rail in the CBD and a further extension to the Inner West;
- more air conditioned train carriages;
- a thousand extra buses;
- completion of the 43 strategic bus corridors across Sydney; and
- completion of the highest priority missing links in the Sydney Strategic Cycleway Network.

In total, these commitments are budgeted to cost \$50 billion over the next 10 years.

Data source: http://www.nsw.gov.au/sites/default/files/uploads/common/5_MTP_10YearFunding_A.pdf.

The do nothing conditions are an upper bound to the transport costs of each scenario, as transport infrastructure projects should only occur if they have greater benefits than they cost to undertake, of which avoided congestion is a major benefit. The extent to which do nothing conditions overstate costs will depend on the effectiveness of transport infrastructure projects. Some projects might achieve benefit cost ratios of 2 and higher. For example, various options for the Eastern Distributor had an expected benefit cost ratio of 1.7 to 4.5,⁵⁰ while studies of road and transport networks in Sydney and Melbourne have found benefit–cost ratios sometimes higher than this (table 6.9).

6.9 Estimates of the benefit cost ratios from transport infrastructure

Project	Benefit–cost ratio (no.)	Source
Eastern Distributor (Sydney)	1.7–4.5	NSW Roads and Traffic Authority (1998)
Sydney's toll road network	3.4	Ernst & Young (2008)
Victorian Transport Plan	9.9	Ernst & Young (2010)

Source: Roads and Traffic Authority (1998), Eastern Distributor: summary of contracts, September; Ernst & Young (2008), *The economic contribution of Sydney's toll roads to NSW and Australia*, prepared for Transurban, July; Ernst & Young (2010), *Economic contribution of the Victorian Transport Plan*, prepared for Victorian Department of Transport, February.

⁵⁰ Roads and Traffic Authority 1998, Eastern Distributor: summary of contracts, September.

We take a more conservative position than these publicly available studies, based on do nothing costs being able to be halved through infrastructure provision. This is equivalent to a benefit cost ratio of two for infrastructure that maintained congestion at current levels. It has the effect of halving the congestion costs shown in chart 6.7.

It is unclear whether infrastructure is likely to be more or less effective in mitigating congestion costs *under each scenario*. For example, if there were continuing economies of scale in transport, and existing corridors could be used, then a scenario that involved denser development in existing areas would be more effective at reducing congestion per dollar spent. There is not sufficient information to allow for this possibility so we use the same effectiveness of transport infrastructure for each scenario. Further investigation of economies of scale in transport provision would be useful in reconsidering Sydney's growth path in the future.

Detailed modelling of congestion costs

To ensure that the approach above is broadly in line with detailed modelling of congestion, the NSW Bureau of Transport Statistics undertook modelling using the Sydney Strategic Transport Model. This modelling estimated vehicle kilometres travelled, time travelled and congested time across the Sydney Greater Metropolitan Area in 2036 under the scenario reflecting the 2005 Metropolitan Strategy and the scenario capturing a fringe focused growth path. As part of undertaking the modelling, employment scenarios for the two growth paths were specified. The modelling incorporated infrastructure as set out in the Metropolitan Transport Plan but no additional infrastructure.

The detailed modelling broadly aligns with the findings set out above. The amount of delay caused by congestion is expected to be higher under a fringe focused scenario than under continuation of the 2005 Metropolitan Strategy. The additional congestion from now to 2036 is expected to be 2.2 per cent higher in 2036 (table 6.10). Congested time is expected to rise faster than population growth in the absence of additional infrastructure beyond that set out in the Metropolitan Transport Plan. Congestion time rises by about 58 per cent between 2011 and 2036, while population growth over this period is 31 per cent.

The detailed modelling has smaller estimates of the difference between the two scenarios than the main approach used in this report. Over the period to 2036, the main approach has additional congestion costs from the fringe focused scenario as 4.9 per cent higher than additional congestion costs from the continuation of the 2005 Metropolitan Strategy. In 2036 the divergence between the scenarios is larger, at 7.1 per cent.

6.10 Detailed modelling of scenarios daily totals

	2011	2036		Difference (%)
		2005 Metropolitan Strategy	Fringe focused	
Vehicle kilometres travelled (km)	112 041 000	140 823 000	142 680 000	1.3
Travel time (hours)	3 087 000	4 150 000	4 187 000	0.9
Congested time (hours)	499 000	786 000	793 000	0.8
Difference to 2011 (%)				
Vehicle kilometres travelled		25.7	27.3	6.5
Travel time		34.5	35.6	3.4
Congested time		57.5	58.8	2.2

Source: NSW Bureau of Transport Statistics.

The differences between the detailed transport modelling and the main approach are likely to reflect the more dispersed employment assumptions that underpin the detailed modelling relative to those implicit in the main approach used to consider congestion costs. The detailed modelling assumes that a shift towards a fringe focused residential scenario is associated with substantial changes in the pattern of employment, with employment relocating to the Central West, North West and South West. The main approach also incorporates shifts in employment but not to the degree captured in the detailed modelling, reflecting that the most significant population movements between scenarios are between the Central West and Growth Centres.

Summary

Transport costs are higher for Greenfield development than for existing areas. This reflects transport costs to connect new areas into Sydney's transport systems and higher congestion or major infrastructure costs to mitigate congestion for people on Sydney's fringe, particularly those seeking employment in the CBD and inner Sydney.

For our scenarios, transport related costs are \$2.3 billion higher to 2036 for the 50/50 scenario relative to the 2005 Metropolitan Strategy (table 6.11). Transport costs are \$1.3 billion lower under the 90/10 scenario relative to the 2005 Metropolitan Strategy.

There are limitations in setting out these figures. These include the extent to which economies of scale (or diseconomies of scale) could lead to differences in the ability of infrastructure to mitigate congestion in the different growth strategies, the uncertainty related to employment projections which are an important driver of the costs of congestion and the ability of demand management strategies (including pricing) to cheaply mitigate congestion costs.

6.11 Transport infrastructure costs associated with each scenario

<i>Cost item</i>	<i>Metropolitan Strategy</i>	<i>Focused on fringe/Greenfield</i>	<i>Focused on urban renewal</i>	<i>Deviations from Metropolitan Strategy</i>	
Ratio – Infill / Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
Connection of Greenfield	2 446	4 235	1 382	1 789	-1 065
Transport infrastructure/ congestion	11 057	11 599	10 786	542	-271
Total	13 503	15 835	12 167	2 331	-1 336
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
Connection of Greenfield	5 422	9 387	3 062	3 965	-2 360
Transport infrastructure/ congestion	24 506	25 708	23 904	1 202	-602
Total	29 928	35 095	26 966	5 167	-2 961

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

7 *Physical infrastructure*

Physical infrastructure includes roads, rail and other transport (discussed earlier), water and sewerage, electricity, gas and telecommunications. Population growth requires additional infrastructure for service standards to be maintained.

The cost of physical infrastructure arising out of alternative growth paths will reflect the extent of capacity in existing areas and the costs of upgrading in Greenfield versus Brownfield areas once capacity constraints are met. In most physical infrastructure categories, there is currently limited capacity (and significant expenditures on new capacity are occurring), reducing the cost differential between Greenfield and Brownfield.

Electricity networks

As an essential service, all dwellings constructed in NSW are connected to the electricity network. The costs of connection and augmentation are divided across developers and the electricity businesses. Developers will pay costs directly attributable to them, while broader augmentation costs will often be borne by the entire customer base, incorporated through distribution and transmission regulated prices.

Electricity use

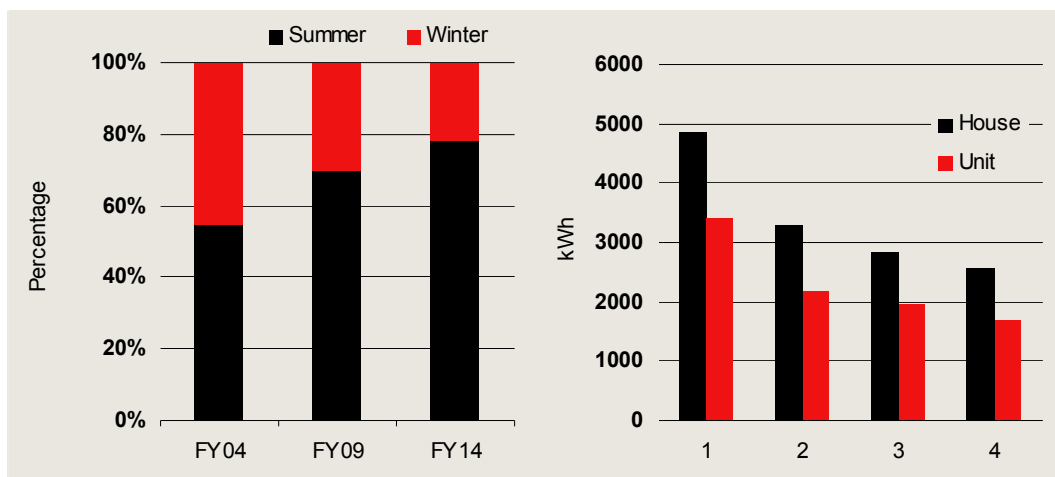
Electricity use is expected to rise in Sydney because of both population growth and higher per capita electricity use. In terms of the electricity network, the major driver of the need for capacity expansion is peak load electricity requirements – that is, the maximum amount of electricity required at any one time. As the use of air conditioners has increased, peak energy demand has shifted towards summer across many areas of Sydney, rather than the original winter peak demand from heating requirements (chart 7.1). This trend is expected to continue.

Alternative growth paths will impact on the total demand for electricity and peak demand for electricity through a number of channels:

- development further from the coast will have a greater impact on peak electricity load requirements as these areas are hotter and likely to have a high uptake of air conditioning; and

- lower density development will likely generate higher electricity use if current patterns of per capita electricity use continue. Chart 7.1 illustrates this for households with different number of occupants.

7.1 Characteristics of electricity use



Note: Proportion of summer and winter is proportion of substations for which peak occurs in winter and in summer.

Data sources: Energy Australia Regulatory Proposal (2008); IPART household survey (2006), p. 11.

Both these factors suggest that electricity use will be higher for a development scenario with more people in Greenfield areas on Sydney's fringe.

The transportation network also has significant electricity demand and this is likely to differ between the different scenarios. The rail network and road tunnels such as the potential M4 tunnel have significant electricity requirements.

In general it is expected that the electricity demands of the transport and rail networks would be higher where a development scenario results in greater distances required to be travelled by road or rail. This is more likely to be the case for a development scenario that accommodates more people in Greenfield areas on Sydney's fringe. Although this would depend on a range of other factors such as the extent of employment that shifts to the fringe areas and whether households that move to fringe areas adjust their travel patterns.

Many of the costs associated with these electricity demand patterns are met privately and factored into people's decisions about where to live. As such, they are included in our estimation of transformation benefits and should not be double counted here. It is possible that people are not fully factoring in future changes in temperature that may arise from climate change. These changes could reduce people's willingness to live out in the Growth Centres or increase their costs of doing so.

Costs of electricity infrastructure

The costs that are not factored into people's decisions are additional infrastructure costs related to new development that are borne by all electricity users. The costs

required to upgrade network infrastructure to meet future demand in electricity due to population growth is dependent on a range of factors such as:

- the extent of spare capacity in the existing network and when full capacity will be reached; and
- the costs of upgrading the network in the particular area.

The two main electricity distribution network service providers (DNSP) in metropolitan Sydney are Energy Australia and Integral Energy. Energy Australia's network covers the majority of the inner city, eastern and northern areas of the Sydney metropolitan region and Integral Energy's network covers the western and southern areas, including both the North West and South West growth centres.

Such a division of location also divides the responsibility, while not perfectly, quite closely, across infill and fringe developments. The majority of Energy Australia's capital expenditure work is focused on maintenance, renewal and augmentation of existing infrastructure, while Integral Energy is more heavily (although not exclusively) involved in the development of capacity to service Greenfield and fringe developments.

Excess capacity

There are significant differences in the extent of excess capacity in the electricity infrastructure network throughout Sydney. The differences can be at a suburb level or at higher levels of spatial aggregation. For example, in many of the suburbs identified in the Eastern Suburbs Area Strategy, capacity constraints are only reached in 2024. The exception to this is in Rose Bay where capacity constraints were anticipated to be reached by winter 2007.⁵¹

In contrast, in the St George area in 2007-08 there was limited excess capacity in all the suburbs except Rockdale which is expected to reach capacity by winter 2012.⁵² Full capacity has also been reached in most of Integral Energy's areas of operation.

In Energy Australia's area of operation, however, there are some differences between suburbs as to when full capacity is expected to be reached. Table 7.2 provides an indication of when the capacity is expected to be reached across the different regions in Energy Australia's area of operation. While the data presents the aggregation of capacity across all suburbs in the region, capacity constraints may be reached earlier or later for some suburbs within these regions.

⁵¹ Energy Australia 2008, *Area Strategy, Eastern Suburbs*, February.

⁵² Energy Australia 2008, *Area Strategy, St George*, February. Additional capacity has now been commissioned in the area.

7.2 Timeframe for reaching full capacity — Energy Australia

<i>Regions</i>	<i>Full capacity reached</i>
Eastern Suburbs	2024-25
Inner West	2014-15
Canterbury Bankstown	2015-16
Carlingford	2019-20
Lower North Shore	2024-25
Upper North Shore	2011-12
North West Sydney	2024-25
Manly Warringah	2014-15
St George	2006-07
Pittwater	2021-22
Sutherland	2013-14
Sydney CBD	2014-15

Note: Capacity timeframes are under population scenarios from 2006, which are significantly below current population forecasts.
Source: Energy Australia Area Strategies.

The data presented in the table above is based on the 2006 population forecasts that are embedded in the Area Strategy documents for each of these areas. We have adjusted this to take account of the revised population forecasts provided by NSW Department of Planning for this project. This indicates that in all regions throughout Sydney, full capacity will be reached by 2015-16 (assuming all other factors remain unchanged), reflecting much higher population growth forecasts.

Cost of upgrading network infrastructure

Given that full capacity is expected to be reached by 2015-16 the differences in electricity infrastructure costs between the alternative scenarios only reflects the costs beyond that date of upgrading the existing infrastructure or providing new infrastructure to meet the population forecasts in that area under the alternative scenarios.

There is limited specific information that we have been able to obtain regarding the costs of infrastructure provision to meet population growth in each area. Given this we have relied on estimated average cost of providing new infrastructure. This cost is applied equally across all suburbs and does not take account of any site specific characteristics of each area that may influence the costs.⁵³

We have based our estimate of the cost of infrastructure upgrades using data provided by Energy Australia. We have used the infrastructure upgrade costs in the St George Area Strategy, given that this area has already reached full capacity and, therefore, a large proportion of the future costs relate to upgrades to meet future

⁵³ At a later stage NSW Department of Planning could seek more detailed cost estimates from Energy Australia and Integral Energy to conduct separate analysis in regards to the specific infrastructure costs of meeting alternative scenarios. However, this would require detailed analysis that is beyond the scope of this project.

demand growth. The costs presented in the Area Strategy for St George are \$207 million (in net present value terms) for the capital and operating expenditure for major capital works projects from 2006 to 2024.⁵⁴ This equates to approximately \$25 526 per dwelling.⁵⁵

This figure includes costs related to maintenance and increases in future demand that are not directly attributable to population growth. Energy Australia advises that approximately 30 per cent of these costs can be attributed to demand growth (due to population growth and increases in per capita use).⁵⁶ We have incorporated this cost into the modelling.

As noted above, a growth path that places more households in Greenfield areas would have higher costs due to the higher peak demand (compared to average demand) in the inland areas. We have not been able to obtain information that would allow us to distinguish the cost 'premium' that would result due to the higher peak demand in Greenfield areas.

On the other hand, upgrading in infill areas can be more expensive due to the higher costs of working with underground assets and the higher land costs in the instance where upgrades to assets such as zone substations may be required. Energy Australia and Integral Energy have indicated that the cost of upgrading assets in infill areas is in the order of 1.5 times higher compared with Greenfield areas. However, infill areas are likely to require less extensive upgrades than the requirements for Greenfield areas.

We have no information that would allow us to calculate the net impact of differences in costs between infill and Greenfield areas attributed to differences in peak demand, the cost of upgrading infrastructure (if it were to occur) and the chance of requiring infrastructure upgrades. Given this, we have assumed that the cost of upgrading network infrastructure is the same between Greenfield and infill areas, although we also conduct sensitivity testing this assumption.

⁵⁴ This is based on a real discount rate of 8.5 per cent. For our analysis, we have converted the costs to a net present value calculation based on a 7 per cent real discount rate (consistent with other cost items).

⁵⁵ While the \$207 million relates to expenditure between 2006 to 2024, equating to approximately \$11 million per annum. The average life of the new assets is around 45 years and will, therefore, provide benefits beyond the 2024. Further, these costs are based on conventional technologies and approaches to service provision. Energy Australia does investigate and promote demand management and non-network options which could result in lower cost options. However, this information is not available for our modelling as it would require detailed analysis of options at the time when alternative infrastructure are being commissioned.

⁵⁶ Energy Australia does not separately collect data on costs attributable to different factors of demand growth.

Gas networks

Gas is not considered an essential service and as such it is not required to be connected to Greenfield or infill developments. Therefore, gas supply networks and developments are dealt with on an as needs basis with Jemena, the gas distribution network provider in Sydney, working closely with land developers to identify developments with sufficient demand for gas connections as well as to plan infrastructure investments.

Gas infrastructure costs are typically borne by developers and hence passed on to buyers of lots or dwellings and are therefore part of the private decision rather than social costs.

Water and wastewater services

As an essential service, all dwellings constructed in Sydney are connected to the water and wastewater networks. The costs of connection and augmentation are typically divided between the developers and Sydney Water. Developers will pay costs directly attributable to them, while broader augmentation costs are borne by the entire customer base, incorporated through regulated prices.⁵⁷

Greenfields Provision of water and wastewater infrastructure

The key Greenfields site currently being considered within Sydney Water's area of operation are the North-West and South-West Growth Centres as well as in the West Dapto Development Area. Sydney Water has developed servicing strategies for these areas.

The provision of the infrastructure typically involves a coordinated approach between all the different utility services. Typically the major water underground assets are located next to the roads that are constructed as part of the development phase. However, major sewer underground assets are generally located at low points (maximising gravity flow), typically along creek and drainage lines. In the case of the North-West and South West Growth areas, the rollout of infrastructure is coordinated by NSW Department of Planning through what was the Growth Centres Commission.

The optimal roll-out of the infrastructure may vary between each of the utility infrastructure services. Therefore, the strategy adopted by the Growth Centres Commission for the rollout of the infrastructure may not be the optimal rollout strategy for each of the infrastructure components.

⁵⁷ In the past a 'developer charge' applied for new developments in Sydney. Currently a developer charge only applies for costs associated with the recycled water network.

Sequencing of infrastructure in different areas is as follows.

- As a general rule, for buried water assets, it is optimal for the assets to be 'installed' in conjunction with the other assets such as roads, rather than seeking to install the assets in a piecemeal manner. Major sewer underground assets can generally be located along creek and drainage lines. Therefore, the buried assets are typically constructed to meet the final capacity of the development.
- Other assets such as Sewage Treatment Plants (STPs) can be constructed to some extent in a modularised fashion with the capacity of these assets being increased in line with the growth in the development. This reduces Sydney Water's exposure to patronage risk (that is, the planned growth does not eventuate). Another benefit is that it allows Sydney Water to adapt to changing technologies such as more energy efficient sewage treatment technology.
- The commencement of the rollout of the infrastructure in these areas is dependent on NSW Department of Planning's timetable. It can also be influenced by developer's timetables. Similarly, the preferences of developers do not impact on the sequencing strategy adopted by the utility.

The construction of assets for a precinct release area in the New Growth Centres is anticipated to take approximately two years. This is part of the planning phase (including Environmental Assessments) that in total may take five years from the time of land release.

Cost differentials between infill and Greenfield areas

The costs to upgrade network infrastructure to meet future demand in water and wastewater services due to population growth is dependent on a range of factors such as:

- the extent of spare capacity in the existing network and when full capacity will be reached; and
- the costs of upgrading the system in the particular area to meet minimum performance standards.

Sydney Water is generally able to determine the extent of excess capacity in water and wastewater systems. However, this capacity is cumulative within the system, and is not able to be attributed to a specific development. Generally there is believed to be capacity in the existing water system to cope with additional population.

In the case of wastewater services there is also generally believed to be sufficient capacity in the existing areas to meet population projections. Therefore, it is assumed that no upgrades to the STPs (such as the facilities in Malabar, Cronulla and Bondi) will be required over the planning period. For Greenfield areas we have taken account of the need for augmentation to STPs to take account of population growth, as discussed below.

The general costs for Greenfield fringe and infill areas that we have used in our modelling are summarised below:

- \$22 000 to \$33 000 per lot in fringe areas for trunk drinking water, recycled water and wastewater services (in total).⁵⁸ This incorporates the provision of new or upgrading of STPs. It also includes costs for providing recycled water services which are estimated to be in the order of \$10 000 to \$15 000 per lot (although the developer charges for recycled water in New Growth areas are capped at \$6200 per lot);⁵⁹ and
- \$5000 per lot for the cost of reticulation assets within the development area for fringe areas.
- \$7000 to \$12 000 for 'Brownfields' development for upgrading water and wastewater reticulation and trunk services, excluding upgrades to STPs.⁶⁰
 - In order to meet BASIX requirements additional rainwater tanks would be required for new infill development. This is estimated at an additional \$4000 per lot. This only applies to townhouses and detached dwellings as units can meet BASIX requirements by installing AAA fitted appliances.
 - There may also be some additional costs of large-scale infill development in a single suburb or where there is the cumulative impact of a multitude of small-scale developments (in different suburbs) due to the need to amplify existing assets.
 - … For water services, there is limited major amplification required – there is some minor local amplification that may be required (such as upgrading water mains in some areas) but these costs are relatively small.
 - … There may be further costs associated with amplification of existing wastewater assets, primarily relating to the trunk sewer mains which are required to meet DECCW wet weather overflow standards. There is limited information available on the extent of differences in capacity constraints across the system in relation to specific developments. All three large coastal wastewater systems currently do not satisfy the DECCW 'no deterioration' requirements. However, costs to meet the wet weather requirements for the three large coastal wastewater systems will vary.

⁵⁸ Stormwater services are not a cost concern for Sydney Water. Stormwater assets are largely owned by councils and is, therefore, treated as part of local council infrastructure costs.

⁵⁹ In other fringe areas, where recycled water is not mandated additional rainwater tanks may be required. The estimated cost is approximately \$4000 per lot which includes both the cost of the tanks as well as the installation costs. Customers may choose greywater systems instead of rainwater tanks

⁶⁰ In this context 'brownfields' sites refer to where there is an existing urban use. Sites where there is no existing urban use (for example, market gardens or army barracks) are referred to as Greenfields sites.

- The need for amplification of existing assets has been aided by the demand management programs in place which reduce demand of drinking water and the volume of wastewater in the system.

A number of other factors (that have not been considered in our modelling) that could change the cost differential between fringe and infill development include:

- DECCW STP licences. DECCW is in the process of reviewing the licences to apply for Sydney Water's STPs. Currently it is anticipated that this review may lead to more stringent limits on releases from STPs, although it is not clear the extent to which such changes may alter Sydney Water's costs. Further, the application of the new licences could have differential impacts on the cost of fringe and infill development, if different standards are imposed on STPs in the Hawkesbury-Nepean catchment compared with other catchments.
- infill hotspots:
 - Compatible Land Use Policy. Sydney Water's costs can escalate if infill is allowed to locate close to STPs or pumping stations. In this case there is a potential for costs to increase to deal with issues such as odour controls or noise control from STPs or pumping stations.
 - Commercial buildings – In the future more widespread use of on-site water management initiatives (such as black water treatment to produce recycled water for in building uses) may reduce or eliminate the need for water and wastewater infrastructure amplification. Enhanced commercial building sustainability, reflected in Green Star Design Ratings, can yield premium tenant rentals.

Telecommunications networks

Telecommunication infrastructure is another key utility service that is required in new developments in fringe and infill areas. Telecommunication services cover services such as telephony as well as high speed broadband.

The telecommunications sector has a number of potential service providers. Telstra is the dominant player in this market, although there are a range of other service providers. Currently Telstra has a Universal Service Obligation to supply reasonable access to voice services where people work and live throughout Australia.

Developers in Greenfield new estates have options around the supply of telecommunications services. Telstra currently offers both a premium Fibre to the Premises solution (involving a developer contribution) and a supplier of last resort option. Other service providers such as OptiComm are actively expanding into the Greenfields sites on the fringe areas.

Cost drivers

Australian Government policy

The Australian Government has developed a policy that requires new homes in Greenfield developments were connected with infrastructure to deliver superfast broadband. On 18 March 2010, the Australian Government introduced the *Telecommunications Legislation Amendment (Fibre Deployment) Bill 2010* into the Parliament to establish a legislative framework to give effect to this policy.

The policy is intended to take effect for new developments from 1 July 2010. It is intended to apply to Greenfield estates as well as major in-fill projects and to also include multi-dwelling units.⁶¹

The Government has indicated that the cost of installing existing legacy technology in the new developments is approximately \$1000 per dwelling compared with \$2500 per dwelling for the installation of infrastructure required to provide superfast broadband.⁶²

In the past the costs associated with the existing legacy technology has been recovered through Telstra's line rental charges. The costs associated with the FTTP technology, however, will be recovered from developers and, therefore, likely to be passed-through to the end-users.

Site specific information

Detailed information was not available for this project to understand the potential cost differences between providing additional services in the infill areas compared with Greenfield areas on the fringe of Sydney. There are a range of factors that are the key drivers of costs in relation to the network communication infrastructure including:

- the distance between customers and the 'core' assets;
- the density of the area. That is, the number of service addresses per unit of land; and
- the terrain of the land which the network assets will be installed.

The issue of *density* is likely to result in lower costs associated with infill developments, unless there is a shift toward higher density in the fringe areas.

⁶¹ There is currently consideration of the application of certain size thresholds. Developments below the threshold size would not be required to install the upgraded infrastructure.

⁶² Department of Broadband, Communications and the Digital Economy 2009, *National Broadband Network: Fibre-to-the-premises in Greenfield estates*. Consultation Paper, May, p. 5.

In regards to *distance*, there is not likely to be a significant difference between new developments in the existing and fringe areas over the next 10 years. The reason for this is that there is expected to be sufficient capacity in the existing network to cope with growth. However, after 10 years additional infrastructure such as Ethernet Aggregation Points may be required into the future which would impact on fringe areas. The fringe areas are also likely to be more expensive due to the need to install transportation conduits.

However, the third factor (the *terrain*) is dependent on the specific site and the costs can vary significantly in between different infill developments as well as fringe developments.

In regards to its servicing strategy, it is possible that in new Greenfield development on the fringe that do not have sufficient density at the moment, that mobile network may be used initially before full infrastructure is provided. However, the use of mobile networks to supply voice and broadband services in new development in fringe areas is likely to be more limited at this stage due to the physical limit of spectrum efficiency.

No quantitative analysis was possible for the costs of telecommunications infrastructure under alternative land use scenarios. A large part of the cost differential is paid for by developers and incorporated into house prices, and hence factored into our analysis of transformation benefits.

Summary

Physical infrastructure costs are significantly higher for Greenfield development than for existing areas. This reflects higher water and wastewater costs in Greenfield areas. Electricity costs do not vary much across scenarios as capacity in all areas would be absorbed by the high expected population growth to 2016 and the costs of augmentation of existing areas are expected to be similar to the costs of providing services to new areas.

The higher Greenfield costs for water and wastewater are reflected in the costs for each scenario (table 7.3). The 90/10 scenario has the lowest costs of \$7.1 billion (in present value for 2011 to 2036). The 2005 Metropolitan Strategy scenario has higher costs of \$7.8 billion and the fringe focused scenario has higher costs again of \$8.5 billion.

7.3 Physical infrastructure costs associated with each scenario

<i>Cost item</i>	<i>2005 Metropolitan Strategy</i>	<i>Focused on fringe/ Greenfield</i>	<i>Focused on urban renewal</i>	<i>Deviations from Metropolitan Strategy</i>	
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
Electricity	1 903	1 919	1 898	16	-5
Water and wastewater	5 912	6 620	5 204	708	-708
Total	7 815	8 539	7 103	724	-713
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
Electricity	4 219	4 254	4 207	36	-11
Water and sewerage	13 103	14 672	11 535	1 568	-1 568
Total	17 322	18 926	15 742	1 604	-1 580

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

8 *Social infrastructure*

At the NSW Government level, provision of social infrastructure extends to schools, TAFE colleges, hospitals, primary and community based services and emergency services. Depending on the allocation of Sydney's increased population, the costs of providing these essential services will alter given cost characteristics specific to fringe and urban development. In addition to NSW Government costs, local councils also provide some social infrastructure including libraries, community centers and child care facilities.

Education

Current education infrastructure provision in Sydney

In 2009, more than 445 000 students were taught in 979 Sydney schools – including infants and primary schools, community schools, high schools and special needs schools. There were over 22 084 permanent teaching spaces (chart 8.1) and 2366 demountable teaching spaces which accommodated an average of 18.2 students per teaching space. The total land area of existing schools in the Sydney metropolitan region is approximately 4000 hectares.

Locality is a particularly important characteristic of school infrastructure which limits location flexibility. NSW Department of Education and Training standards require that, as far as possible, a primary school should be within 1.6 kilometres road distance of the bulk of its likely drawing area to minimise the demand for bus transport.⁶³

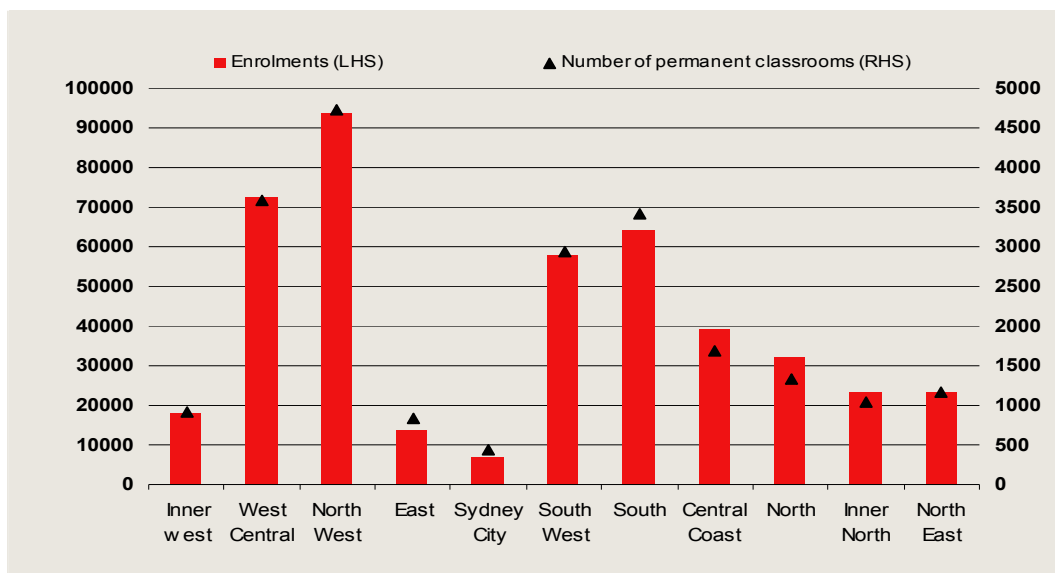
TAFE institutes have been excluded from the study given that the need for them to be localised to a particular geographical area is not as great. Instead, many TAFE facilities tend to specialise in business areas and draw students from across the metropolitan area.

Schools for specific purposes have also been excluded from the analysis. Although an important element of education facility planning across the Sydney metropolitan area, the specific entry requirements and unique design characteristics of these schools makes comparison unsuitable. However, it is recognised that population

⁶³ Department of Education and Training, *Requirements for New School Sites*.

growth will necessitate additional such schools, especially in Western and South Western Sydney regions and in Greenfields developments.

8.1 Current school infrastructure and enrolments by subregion



Data source: NSW Department of Education and Training (2010).

Current capacity in Sydney's education infrastructure

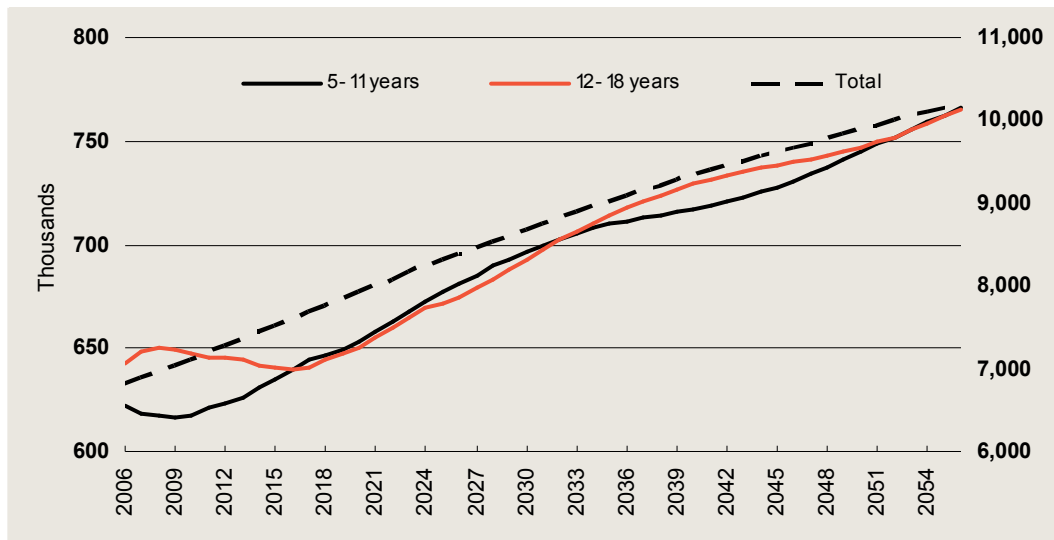
Existing aggregate education infrastructure in the Sydney region is already over capacity. Rising student enrolments in existing schools are the function of increasing fertility rates and a greater propensity for families to locate in higher density urban areas. School capacity has been further limited by policy prescriptions that aim to lower average class sizes and improve building standards, which increasingly demand additional space per student. For instance, practical activities areas, withdrawal spaces and additional storage are now standard requirements of modern primary school teaching spaces.

Capacity constraints are concentrated in primary schools in the near term. By 2014, a permanent accommodation capacity deficit of over 30 000 enrolments is expected in primary schools, while high schools are expected to have the facilities to accommodate a further 17 000 students. Given that there is currently an average of 23 students per teaching space in metropolitan infants and primary schools, keeping students per classroom constant would necessitate an additional 1300 primary school teaching spaces in 2014 to accommodate the 30 000+ additional students.

Demographic factors including current higher than anticipated fertility rates are expected to lead to significant additional demand for secondary school facilities at a later stage. While the population aged between 5 and 11 years has just begun to increase significantly, the population aged between 12 and 18 years is expected to rise only from 2017 (chart 8.2). However, expected higher demand for government

high school facilities may be mitigated to some extent in established urban areas by the higher proportion of students who choose to leave the secondary school system and the presence of non-government sector providers, which typically capture a higher proportion of the secondary school market (compared to the primary school market).

8.2 NSW population projections



Data source: ABS (2008), *Population Projections*, Canberra.

However, such factors have been incorporated into planning models by DET and, as such, the demand shortfall may still be significant. Adding to this pressure, private sector providers may continue to only capture their current level of demand at the secondary level. It should be recognised that while government schools have a legal obligation to enrol students, this obligation is not imposed on non-government schools. Recent legislation that has raised the school leaving age to 17 years old may also exacerbate the demand shortfall.

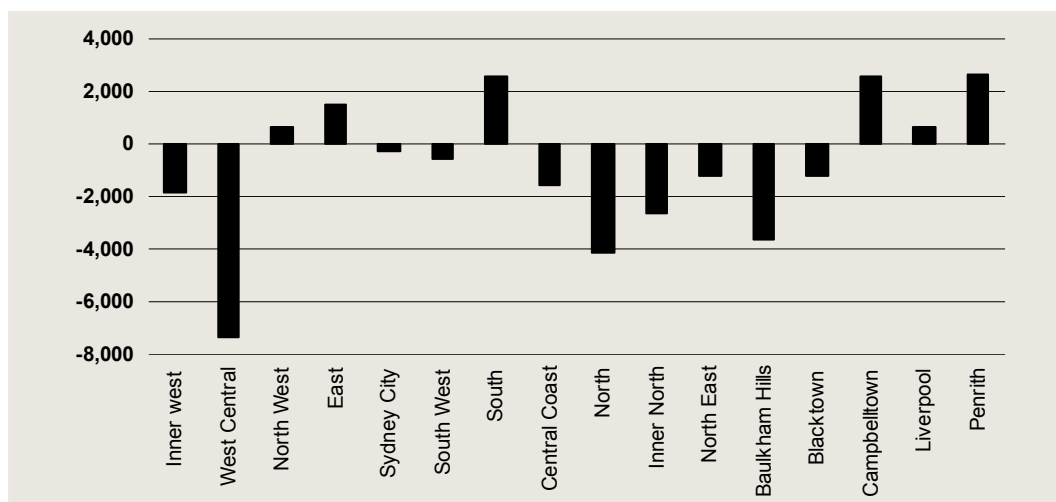
DET also advises that there may be a greater impact on government schools in some infill areas where student demand may exceed teaching spaces supplied, especially near transport centres.

Education capacity levels also differ among the geographical regions. In 2014, it is expected that there will be excess capacity in schools located in the East, North West, South subregions as well as in Liverpool and Penrith. However, the expected aggregate capacity deficit is around 14 000 enrolments, of which the West Central subregion is expected to account for over half of the shortfall (chart 8.3).

We note however that these geographic subregions mask important differences across local government areas (LGAs) in future education service demand. The impact of population growth on education capacity varies considerably within geographic subregions. Ideally, population targets should more carefully consider

variations within LGAs to utilise existing capacity more effectively. We also note that the capacity of different geographic regions also varies considerably for that of primary and secondary schools.

8.3 Expected enrolment capacity in 2014 by subregion



Data source: NSW Department of Education and Training.

The Department of Education and Training also advises that areas close to transport nodes have greater educational capacity deficit issues than those that are not located in close proximity to transport corridors. Refer to the Technical Appendices regarding *Measuring the Costs of Social Infrastructure*.

The current capacity shortfall is complicated by factors which limit the government's ability to extend existing education facilities. For instance, the necessary land requirements for extending school facilities are relatively large. The school facilities standard land area per student equated to around 70 metres squared. There are only limited cases where the NSW Department of Education has been able to buy additional land to increase capacity and expand an existing school. Such acquisitions are subject to administrative procedures that limit the Department's ability to purchase appropriate lots of land in a permitting timeframe as they become available.

Increasing enrolment density within the confines of existing school grounds, or creating 'medium density schools', has seemingly proven unappealing to community stakeholders. Further, a large stock of heritage listed buildings on existing school sites makes extension of current facilities more difficult.

Costs of education infrastructure provision

The NSW Department of Education and Training has estimated approximate per capita building and development costs for new and upgraded school facilities as per table 8.4. Average costs per student place associated with an urban school

redevelopment where the school size is deemed to be inadequate are proportionally much larger than the cost of providing new facilities in fringe areas. However, where the size of a school is deemed to be adequate, it becomes relatively more cost efficient to upgrade an existing school than build a new one in the fringe.⁶⁴

8.4 Cost of providing new and upgraded school developments

	<i>Primary schools (per student place)</i>	<i>High schools (per student place)</i>
Core upgrade, existing area: school size is generally adequate ^a	\$21 000	\$31 000
Core upgrade, existing area: school size is generally inadequate ^b	\$34 000	\$50 000
New school on Greenfields site	\$26 000	\$38 000

^a Upgrade by a combination of refurbishment and additions. ^b Upgrade by demolition of existing and multi-story rebuild on existing site.

Source: NSW Department of Education and Training (2010).

Aggregate relative costs were calculated on projected enrolments out to 2036 associated with each population growth scenario⁶⁵ in excess of capacity in 2014, the average land cost per student relevant in each LGA, and building and development costs dependant on whether the average school size is deemed to be adequate or not in each LGA. See technical appendices for greater detail on applied methodology.

Note that no costs of changes in the quality of school provision (such as crowding) were calculated given that education service standards were held constant for this exercise. That is, the cost of maintaining the average land available per student as enrolment populations in each LGA increase is incorporated into the cost results.

Health

Estimated costs of health infrastructure provision

The NSW Department of Health (NSW Health) makes infrastructure allocation decisions based 10 year Capital Investment Strategic Plan, which is aligned to limits as advised by NSW Treasury. Health expenditure projects are then approved as part of the annual budget processes.

It is noted that given the changing models of health care provision, there are challenges in trying to predict the type and nature of investment required to address

⁶⁴ School size was deemed adequate if the average land available per student in each LGA was greater than the benchmark average school size (three hectares per primary school and six hectares per high school) divided by the benchmark number of students per primary and high school (provided by DET).

⁶⁵ Projected enrolments were based on the proportion of both primary school and secondary school enrolments in 2009 in each LGA to the total population of that LGA. This ratio was assumed to remain constant.

future health service needs for the timeframe under consideration. Health planning is dependant on the mix of health service, for example acute admitted services, sub acute rehabilitation services, mental health and so on, required to respond to the needs of identified catchment populations.

However, in relation to considering potential cost implications, NSW Health estimated that an additional 656 000 separations would occur given the forecast population in 2036-37 compared with a base of 936 391 in 2008-09. This would suggest that another 7000 'beds' would be required, based on NSW Health assumptions that beds have an 85 per cent occupancy rate. This compares to an estimated number of 10 651 in 2008-09. NSW Health estimated that additional costs would equate to \$17.2 billion over the period in order to provide this additional capacity.

Further to providing capacity for admitted patients for acute health services, capacity also needs to be provided for Ambulance; mental health; sub and non acute care; community and primary care; non inpatient care such as radiotherapy; and so on. NSW Health estimated that capital costs would therefore need to be increased by an additional 40-50 per cent to accommodate capacity required in these other health services and to take account of investment required in support infrastructure such as Information Management and Communications Technology. Estimated capital costs were therefore increased by 45 per cent.

NSW Health cost estimates increase exponentially over time given population increases as well as known increases in health service demand and the ageing of the population. However, we have included only costs relating to population increases in our cost estimates for this study.

A range of privately provided health services, including nursing homes, retirement accommodation, hostels, medical centres, dentists, pharmacists, General Practice and private hospitals will also be provided for a growing population. While these costs are important, they do not need to be factored into this study as the infrastructure costs to provide these services are privately incurred and hence indirectly accounted for as part of the transformation benefits of an area.

NSW Health indicated that the distribution of the growth under various scenarios may impact on the extent of additional capacity that may be added at existing health sites and/or the need for new facilities. However, it is not considered that these differences would be significant due to the fact that health services are provided for populations through service networks and large catchment areas. For instance, highly specialised clinical services for the south west release areas would be accommodated at designated statewide services or through Liverpool hospital.

In regards to building and development costs, we have assumed that these are the same for accommodating population growth in Greenfield and existing areas based on advice provided by NSW Health. Although, based on discussions with developers

and providers of other utility services it is highly likely that the building costs in existing areas will be higher than Greenfield areas.

The estimated costs above do not incorporate land acquisition costs. Based on advice from NSW Health, estimates of capital costs of Greenfield development were sourced from the GCC superseded Special Infrastructure Contribution (SIC) Practice Note. The SIC note assumed 14.1 ha of land would be required for necessary health services at a cost of \$21.1 million. These costs have been included in our analysis. However, no information was available for the potential land acquisition costs for existing areas although it is likely to be significantly higher than the cost of land acquisition in Greenfield areas. The NSW Department of Health has, however, indicated that only a nominal amount of additional land will need to be purchased to accommodate additional capacity in existing areas.

Further potential costs may also be imposed on the health care system by services and facilities planning, which impact on variables such as air quality and the design of the built environment and are therefore critical to contributing to the health of communities. While these costs were not quantitatively included in this study, consideration of these issues and potential costs are provided in box 8.5.

8.5 Health impacts of urban environments

Aspects of the design and location of development can have a major bearing on health, wellbeing and life expectancy outcomes. Poor social, economic and environmental circumstances affect health throughout life, with social disadvantage doubling the risk of serious illness and premature death when compared with the rest of the population. When considering the health costs of alternative growth paths, it is therefore important to consider urban environments along with the provision of primary health services.

Health Impact Assessment undertaken in Greater Western Sydney⁶⁶ identified several urban environment factors that would influence health outcomes, including the extent to which people have access to employment, basic services and mobility. Important urban dimensions such as transport patterns and urban form are linked to human health by issues such as air quality and climate, accidents and injury, physical activity, access to quality food and social connectedness.

(Continued on next page)

⁶⁶ *Health Impact Assessment of the Sydney Metropolitan Strategy 2005 in relation to Greater Western Sydney*, Western Sydney Regional Organisation of Councils Ltd and AGA Consulting, October 2007

8.5 Health impacts of urban environments (continued)

For instance, high levels of physical activity can be facilitated by public transport infrastructure and mixed use development patterns. Proximity between housing, employment and local destinations (shops, recreational and cultural facilities, open space, civic centres etc) also has a significant impact on levels of incidental and recreational physical activity, as does the safety and attractiveness of areas.

New development has the greater potential, in not being constrained by existing development, to implement better urban form in terms of urban design, amenity and environmental conditions. However, it is possible that more facilities, services and opportunities will be available in existing environments.

Differential financial costs associated with fringe development and urban regeneration will be influenced by health impacts of the urban form. However, new research into the links and causality between urban development and health and wellbeing is currently underway for the Sydney region. Quantifying alternative financial costs has not been possible and is flagged as an area warranting further study.

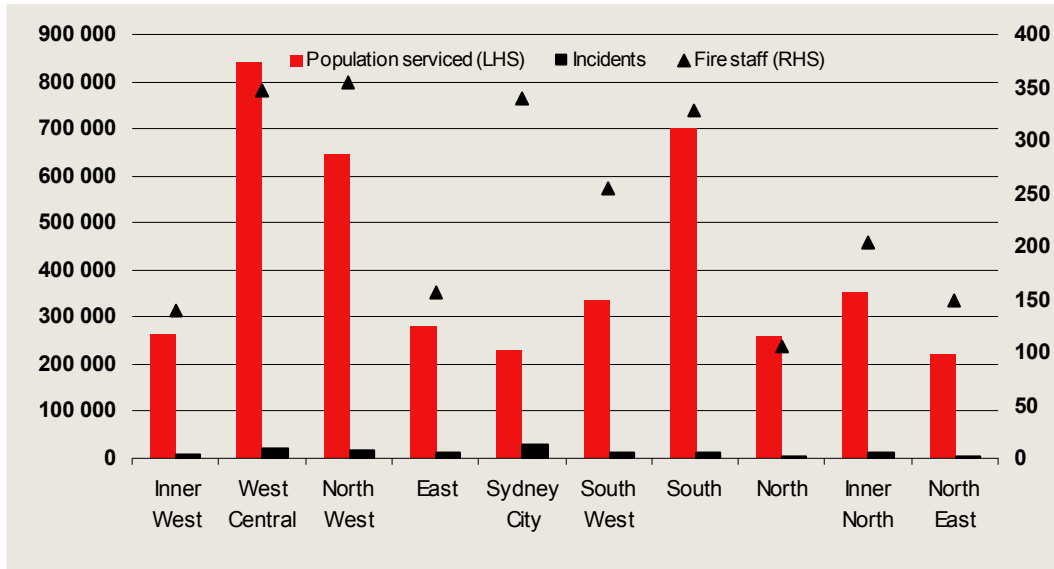
Emergency services

Fire

Current fire service infrastructure provision in Sydney

NSW Fire Brigades do not have specific service standards, but a corporate performance target of responding to 90 per cent of calls to structure fires within 10 minutes. As such, there are currently over 90 fire stations and 2300 fire crew within the Sydney metro region (chart 8.6). These resources facilitated the response to over 131 000 incidents in 2009. Incident rates vary considerably between LGAs, given differences in building environments as well as the socioeconomic profiles of regions.

8.6 Current fire staff and population serviced by subregion



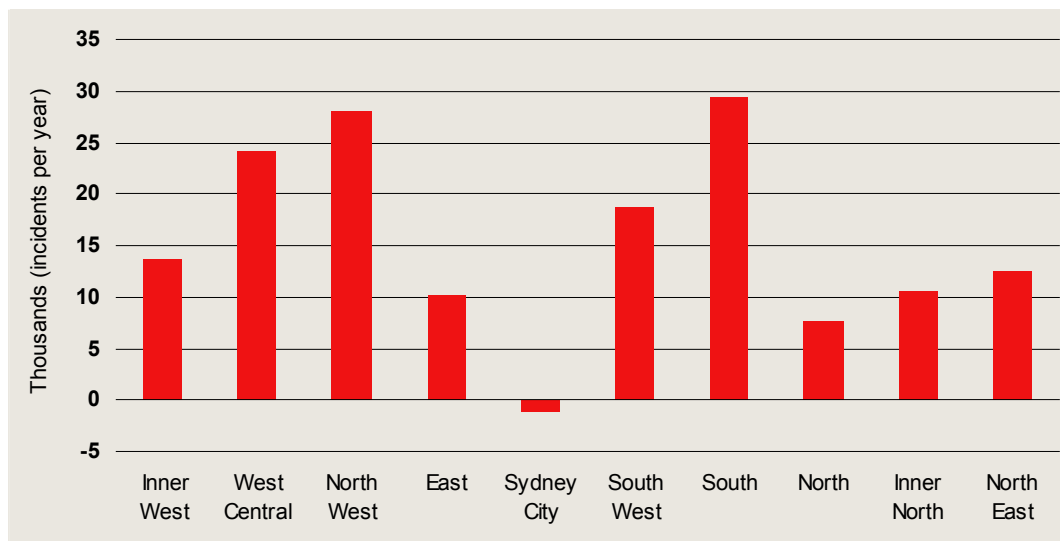
Data source: NSW Fire Brigades.

Current capacity in Sydney's fire service infrastructure

For the purposes of this exercise it was assumed that each fire crew had the capacity to respond to 3000 incidents per year before another unit became necessary. However, it is noted that in practice two fire crews from two different stations respond to the majority of incidents. For example, the Darlinghurst fire station currently responds to over 3000 calls per year, however City Of Sydney stations provide a reliable backup during times of peak activity given their geographic proximity.

However, given the threshold potential response rate per fire station of 3000 incidents per year, significant existing capacity was found to be available in all but the Sydney City sub-region (chart 8.7). On average, around 153 000 additional incidents per year could be serviced across the Sydney region given 2009 population levels and fire service infrastructure.

8.7 Capacity of fire services to respond to additional incidents



Data sources: NSW Fire Brigades; The CIE calculations.

Costs of fire service infrastructure provision

The NSW Fire Brigades estimate the cost of providing a new standard two bay fire station on a 2000 square metre block at around \$2.5 million. However, it was recommended that a higher cost of \$3 million per fire station be adopted as a conservative estimate given additional necessary requirements. For instance, some fire stations require more than two bays and an additional crew in each station necessitates additional accommodation and facilities.

Upgrading existing fire station facilities was estimated to cost \$1 million or \$100 000 depending on whether a major extension or minor works were necessary. This was based on whether current station facilities could accommodate an additional crew of four without the construction of new amenities but rather by internal works.

Additional cost information incorporated into the quantitative analysis included the cost of a fire engine, estimated by NSW Fire Brigades at \$530 000, and the annual staffing cost per engine, estimated as \$2.3 million. Refer to technical appendices for details on applied methodology.

Police

It was not possible to obtain the necessary data from the NSW Police Force in order to incorporate the relative cost of providing police service infrastructure into the quantitative analysis. However, we expect that these costs would be relatively small and believe that their omission will not compromise final results. This assumption is supported by the Growth Centres Commission superseded special infrastructure contribution practice note, which estimated that providing police service

infrastructure in the NW and SW growth centers would cost a total of \$72.8 million or 0.92 per cent of total infrastructure costs.

Council infrastructure

Councils provide social and physical infrastructure including:

- local roads
- local bus infrastructure
- local parks
- local sporting, recreational, cultural, civic and social services facilities
- drainage and stormwater management works
- other community infrastructure.

Councils currently collect contributions from developers as part of funding their infrastructure commitments, as discussed in chapter 2. NSW Department of Planning has recently undertaken a review of local council charges and has set a limit of \$20 000 per dwelling in infill areas and \$30 000 per dwelling in Greenfield sites unless exempted. Previous charging arrangements aimed at capturing infrastructure costs related to new developments suggest that costs could, in some cases, be as high as \$60 000 per dwelling for council infrastructure (table 8.8).⁶⁷

8.8 Council infrastructure costs for high cost developments

<i>Council area</i>	<i>Specific area</i>	<i>Exemption from maximum</i>
		\$ per dwelling
Liverpool	Middleton Grange Land	31 323
Penrith	Surveyors Creek Precinct	36 534
Penrith	Western Precinct	41 617
Pittwater Council	Warriewood Land	62 100
Camden	Elderslie Land	50 141
Camden	Spring Farm Land	58 970
Camden	Other urban land	27 505
City of Sydney, Wollondilly, Hills, Holroyd, Ku-Ring-Gai and Leichhardt		Not reported
All other councils		Maximum of 20 000

Note: Data that is not reported reflects time given to councils to undertake reviews.

Sources: NSW Department of Planning, Local Contributions Review, Letters to councils, (July 2009).

There are estimates available of council expenditure on infrastructure related to new development through the section 94 contributions. While this data is not audited it provides the best indication available of the costs to councils. Previous work by SGS Economics and Planning has been undertaken to compile this data. From this

⁶⁷ This assumes that the charging arrangements by councils were reflective of infrastructure costs.

database, estimates of average contributions for metropolitan areas range from \$4000 per dwelling to almost \$40 000 per dwelling.

8.9 Historical average contributions for a 3-bedroom house

<i>Sydney Metro Region</i>	<i>Average contribution</i>
	\$/dwelling
North East	38 225
North West	19 855
North	19 598
Sydney	17 717
Inner North	15 167
South West	14 120
Inner West	9 954
Central Coast	7 010
West Central	6 258
South	5 896
East	4 213

Source: SGS Economics and Planning (2008), Section 94 Database, prepared for NSW Department of Planning.

The largest infrastructure cost component of section 94 contributions was open space, followed by local roads and traffic costs.

Section 94 contributions are separately accounted for and expenses for infrastructure are taken out of the infrastructure funds. In 2007-08, councils in Sydney's metropolitan region spent about \$200 million on infrastructure using funds from section 94 contributions.⁶⁸ On a per dwelling basis, this averages out at about \$14 000 per dwelling with a maximum for a local government area of \$40 000 per dwelling.⁶⁹

Councils may have different willingness to absorb infrastructure costs from new development into their broader costs in order to promote development. They may also face changing infrastructure costs as more development occurs in their areas. Councils can also save costs through regional and multi-use facilities, which can be facilitated through regional contribution plans. We are not able to consider either of these effects in quantifying the costs to councils.

Summary

Social infrastructure costs are large under all scenarios at about \$18.5 billion to 2036 (in net present value terms, table 8.10). Differences in the urban growth path can have small impacts on social infrastructure costs, although the lack of capacity in most areas of social infrastructure mitigates the ability to lower costs from building

⁶⁸ NSW Department of Planning analysis of section 94 contributions accounts.

⁶⁹ Dwelling forecasts for 2007-08 by local government area based on NSW Department of Planning, Metropolitan Development Plan update 2007-08.

up existing areas. Education costs are estimated to be higher for growth paths focused in existing areas, as land costs constitute an important component of capital costs for schools, and the cost of upgrading can be higher than the costs of building a new school. Local council costs vary in the opposite way (these costs include physical and social infrastructure), with new areas tending to require more council investment.

In total, variations in social infrastructure costs across scenarios are small, with scenarios differing by less than \$150 million in net present value terms over the period to 2036.

8.10 Social infrastructure costs associated with each scenario

<i>Cost item</i>	<i>2005 Metropolitan Strategy</i>	<i>Focused on fringe/ Greenfield</i>	<i>Focused on urban renewal</i>	<i>Deviations from Metropolitan Strategy</i>	
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
Education					
▪ Primary education	2 064	1 922	2 186	-142	122
▪ Secondary education	1 247	1 164	1 298	-84	51
Health	8 651	8 656	8 645	5	-5
Other (fire services)	103	99	108	-4	5
Local council infrastructure	6 529	6 695	6 419	167	-110
Total	18 593	18 535	18 657	-58	63
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
Education					
▪ Primary education	4 574	4 259	4 845	-315	271
▪ Secondary education	2 765	2 579	2 877	-186	113
Health	19 173	19 184	19 161	11	-11
Other (fire services)	228	219	240	-9	12
Local council infrastructure	14 470	14 839	14 226	370	-243
Total	41 209	41 080	41 350	-129	141

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

9 *Environmental impacts*

Different urban growth paths will have different environmental footprints. Greater Greenfield development on Sydney's fringe will tend to lead to poorer environmental outcomes as it typically means more energy use both in the house and from transport, greater air pollution from transport and greater impacts on areas of biodiversity. However, there are also environmental impacts from urban consolidation, as localized environmental impacts are more concentrated.

Coverage of environmental impacts

There are many different environmental impacts arising from different urban growth paths. In some instances, the environmental impacts can be very particular to how growth is managed at a very localised area, while in other instances the environmental impacts from the scenarios considered in this study are relatively clear. We focus our attention only on these areas, which includes the following.

- Greenhouse gas emissions – development on Sydney's fringe would be expected to lead to higher overall greenhouse gas emissions as people on the fringe tend to travel more and on average live in dwellings with higher energy use.
- Air pollution from transport – the greater the use of cars the greater the air pollution, indicating the development strategies focused on fringe areas will have poorer outcomes for air pollution. Air pollution can be both a local phenomenon, (with pollution higher right next to roads) and a Sydney-wide problem with air pollution concentrating in particular areas due to topography.
- Noise pollution from transport – noise pollution tends to be higher when there is more road travel, although it can be mitigated through design of the areas around roads.
- Biodiversity – any growth path is likely to impact on biodiversity with many potential channels through which biodiversity can be impacted.

There are other areas that we have not quantified and valued in this study, such as impacts on waste or water quality.

Greenhouse gas emissions

There are many factors that would affect GHG emissions from different urban growth paths. These include the extent to which people find jobs near where they

live, restricting commutes, the extent to which service provision is local, the types of dwellings that people choose to build in different areas and the climatic conditions associated with different areas. The amount of greenhouse gas emissions will also depend on the types of energy used in the future, both in-house (such as gas, electricity and solar) and for the power stations. Policies that make electricity sources and transport fuels less greenhouse gas intensive, such as an inclusive emissions trading scheme, would reduce the difference between alternative land use scenarios.

Factoring in all these effects is complex. A comprehensive analysis of how changes in land use affected energy use and greenhouse gas emissions was conducted by Peter Rickwood.⁷⁰ This study included greenhouse gas emissions from transport and from dwellings. Dwelling related energy use and emissions factors in the energy used in creating the dwelling (embodied energy) as well as the energy used by people living in the dwelling. This study considered alternative scenarios for land use and associated energy use and greenhouse gas emissions. We draw heavily on their analysis for our modelling by adjusting the information from the wide range of scenarios used in the Rickwood study to fit the scenarios adopted in our study.

The scenarios considered by Rickwood (2009) do not align exactly with those that we consider. The scenarios can be considered as varying a number of factors.

1. The share of development occurring on Sydney's fringe
2. The share of development in existing areas located near centres
3. The nature of development near centres – East Asian style high rise or European style medium rise

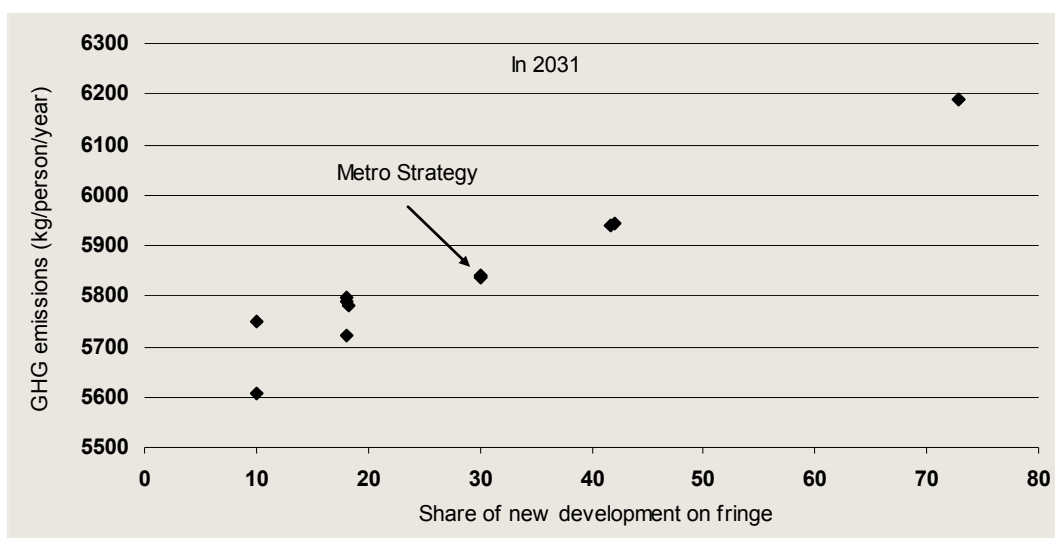
The most important of these factors by a substantial margin is the share of development occurring on the fringe. However, even this factor drives only relatively small changes in GHG emissions (chart 9.1). The highest per capita GHG emissions scenario (capturing urban sprawl) has 6 per cent higher GHG emissions per capita than the 2005 Metropolitan Strategy, while the least GHG emissions scenario (Parisian style medium density development) has 4 per cent less than the 2005 Metropolitan Strategy by 2031.

Having a greater proportion of development near centres can also lead to small reductions in GHG emissions.

From the scenarios in Rickwood, we can deduce the average impact of 1 per cent extra share of growth coming from fringe areas and from an extra 1 per cent from centres. These factors can be applied to the much larger differences captured by our scenarios.

⁷⁰ Rickwood, P. 2009, *The impact of physical planning policy on household energy use and greenhouse emissions*, submitted for PhD to University of Technology Sydney, October.

9.1 Land use scenarios and GHG emissions



Data source: Rickwood (2009).

We find that:

- on average, an extra 1 per cent of new development occurring on Sydney's fringe raises per capita GHG emissions by 6.8 kilograms in 2031; and
- on average, an extra 1 per cent of new development occurring near centres (rather than in existing areas not near centres) reduces per capita GHG emissions by 0.7 kilograms in 2031.

We apply these factors in our modelling of the growth paths.

We do not account for changes in the GHG emissions intensity of energy sources, similar to Rickwood (2009). This likely means that we overstate the impacts of the scenarios.

In aggregate a fringe focused scenario would increase the GHG emissions (CO₂ equivalent) by 6 million tonnes to 2036 relative to continuing with the 2005 Metropolitan Strategy. An infill focused scenario would have the opposite impacts, reducing GHG emissions by 6 million tonnes to 2036.

To value the changes in GHG emissions reductions from land use, we use the prices set out in Australian Treasury modelling (for CPRS -5) of an emissions trading scheme which reflects the costs of mitigation (not the environmental cost).⁷¹ In doing this, we are in effect assuming that an emissions trading scheme is in place and GHG emissions avoided through changes in land use mean that there is less need to reduce GHG emissions in other areas. It is plausible that the values would be much higher in

⁷¹ Australian Treasury 2008, *Australia's Low Pollution future*, Canberra.

the absence of an emissions trading scheme, as values would reflect environmental costs rather than alternative abatement opportunities.⁷²

It should be noted that the carbon price in the Treasury modelling reflects the economywide marginal cost of abatement. There may also be additional costs of adapting to the effects of climate change which could vary different across regions. Sydney, for example, may face significant adaptation costs such as increased health related costs attributable to heat stress, increased risks of bushfires and additional infrastructure costs. These costs have not been included in our analysis.

Air pollution

Air pollution is a persistent health concern in major cities in Australia and around the world. Those particularly susceptible to the health impacts of air pollution are the very young, the elderly and those with pre-existing health conditions. Air pollution in Sydney is estimated to cost between \$1 billion and \$8 billion per year.⁷³ These costs include loss of life or quality of life, costs of health care and loss in productivity.

In order to help protect the health of the Australian population, the National Environment Protection Council (in 1998) set ambient air quality standards and goals for six criteria pollutants in the National Environment Protection Measure for Ambient Air Quality (AAQ NEPM). The six pollutants in the AAQ NEPM are ozone, particles, carbon monoxide, nitrogen dioxide, sulfur dioxide and lead – these are also the air quality targets in the NSW State Plan. The standards and goals in the AAQ NEPM are currently under review with final recommendations about any adjustments to them expected in 2010–11.⁷⁴

NSW consistently complies with the NEPM for four (carbon monoxide, nitrogen dioxide, sulfur dioxide and lead) of the six pollutants listed but does not meet goals for ground level ozone or for particles in some years.

The NSW Air Emissions Inventory provides a detailed listing of pollutants discharged into the atmosphere by each source type during a given time period and at a specific location.⁷⁵ Air pollution can come from a number of sources, of which transport is a particular focus of this study. Motor vehicles are projected to remain

⁷² This would be the case only if environmental costs were world environmental costs rather than for NSW.

⁷³ NSW Department of Environment and Conservation 2005, *Air pollution economics: health costs of air pollution in the Greater Sydney Metropolitan Area*, Department of Environment and Conservation NSW: Sydney.

⁷⁴ DECCW, http://www.environment.nsw.gov.au/soe/soe2009/chapter4/chp_4.1.htm#4.1.3.

⁷⁵ DECCW, <http://www.environment.nsw.gov.au/air/airinventory.htm>.

the most significant source of ozone forming pollutants in the Sydney Region. In 2002, transport made up between 9 per cent and 58 per cent of different types of air pollution.⁷⁶ Between 2003 to 2008 emissions from motor vehicles decreased as a result of improving vehicle emissions standards, a stabilization in vehicle kilometers travelled over that period and a lower fleet age.⁷⁷

While transport is the major emission source of nitrogen oxides (NO_x) and critical in a discussion of urban growth, there are a range of other significant emissions sources. In Sydney, for example, industry is the highest emitter of particulate matter (PM₁₀) and second highest emitter of nitrogen oxides (NO_x). The domestic and commercial sectors are also a major contributor to air pollution and is the largest contributor to VOC emissions in all areas of the greater metropolitan region.

Given the data limitations, the major driver of differences in air pollution considered in this study is differences in the use of transport. The Bureau of Transport and Regional Economics uses an estimate that each kilometer of urban car travel incurs 2.5 cents in air pollution costs.⁷⁸ We use this figure for our modelling.

Other modes of transport also produce air pollution, although much smaller amounts than cars. For instance, air pollution costs attributable to buses are estimated at 32.8 cents per vehicle kilometer and air pollution costs for rail are estimated at 0.9 cents per rail car kilometer.⁷⁹

As noted in chapter 7, development in Greenfield areas will tend to lead to greater kilometres travelled as well as a greater share travelled by cars. Both factors suggest that it would lead to higher air pollution.

We apply current transport patterns in each local government area to the population growth in each area to estimate future air pollution costs for the 3 scenarios.

Our modelling does not capture all possible impacts of land use scenarios on air pollution costs. Some areas of Sydney are more susceptible to air pollution than other for reasons related to topography and the weather. This means that smog can concentrate in particular areas. If more people were to live in these areas then air pollution costs would be higher than accounted for in this report.

⁷⁶ NSW Department of Environment and Conservation 2005, *Air pollution economics: health costs of air pollution in the Greater Sydney Metropolitan Area*, Department of Environment and Conservation NSW: Sydney, p. 6.

⁷⁷ DECCW, http://www.environment.nsw.gov.au/soe/soe2009/chapter4/chp_4.1.htm#4.1.3, p. 4.

⁷⁸ Bureau of Transport and Regional Economics 2007, *Estimating urban traffic and congestion cost trends for Australian cities*, Working Paper no. 71, p. 79.

⁷⁹ RailCorp 2007, *The value of CityRail to the NSW Community*, November, pp. 20–21.

Offsetting this is that environmental standards for cars and buses could be higher in the future than now. Fuel standards are set under the *Fuel Quality Standards Act 2000*. For example, the Australian Government is currently considering higher standards (the Euro 5/6 standards) to reduce emissions from light vehicles.⁸⁰ Such changes in policies, is expected to contribute to lower air pollution from motor vehicles into the future.

As well as actions to reduce per capita emissions across sources, other strategies to control air pollution also include specific exposure reduction measures such as the NSW Department of Planning's Interim Guidelines for Development near Rail Corridors and Busy Roads.⁸¹

DECCW's ozone modelling undertaken for the 2005 Metropolitan Strategy is summarised as follows.

- Unless action is taken to control emissions, population growth has the potential to significantly worsen Sydney's air quality, and more people will be exposed to concentration above the NEPM standards.
- Simulated ozone concentration depended on its population but not its distribution.
- Exceedances of the ozone standard will continue to occur more frequently in Western Sydney. This finding has since been reinforced by recent CSIRO modelling of ozone formation under climate change scenarios which suggests that climate change will result in more ozone exceedances and, similarly, have the greatest impact on Western Sydney.
- The response of ozone formation to a reduction in emissions varies each day.
- There is no single control strategy to reduce ozone concentrations.
- Control of both VOC and NO_x is required in order to reduce ozone concentrations.
- While significant gains are likely from currently mandated control of motor vehicle emissions, motor vehicles will remain a significant source of ozone forming emissions.⁸²

⁸⁰ In Australia, vehicle emissions standards are set via the Australian Design Rules, which are legislative instruments under the *Motor Vehicle Standards Act 1989*.

⁸¹ NSW Department of Planning, http://www.planning.nsw.gov.au/planningsystem/pdf/guide_infra_devrailroadcorridors_interim.pdf.

⁸² DECCW 2007, 'Current and Projected Air Quality in NSW; A Technical Paper Supporting the Clean Air Forum 2007' appears online at www.environment.nsw.gov.au/resources/air/07529cpairqualcaf2007.pdf.

Noise pollution

There are a range of possible sources of noise pollution. These include from, for example, transport sources as well as from aircraft, industrial and construction. There is limited information available to evaluate the potential impact of noise pollution from aircraft, freight, increased density, industrial and construction sources. Therefore, our focus is on trying to account for noise pollution from urban transport.

Noise pollution from transport can result in loss of amenity and potentially stress and health costs. Noise pollution from alternative urban growth paths will depend on the exact nature of the transport systems used to manage growth and the nature and mitigating measures for developments around transport systems. For example, building high density apartments directly under the air routes would lead to many people incurring airport noise, while locating these away from air routes would avoid these effects.

The only noise effects that we quantify and value are vehicle use for which there are previously estimated per vehicle kilometer estimates of noise pollution. This ignores all the complexities of noise pollution relating to when it occurs during the day, how many people are affected by each vehicle, whether the cost of noise pollution along a particular road varies in non-linear ways with vehicle numbers and options to mitigate noise pollution.

We use noise pollution estimates of 0.9 cents per car kilometer, 2.1 cents per bus kilometer and 3.7 cents per rail car kilometer.⁸³ These are applied to estimated travel use projected in the same way as for air pollution and congestion costs.

Biodiversity impacts

'Biodiversity' is the diversity of life on earth and consists of three components: genetic diversity, species diversity and ecosystem diversity. Biodiversity encompasses the complete range of life forms from the most obvious (such as birds, mammals and flowering plants) to the least obvious (such as soil microorganisms), many of which remain unknown to science.⁸⁴

Biodiversity is important both for its intrinsic value – its uniqueness and power to inspire – and the ecosystem services it provides to society. For example biodiversity purifies air and water, moderates climate, retains soil fertility and decomposes waste.

⁸³ RailCorp 2007, *The value of CityRail to the NSW Community*, November, pp. 20–21.

⁸⁴ DECCW 2008, *A New Biodiversity Strategy for NSW: Discussion Paper 2009*, p. vii.
<http://www.environment.nsw.gov.au/resources/biodiversity/08398biostr.pdf>.

Biodiversity can, therefore, impact on the quality of life of present and future generations.

The range of potential impacts on biodiversity differs across the different urban forms in urban areas. For example replacing an existing industrial site with a low density residential development could result in improving biodiversity where it is associated with planting native species. On the other hand, the clearing of habitat to increase dwelling numbers in a low density residential area would negatively impact on biodiversity, particularly if threatened species, habitat or communities are cleared.

In order to numerically assess the potential impact on biodiversity of the alternative growth scenarios considered for this project, detailed information is required on the spatial location of the population and the specific biodiversity characteristics within each LGA. Such information is not readily available.

The NSW Department of Environment Climate Change and Water (DECCW) has advised that new urban development in the rural or outer areas of the Sydney basin would likely have a greater impact on biodiversity than new development in existing built up areas. The outer areas of western Sydney are where most of the larger, better condition remnants of native vegetation on the Cumberland Plain remain. These remnants support plants and animals that were once more abundant. Most of the recognised vegetation types on the Cumberland Plain are now listed as threatened ecological communities under the *NSW Threatened Species Conservation Act 1995* (TSC Act), and two are also listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1998* (EPBC Act). The Cumberland Plain Woodland community is now listed as critically endangered under the TSC Act as well as under the EPBC Act under the name "Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest".

It is estimated that only 13 per cent of the pre-1750 extent of native vegetation on the Cumberland Plain remains in the greater Sydney Metropolitan region as a result of past and continuing land use pressures.⁸⁵ The majority (76 per cent) of this vegetation is on land that is privately owned and only 7 per cent of the total remaining is protected within a formal reserve system. Reserves and other protected areas, whilst vital, are unlikely to be sufficient to protect biodiversity.⁸⁶ It has been suggested that a minimum of 30-40 per cent of the landscape needs to be managed for conservation in order to protect and maintain biodiversity values and that this

⁸⁵ DECCW 2009, *Draft NSW and National Recovery Plan: Cumberland Plain Recovery Plan draft for Public Comment*. November 2009, <http://www.environment.nsw.gov.au/resources/threatenedspecies/DraftCumberlandPlainRP.pdf>.

⁸⁶ DECCW 2008, *A New Biodiversity Strategy for NSW: Discussion Paper 2009*.

strategy needs to be complemented by sympathetic management of a proportion of the surrounding productive or urban landscape.⁸⁷

Research also suggests that biodiversity loss caused by habitat fragmentation significantly increases once clearing levels exceed 70 per cent of the landscape.⁸⁸ This threshold has already been passed on the Cumberland Plain.

Clearing and fragmentation have already had a profound effect on fauna of the Cumberland Plain. Many mammal species have disappeared and many species of birds, that were relatively common in the 1950s, are now generally absent. The few threatened woodland birds that have persisted are now restricted to the larger and better connected remnants of bushland. Many plant species, including those only found in the Cumberland Plain are also now at risk of extinction although some populations persist in small and sometimes degraded remnants.⁸⁹

Urbanisation of outer city areas can also impact on aquatic biodiversity through increased levels of polluted run-off from surfaces hardened for new roads and housing or loss or fragmentation of riparian vegetation cleared for development for example.

Impacts on biodiversity are also accelerated by the edge impacts of new residential development on remnants that are not initially cleared for development. Impacts can include for example, increased instances of fire by arson or error, rubbish dumping, weed and feral animal invasion, or predation by domestic cats and dogs and increased recreational use of the remnants can all impact on remaining fauna and flora species. The greater the fragmentation caused by new Greenfield development in outer urban areas, the greater the edge impacts on remaining biodiversity.

The NSW Government has established biodiversity certification to help conserve biodiversity, threatened species, population and communities.

Summary

The measurable environmental costs are lowest for a scenario that redevelops existing areas, rather than Greenfield areas (table 9.2). This reflects the lower energy use of dwelling types that would be built in existing areas and the lower transport use in a higher density city. In total, we find that GHG emissions, air pollution and noise pollution could be \$160 million lower over the period to 2036 under a scenario

⁸⁷ Svancara et al. 2005, quoted in DECCW 2008, *A New Biodiversity Strategy for NSW: Discussion Paper 2009*.

⁸⁸ Freudemberger et al. 1997 and WALGA 2004 quoted in DECCW 2009, *Draft NSW and National Recovery Plan: Cumberland Plain Recovery Plan draft for Public Comment*, November 2009.

⁸⁹ DECCW 2009, *Draft NSW and National Recovery Plan: Cumberland Plain Recovery Plan draft for Public Comment*, November 2009.

with 90 per cent of new dwellings built in existing areas compared with the scenario representing the Metropolitan Strategy. A strategy that accommodated more people in Greenfield areas on Sydney’s fringe would have greater environmental costs than the 2005 Metropolitan Strategy, valued at approximately \$250 million over the period to 2036.

9.2 Environmental costs associated with each scenario

Cost item	2005	Focused on	Focused on	Deviations from Metropolitan	
	Metropolitan Strategy	fringe/Greenfield	urban renewal	50/50	90/10
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
GHG emissions (relative to Metropolitan Strategy)	0	116	-116	116	-116
Air pollution	889	1 010	857	121	-33
Noise pollution	314	356	302	43	-12
Total	1 203	1 482	1 043	279	-160
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
GHG emissions (relative to Metropolitan Strategy)	0	257	-257	257	-257
Air pollution	1 971	2 238	1 898	267	-72
Noise pollution	695	790	669	95	-26
Total	2 666	3 285	2 311	619	-355

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

There are other non-quantified environmental costs that are expected to be higher for Greenfield development, particularly related to loss of biodiversity.

10 Impacts on existing residents

Not in my backyard (NIMBY) is a common phrase applied to development efforts in Sydney and other areas. NIMBY reflects localised costs that may constrain actions that have broader benefit. Localised costs are important in development as unfettered development could reduce land values in neighbouring areas and generate impacts such as over-crowded parks, beaches and other open spaces, transport congestion and aesthetic impacts. Higher density development could also have benefits, such as improved local amenities and services.

Types of impacts on existing residents

Existing residents can be impacted by new development in a number of ways, both positive and negative as set out in chapter 4. Some impacts are substantial – for instance a major road put in next to your property can reduce values by 20 per cent to 30 per cent.⁹⁰ Similarly, a new 10 storey apartment block next to your house, blocking out the view can depress the value of the property by as much as 30 per cent. There are also potentially impacts in Greenfield areas, as agricultural and residential land uses impose constraints on each other. The magnitude of these impacts could be close to zero if urban growth is well managed.

Across an entire growth path, only some impacts on existing residents can be quantified. These include traffic congestion, which was discussed in chapter 6 and pollution impacts discussed in chapter 9. Investments to manage impacts on existing residents are also quantified as part of expenditure by local councils to increase or upgrade open space areas, although open space areas may still be subject to greater crowding for example.

It is not possible to systematically identify aesthetic impacts on neighbouring properties. These will largely depend on the specifics of the development. The NSW Department of Planning Stakeholders' Forum reported that stakeholders thought in general that there would not necessary be negative neighbourhood impacts from

⁹⁰ This information has been sourced through discussions with land valuers. The extent of the impact, however, would differ according to the specific characteristics of the relevant properties.

medium density development around transport nodes and centres.⁹¹ But some types of development in specific areas could have negative impacts depending on the specific characteristics of the area. This is likely to reflect more than issues relating to open space and congestion.

Open space

Open space includes public areas such as parks, play facilities and sporting grounds, as well as private open space such (as golf courses). Providing open space has significant benefits to residential areas close to the areas of open space, particularly for apartments. For example:

- In the UK, estimates suggest that a 1 per cent increase in the amount of green space in a London neighbourhood increases house values on average by 0.3 to 0.5 per cent.⁹² (Aligning this to Sydney, a one per cent increase in green space would increase values by \$1900 to \$3200 per dwelling).
- In the US, a review of the extensive literature on the value of different types of parks and open spaces concluded that being directly adjacent to a park led to a 20 per cent increase in property values and being within 1 to 2 blocks to a 10 per cent increase.⁹³

These benefits can vary across different types and designs of parks and areas of open space. To a large extent, the benefits of open space are about accessibility and quality rather than quantity of provision of open space. Accessibility is not impacted by higher density development in infill areas.

There is no study (that we know of) that considers Sydney's preferences for open space and variations in this amongst Sydney's suburbs.

Councils may react to higher populations in a number of ways. In some cases, councils may be able to provide more open space. Where this is possible these costs have been included as part of the assessment of costs to local councils. In many cases there is limited scope to provide more open space. Councils can instead provide higher quality open space, such as playgrounds, lighting and space for public events. Again, where the need for this upgrade was considered by councils and linked to new development the costs are part of the assessment of costs to local councils.

⁹¹ NSW Department of Planning 2010, *Sydney Towards 2036*, Metropolitan Strategy Review Key Stakeholders Forum, 9th April.

⁹² GLA Economics 2003, *Valuing greenness: green spaces, house prices and Londoners' priorities*, Greater London Authority: London.

⁹³ Crompton J. 2005, 'The impacts of parks on property values: empirical evidence from the past two decades in the United States', *Managing Leisure*, Vol. 10, pp. 203–18.

In other cases, councils may not need to provide additional open space as open space can be considered underutilised, with parks having little patronage even at 'peak' times. (This can reflect the characteristics of the park, as well as a large supply of open space.) In these areas, additional people who use open space may have little impact on the value of these areas to others.

The extent to which the value of open space declines as density rises across Sydney's suburbs, even with improved quality of open space, is unknown. For parks that become too crowded for some uses or for which there is excess demand (such as sporting fields), there will be social costs from higher density in existing areas.

The NSW Department of Planning has previously used a threshold for the provision of open space in the Growth Centres of 2.83 hectares of open space per 1000 people.⁹⁴ While this ratio is a useful guide, the quality and type of open space will also be important and work is underway to consider these adjustments to open space policy.⁹⁵

The local government areas that had no capacity in terms of open space in 2006 are shown in table 10.1. The Inner West is most prominent as a region without open space capacity, as well as areas close to the CBD. By 2036, a number of other areas have reached the threshold under each scenario.

10.1 Local government areas without open space capacity

Auburn	Leichhardt	Sydney
Burwood	Marrickville	Warringah
Canterbury	North Sydney	Waverley

Source: The CIE calculations based on NSW Department of Planning open space data.

The cost of providing additional open space in areas without capacity would be equal to the cost of buying land, landscaping and maintenance. We account for some additional purchases of land for open space through local infrastructure costs discussed in chapter 8.

However, table 10.1 above does not factor in beaches, waterways and harbour fronts that significantly improve the quality of open space in some of these areas. In addition, it is unclear whether people value the proximity of open space, such as has been the focus of most studies on open space value or the amount of open space per person. We expect that the former is more important, particularly at the current density of Sydney, and this would not be impacted by higher density development in infill areas.

⁹⁴ Growth Centres Commission 2006, Growth Centres Development Code, table A.4.

⁹⁵ For example, the guideline value of 2.83 hectares per 1000 people is being reconsidered to better capture the value that people place on open space quality.

Summary

There are a range of impacts to existing residents that were quantified in previous chapters. These include, for example, transport congestion costs which have been specifically calculated. The cost of purchasing additional land to provide open space or of improving the quality of open space through infrastructure contributions has also been considered through the local infrastructure costs.

We are unable to quantify the benefits and costs to existing residents from factors such as increased amenities or immediate neighbourhood impacts. We have also not been able to quantify the impact that reduced open space per person would have on existing residents after accounting for council expenditures to improve the quality of open space. However, in general one would expect that the impacts on reduced open space would be higher in infill areas where there is limited capacity to provide more open space and hence for an infill focused scenario. For example, areas such as the Inner West and Sydney CBD have less open space and could face crowding of open space areas and lower value to users.

11 Transformation benefits

Transformation of sites to accommodate additional residential dwellings can have substantial benefits for participating households, as these households, by making their purchases, are showing they place higher values on the transformed areas than the costs of transforming the area. Transformation benefits are very difficult to estimate in a comprehensive way as this is akin to requiring information on the underlying demand and supply of every possible site in Sydney. We use current market information and land valuation data to estimate land value uplift from redevelopment in each local government area as a proxy for transformation benefits. This method and the results are set out in detail in this chapter.

Types of transformation

Transformation is a generic term that can capture a number of different changes in urban landscape. It is most likely to involve:

- redevelopment of low density areas into higher density areas;
- redevelopment of industrial areas into residential (and probably higher density residential) areas; and
- redevelopment of non urban land (mainly on Sydney's fringe) into residential areas.

The common characteristic is the change in existing site use in a way that increases the number of dwellings on a given site.

Transforming the land itself for these different purposes is not typically costless, even when administrative and infrastructure/utilities costs outside of the development are excluded. For example industrial land might need to be remediated for years in order to be suitable for residential purposes. Non urban land will typically need to be leveled, excavated and sub-divided in order to be suitable for residential purposes. There will be possibly more modest costs, such as demolition etc, to make land that currently has low density residential development suitable for higher density development.

Transformation benefits

Transformation benefits reflect the difference between the value households (or businesses) place on a new development versus the underlying economic costs of producing the new development. This is shown stylistically in chart 11.1, where:

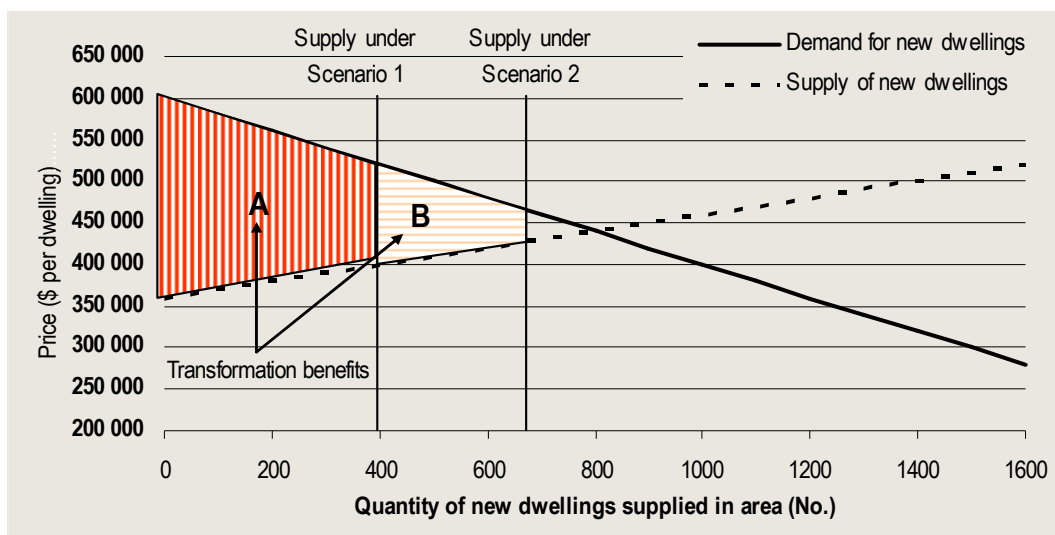
- the supply or marginal cost of new dwellings is the dashed line – it slopes upwards, reflecting the fact that as sites that are least costly to transform/develop are used up additional dwelling development becomes successively more costly and a higher ‘supply price’ is required to make such development worthwhile. The supply curve illustrated does not include government charges, infrastructure costs outside the development site, costs imposed on others or the regulatory constraints imposed by councils, as these are considered separately in other parts of this report. It includes the opportunity cost of land in its current use and any on-site development costs;⁹⁶
- the demand or consumer value for dwellings is the downward sloping line – it slopes downward, reflecting the variation in willingness and ability to pay for additional dwellings marketed in given area. Different people place different value on a dwelling in that area, reflecting a range of factors such as ability to pay, lifestyle preferences and friends and family. Successively lower values associated with increased quantities of dwellings signify that, to draw in additional purchasers with lower and lower willingness to pay, lower and lower prices are required;⁹⁷
- the gap between the supply and demand curve reflects the constraints imposed by planning, councils and government charges and frictions relating to expectations of landholders. For these reasons consumer value would be expected to be higher than the supply price (excluding government charges and costs);
- the number of new dwellings in an area will differ according to the scenario for how growth is accommodated across Sydney. So will the transformation benefits from new dwellings, which are the difference between consumer value (demand) and supply costs. In chart 11.1, an example is shown for a local government area in which there is more development under scenario 2 than scenario 1. As total new development is the same, there will be local government areas where there is more development in scenario 1 than scenario 2. (Scenario 3 is not included as the chart is an example only.) In this case, the transformation benefits from scenario 1 are equal to the shaded area A, while the transformation benefits from scenario 2 are equal to A plus B. If further dwellings continued to be accommodated in that

⁹⁶ The supply curve does not reflect the full costs facing developers.

⁹⁷ Note that demand and supply relationships are much more complicated in reality as dwellings are all different. The illustration reflects demand and supply of dwellings that are the same.

area then the transformation benefits of additional dwellings would eventually become negative.

11.1 Transformation benefits



Source: The CIE.

The transformation benefits could go to a number of different groups, including existing landowners, developers/builders, councils/NSW Government and households purchasing the new dwellings. The exact division will depend on the elasticity of demand and supply in the component markets (e.g. for sites and finished dwellings), the planning processes (including charges and compliance costs) and the extent of competition in the development and construction sectors.

The market picture above includes the cost and value of new dwellings, as dwellings are the final product that we are interested in. In reality, dwellings are all different, in terms of construction, fit-out, design etc. The market value of a dwelling will reflect the value of the site and the value of the dwelling itself. Ideally, we would like to abstract from the value of the dwelling component because of its variability. We can do this through considering only the value of the site. Changes in the value of the site will adequately proxy for transformation benefits as long as the value of dwellings is reflective of their costs.⁹⁸

⁹⁸ More specifically, if the total value of the new dwelling is TVD_N and the total value of the existing dwelling (or site if unoccupied) is TVD_O then the transformation benefit (TB) is the difference between the two less the costs of achieving the transformation (TC), as follows.

$$TB = TVD_N - TVD_O - TC$$

The total value of the dwelling can be decomposed into the value of the dwelling VD and the value of the site VS . The cost of transformation can be broken into the cost of transforming the site ($Cost_{Land}$) and the other costs, such as demolition and construction of dwellings. The total benefit is then as follows.

$$TB = (VD_N + VS_N) - (VD_O + VS_O) - (Cost_{Land} + Cost_{Other})$$

This study uses unimproved site value data as the best method of approximating transformation benefits on this basis. Unimproved site values are collected by the Land Valuer General for taxation and rating purposes. This measure may underestimate transformation benefits to the extent that existing site valuations incorporate an uplift for the possibility of future transformation – that is, existing owners can extract some of the potential transformation benefits. It should also be noted that we exclude costs related to navigating the planning system from the costs of transformation. While these costs are real economic costs that are borne by developers, the correct measure for benefit cost analysis of alternative development paths should abstract from differences in local planning arrangements other than those factored in separately as infrastructure requirements.⁹⁹

As can be seen in chart 11.1, it is also necessary to consider the extent to which transformation benefits will decline as dwelling supply changes. The change in transformation benefits as a greater amount of development occurs in an area reflects the use of the best sites for development initially, as well as the uptake ‘first’ by households with the highest value for the location and diminishing valuations placed on additional development. Operating against the decline in transformation benefits is the tendency of house and land prices to rise through time, meaning that transformation benefits for a given site will be higher in ten years time than now.

What is captured in site value?

The site value and generic demand curve of the type illustrated reflects the value that households place on land in a particular location. This value in turn reflects the characteristics of the location, such as amenities and recreation, employment opportunities, housing type, crime and climate, individual preferences for these characteristics and idiosyncratic factors such as income and wealth and location of family, friends and work.

This can be rearranged as:

$$TB = (VS_N - VS_O - Cost_{land}) + (VD_N - VD_O - Cost_{other})$$

The transformation benefits then collapses to the difference in site values less the costs of transforming the site if the additional value of new dwellings is equal to their costs ($(VD_N - VD_O - Cost_{other}) = 0$), which is a reasonable assumption in a competitive building market, where building costs include a normal profit on construction. The land value data used in this study captures VS.

⁹⁹ These costs are partly responsible for the existence of transformation benefits and differences in transformation benefits between areas. Planning related costs and even differences in planning costs across areas may partly reflect regulatory constraints aimed at minimising the costs on existing residents. Evidence on the extent to which this is true has not been gathered for this study.

Not everyone's value matters for the possible transformation benefits at each location. Rather it is the value of the households whose choices of location would change under the different scenarios. These are the marginal households – those whose values are close to the current market value of sites in that location. This means that current market values can be used, in conjunction with information of costs of transformation, as a basis for estimating transformation benefits. Indeed, there is a long history of using house and land prices in this way, known as hedonic pricing.¹⁰⁰ Hedonic pricing seeks to identify the unique influence of particular characteristics on land or dwelling value. In this instance we are interested in the influence of zoning.

The current site value reflects current levels of amenity and traffic congestion. This means that projecting forward using this approach does not double count changes in these factors that have been covered elsewhere, such as changes in traffic congestion.

What is the market telling us about transformation benefits?

The best broad indicator of transformation benefits is what is happening in the market. New dwellings will tend to be developed where there are transformation benefits and not where these benefits are low (or negative). However, it is important to recognise that the market signal reflects the policies in place. For instance there may be transformation benefits to be had but the market does not reflect this because of the current infrastructure charges, planning controls etc that seek to incorporate the costs discussed in other parts of this report.

The current signals from the market suggest that infill areas are likely to have greater transformation benefits. From 2001 to 2008, approximately 80 per cent of new dwellings were created in infill areas.¹⁰¹ There are similar expectations for dwelling production in the short term, with 79 per cent of new dwellings expected to be created in existing urban areas for the period 2008-09 to 2012-23.¹⁰²

For the purposes of confirming these directions from the market, we held structured discussions with a number of major developers. The general themes that emerged

¹⁰⁰ Rosen, S. 1974, 'Hedonic prices and implicit markets: product differentiation in pure competition', *The Journal of Political Economy*, Vol. 82, no. 1, pp. 344-55; Gibbons, S. and Machin, S. 2008, 'Valuing school quality, better transport and lower crime: evidence from house prices', *Oxford Review of Economic Policy*, Vol. 24, no. 1, pp. 99-119; Davidoff, I. and Leigh, A. 2008, 'How much do public schools really cost? Estimating the relationship between house prices and school quality', *The Economic Record*, Vol. 84, No. 265, June, pp. 193-206; Smith, V. K. and J. Huang 1995, 'Can markets value air quality? A meta-analysis of hedonic property value models', *Journal of Political Economy*, Vol. 103, no. 1, pp. 209-27.

¹⁰¹ NSW Planning 2010, *Metropolitan Development Program 2008-09 Report*, February, p. 79.

¹⁰² NSW Planning 2010, *Metropolitan Development Program 2008-09 Report*, February, p. 79.

from these discussions were that, given current development arrangements, there was limited ability for developers to make returns in Greenfield areas and often the land had a higher value as small rural properties than it could have as a residential development. There were some Greenfield areas where returns could be made¹⁰³ but particularly in the South West it was unlikely that demand could match the prices required by developers in order to pursue these projects. In infill areas developers were generally more positive, although they recognised that their ability to continue to redevelop in existing urban areas was highly dependent on the timeframes of planning processes and the existence of sites that did not require negotiating with a large number of owners.

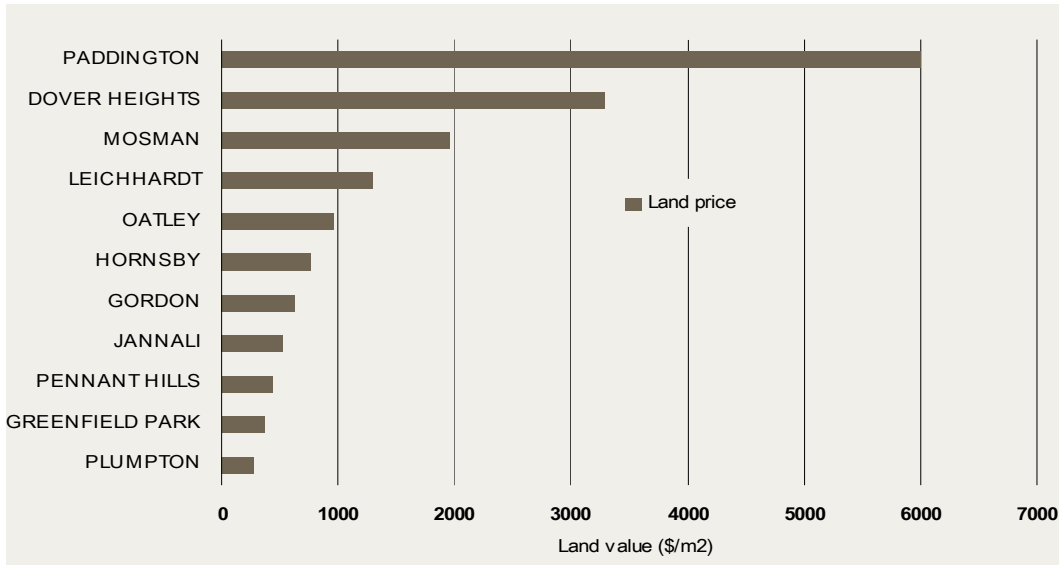
The market, or data derived from the market, can also tell us about the current value placed on land in different areas. The NSW Land Valuer General constructs land price estimates for use in calculating land tax and council rates. This measure is based on the 'unimproved' value of the land at that point in time, reflecting the location, amenities, zoning and other characteristics of the land, estimated using the market value of parcels of land sold nearby and sales of houses and units. 'Unimproved value' captures some improvements to the land including clearing of timber and vegetation, removal of stone, improvement of soil and excavation, filling, grading and leveling.¹⁰⁴ While not perfect, this data is the best available measure of the value of land in different local government areas and for differently zoned properties. As such it can serve as a proxy of the value of land under alternative uses and hence the potential benefits from transforming the land for alternative use.

Using this data, across Sydney, land prices (on a per square metre basis) differ markedly. According to representative values published by the Valuer General, average land prices can be as high as \$6000 per square metre (in Paddington, Woollahra) compared with \$300–400 per square metre in many other areas. Examples of land prices are shown in chart 11.2.

¹⁰³ For instance the queuing at Oran Park suggests there could be demand for this area; ABC News 2010, 'Desperate Sydneysiders camp for new land,' March 26.

¹⁰⁴ NSW Parliament, Valuation of Land Act 1916, section 4.

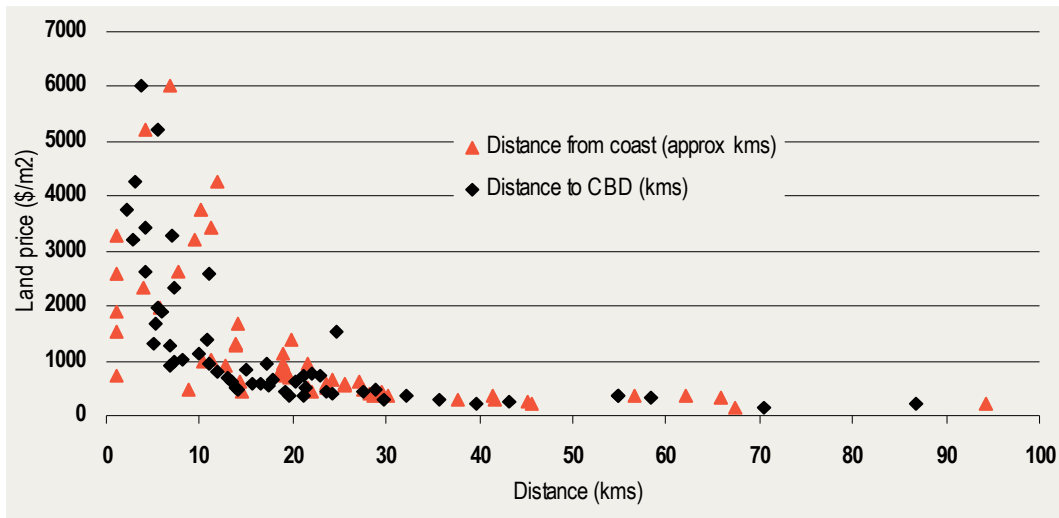
11.2 Land prices in selected Sydney suburbs



Data source: NSW Land Valuer General, Table 1: Representative Land Values for the Sydney Metropolitan Area.

The most important drivers of differences in average land price are distance from the coast and from the CBD (chart 11.3). In fact, for the set of suburbs for which indicative data is publicly available, 86 per cent of the variation in average land price for these suburbs is explained by these two variables alone.

11.3 Land prices and distance from CBD and coast



Data sources: NSW Land Valuer General, Table 1: Representative Land Values for the Sydney Metropolitan Area; CIE calculations.

The conclusions from the evidence available in the market at the moment is that there are likely to be more infill sites that have transformation benefits relative to Greenfield sites and that the highest values tend to be placed on properties located nearer the coast and CBD.

Estimating transformation benefits from alternative growth paths

The approach that we have taken to estimating transformation benefits from alternative growth paths is based on the valuation of sites under alternative uses. For example, the land value of an industrial site in Summer Hill is \$500 per square metre. Nearby medium density residential properties have a land value of \$700 per square metre. Transformation could therefore lead to gains of \$200 per square metre less the costs required to make the industrial sites suitable for residential development, such as remediation and other costs. If these were \$150 per square metre then the aggregate transformation benefit would be \$50 per square metre of land transformed.

The approach uses information on the current value of properties able to be used for alternative purposes in the Sydney area collected by the NSW Land Valuer General. Average property values cannot be used to identify the value of property under alternative uses as properties are likely to be in different locations. For example, industrial properties are not typically located in areas with stunning views or beachside access. In order to accurately identify the component of land value that is attributable to the use of the property we therefore have to find properties that have a similar location but different use.

Control group analysis

The process of matching properties that are similar in most respects but have different use is a control group approach. A control group approach involves considering the difference between the group of interest (such as medium and high density developments) and a control group of low density residential properties. The key feature of a control group approach is that important differences between the group of interest and low density residential properties are removed by only considering low density residential properties with similar attributes. Following the example earlier, if the value of industrial property was negatively affected because a large share of this property was in undesirable locations then a comparison of average industrial value with average low density residential value would not be a like-for-like comparison.

A control group approach avoids this potential bias by matching each property of interest with a similar low density residential property (or properties).

We match properties on the basis of the size of the property and the location of the property. For medium and high density properties for example, we match with low density residential properties within 100 metres and within 10 per cent of the property size. To minimise issues of data quality we take the median land value of all the matched low density residential properties.

Summary of dataset

The Land and Property Management Authority provided us with a dataset of land valuations and other characteristics for all properties in the Sydney statistical division. This dataset includes the:

- property address;
- local government area;
- property size (in square metres or hectares – all are converted into square metres);
- property value as of 2009;
- whether the property is a strata property or not. Note that each strata property (i.e. a block of units) is a single record;
- the zoning of the property – this differs across LGAs. For most LGAs properties are zoned broadly, such as residential, industrial, commercial, open space and non-urban. For a small number of LGAs, zoning information is more detailed such as low density residential, medium density residential and high density residential; and
- the latitude and longitude of the property location.

In total the dataset contains 1.3 million property records and information is available in most categories for over 1 million records. Summary statistics for the raw dataset are shown in table 11.4.¹⁰⁵ As can be seen by the variability within the data, there is some data cleaning required to ensure that the data used is of high quality. We undertake data cleaning as part of the control group analysis discussed below.

11.4 Summary statistics for dataset

<i>Variable</i>	<i>Obs.</i>	<i>Mean or no of categories</i>	<i>Standard deviation</i>	<i>Min</i>	<i>Max</i>
Council	1 260 309	43	.	.	.
Property type	1 260 309	2	.	.	.
Zoning	1 260 309	36	.	.	.
Property area (m ²)	1 246 794	8 293	618 127	0.0	3.0e+08
Property value (\$)	1 260 309	514 110	1 218 315	1.0	2.0e+08
Property value per m ²	1 246 793	952	27 629	0.0	2.1e+07
Latitude	1 252 896	-33.8	0.19	-34.3	-33.0
Longitude	1 252 896	151.0	0.22	150.1	151.6

Source: The CIE analysis of land value database.

Using this dataset, we consider three types of transformation:

- low density residential to higher density residential

¹⁰⁵As can be seen by the variability within the data, there is some data cleaning required to ensure that the data used is of high quality. We undertake data cleaning as part of the control group analysis discussed below.

- industrial to residential
- non-urban to residential.

Low density residential to higher density residential development

In many areas there are likely to be transformation benefits from redeveloping low density residential areas into higher density residential. For most local government areas we do not have residential zoning data disaggregated into different densities. Instead we use strata properties as a proxy for higher density residential development. This is a relatively good proxy, although it does not distinguish between medium and high density development and there are some apartment blocks that are not strata buildings.¹⁰⁶ In addition, there will be areas that are zoned for higher density use but that are not used for higher density.

We match each strata development with non-strata residential properties of a similar size (within 10 per cent) and in a similar location (within 100 metres). For this group of matched properties we find the median land value per square metre. This process is undertaken across every strata property in the Sydney statistical division, giving the unit value of land with residential strata properties against the unit value of land with residential non-strata properties for all strata properties. In table 11.5 we report these statistics, as well as the difference between them, which is the estimated transformation benefit, and the statistical certainty around the estimate of transformation benefit.

The size of the transformation gain from developing low density residential properties into higher density use varies from less than zero in Mosman to \$784 per square metre in Waverley. In terms of percentage uplift in land value, the highest transformation benefits are estimated to be in Ku-Ring-Gai, where properties with higher density development are valued at 50 per cent more than those with lower density development.

11.5 Transformation benefits from redevelopment of low density residential areas

LGA	Number of strata properties used	Land value of strata properties \$/m ²	Land value of non-strata properties \$/m ²	Transformation benefit			
				Average \$/m ²	Average % of low density value	5% CI \$/m ²	95% CI \$/m ²
Ashfield	340	989	879	110	12	84	135
Auburn	336	628	545	83	15	64	102

(Continued on next page)

¹⁰⁶ They have a single owner of all units and hence do not need strata arrangements.

11.5 Transformation benefits from redevelopment of low density residential areas (continued)

LGA	Number of strata properties used	Land value of strata properties \$/m ²	Land value of non-strata properties \$/m ²	Transformation benefit			
				Average \$/m ²	Average % of low density value	5% CI \$/m ²	95% CI \$/m ²
Bankstown	531	462	420	42	10	36	49
Baulkham Hills	230	449	426	23	5	11	36
Blacktown	487	340	320	21	7	15	27
Blue Mountains	96	269	235	34	14	13	54
Botany Bay	179	1 100	923	177	19	71	283
Burwood	73	1 050	861	189	22	103	275
Camden	55	356	310	46	15	21	72
Campbelltown	381	255	245	10	4	6	15
Canada Bay	309	1 720	1 413	307	22	252	362
Canterbury	1 134	834	632	201	32	190	213
Fairfield	330	522	419	103	25	84	122
Gosford	1 843	518	495	23	5	14	32
Hawkesbury	424	307	298	8	3	4	13
Holroyd	400	515	448	68	15	53	82
Hornsby	618	546	494	52	11	35	69
Hunters Hill	86	1 325	1 271	54	4	-41	149
Hurstville	448	1 028	868	160	18	124	195
Kogarah	350	937	795	143	18	117	168
Ku-ring-gai	174	925	607	318	52	262	375
Lane Cove	45	1 340	1 101	240	22	23	457
Leichhardt	286	2 200	1942	258	13	193	323
Liverpool	302	471	408	63	15	49	77
Manly	787	2 242	2 051	190	9	130	251
Marrickville	342	990	1 023	-33	-3	-61	-4
Mosman	470	2 377	2 453	-77	-3	-142	-12
North Sydney	1 071	2 490	2 372	118	5	55	180
Parramatta	637	639	566	73	13	59	87
Penrith	799	319	309	9	3	5	14
Pittwater	158	1 479	1 063	416	39	334	498
Randwick	1 544	2 163	1 877	286	15	250	322
Rockdale	467	1 137	876	260	30	225	296
Ryde	590	981	746	235	32	214	256
Strathfield	105	895	778	118	15	65	170
Sutherland Shire	1 329	859	813	46	6	32	60
Sydney	341	4 343	3 996	347	9	182	512
Warringah	736	1 678	1 347	331	25	300	362
Waverley	1 041	3 939	3 155	784	25	687	882
Willoughby	207	1 343	1 118	225	20	165	286
Wollondilly	31	201	163	38	23	15	60
Woollahra	883	4 082	3 941	140	4	44	236
Wyong	713	342	336	5	2	-2	13

Source: The CIE analysis of land value database.

For Lane Cove and a subset of Ku-Ring-Gai we have additional information on the density of residential development (low, medium and high). We undertake a similar process considering the value of medium and high density properties matched with similar and nearby low density properties. For these areas, the transformation benefits are estimated to be higher for moving to high density residential rather than to medium density residential development. The estimated transformation benefit from moving to high density is similar for Lane Cove but lower for Ku-Ring-Gai relative to the standard approach. This may reflect that rezoning is only part of the change necessary to generate higher density development and that there are properties zoned for higher density development that are not developed to this level due to other constraints imposed on development.

11.6 Comparison of transformation benefits from higher density

LGA	Strata properties		Medium density		High density	
	Obs.	Transform. benefit	Obs.	Transform. benefit	Obs.	Transform. benefit
	no.	\$/m ²	no.	\$/m ²	no.	\$/m ²
Lane Cove	45	240	290	-26	530	208
Ku-Ring-Gai	174	318	209	-14	547	58

Source: The CIE calculations based on land value database.

Industrial to residential development

A significant part of residential redevelopment in Sydney has and will continue to reflect redevelopment of industrial sites rather than redevelopment of existing residential sites. For example Green Square and residential areas around Olympic Park were formerly industrial areas that have been redeveloped for housing and other purposes. Former industrial areas are typically redeveloped as medium or high density residential areas. For the purposes of this study the uplift is measured in two stages. The first is the uplift from industrial to low density residential (below). The second stage is the estimates above of the uplift from low density residential to higher density residential discussed above. The process is undertaken in two stages as there are many more low density residential properties to match near industrial areas than there are higher density properties.

For industrially zoned properties, the matching criteria are weaker, as industrial properties are often much larger than residential properties. We matched industrial properties with residential properties within 300 metres of an industrial property. The results are shown in table 11.7.

Industrial land is typically valued at a substantial discount to low density residential land. In some areas where industrial land is near premium residential land the extent of uplift could be over \$1000 per square metre, while in others, industrial land is valued at similar rates to low density residential land.

Transforming existing industrial areas can have high costs of remediation. For instance in table 11.8, major industrial area remediation projects in Sydney have ranged from \$35 million to \$137 million and taken up to 10 years to complete. On a per hectare basis, costs for these projects range from \$180 000 per hectare (or \$18 per square metre) to \$25 million per hectare (or \$2500 per square metre). This figure excludes the costs of holding land for years while it is being remediated, although holding costs are partly offset by appreciating land value.

11.7 Transformation benefits from redevelopment of industrial areas

LGA	Number of industrial properties used	Land value of industrial properties	Land value of residential properties	Potential transformation benefit (excluding remediation and conversion costs)			
				Mean	Mean	5% CI	95% CI
	no.	\$/m ²	\$/m ²	\$/m ²	%	\$/m ²	\$/m ²
Ashfield	60	832	1 348	516	62	595	437
Auburn	707	536	620	85	16	105	65
Bankstown	1 205	539	471	-68	-13	-57	-78
Baulkham Hills	98	359	400	41	12	70	13
Blacktown	720	313	267	-46	-15	-36	-55
Blue Mountains	155	190	207	17	9	22	11
Botany Bay	486	833	2 098	1 264	152	3 509	-981
Burwood	2	449	835	386	86	844	-72
Camden	140	263	278	15	6	35	-4
Campbelltown	438	283	269	-15	-5	-5	-24
Canada Bay	94	849	1 013	164	19	222	105
Canterbury	614	626	579	-46	-7	-31	-62
Fairfield	731	377	361	-16	-4	-10	-23
Gosford	313	296	305	9	3	22	-3
Hawkesbury	192	257	297	40	16	51	29
Holroyd	389	352	416	64	18	74	55
Hornsby	244	431	597	166	38	206	126
Hunters Hill							
Hurstville	328	528	719	191	36	208	175
Kogarah	115	621	741	120	19	144	97
Ku-ring-gai							
Lane Cove							
Leichhardt	151	892	2 129	1 236	139	1 347	1 126
Liverpool	279	313	372	59	19	73	46
Manly	33	939	1 340	401	43	445	356
Marrickville	1 044	937	1 270	333	36	349	318
Mosman							
North Sydney							
Parramatta	663	524	475	-50	-9	-33	-66
Penrith	466	239	300	61	26	70	53
Pittwater	185	752	935	183	24	232	134
Randwick	82	630	808	178	28	218	138
Rockdale	184	686	888	202	29	237	166
Ryde	130	612	793	180	29	215	146
Strathfield	183	606	657	52	9	88	16

(Continued on next page)

11.7 Transformation benefits from redevelopment of industrial areas (continued)

LGA	Number of industrial properties used	Land value of industrial properties	Land value of residential properties	Potential transformation benefit (excluding remediation and conversion costs)			
				Mean	Mean	5% CI	95% CI
	no.	\$/m ²	\$/m ²	\$/m ²	%	\$/m ²	\$/m ²
Sutherland Shire	23	322	533	211	66	242	180
Sydney	61	921	2 063	1 142	124	1 372	912
Warringah	602	781	965	184	24	204	165
Waverley							
Willoughby	221	860	951	91	11	144	39
Wollondilly	14	224	150	-74	-33	-43	-105
Woollahra							
Wyong	133	157	280	123	78	137	108

Source: The CIE analysis of land value database.

The projects cited in table 11.8 are those that would have higher remediation costs. There will be other industrially zoned areas with smaller costs to ensure that they can be used for residential purposes.

11.8 Remediation costs of selected industrial sites

Site	Financial costs	Time	Land area	Cost per hectare
	\$m	years	ha	\$/ha
HMAS Platypus Site ^a	46	2	1.8	25 555 556
Olympic Park ^b	137	10	760	180 263
Southlands Banksmeadow ^c	110	-	18.3	6 010 929
Lednez Union Carbide site, Rhodes Peninsula (and Homebush Bay) ^d	100	5	10	10 000 000
Allied Feeds site, Rhodes Peninsula ^d	35	4	5	7 000 000
Breakfast Point ^e	70		52	1 350 830

^a <http://www.environment.gov.au/minister/garrett/2009/mr20090527.html>, Accessed 30 July 2010.

^b http://www.sydneyolympicpark.com.au/education_and_learning/history/site_remediation, Accessed 3 July 2010.

^c <http://www.oricabotanytransformation.com/files/pdf/Southlands/SouthlandsProjectScopingBreifingDocumentToDoP.pdf>, Accessed 30 July 2010. Note that remediation is to make suitable for industrial use rather than residential use.

^d <http://www.rhodesremediation.com.au/index.php?q=node/1>, Accessed 30 July 2010.

^e http://www.planning.nsw.gov.au/asp/pdf/bp_breakfast_point_concept_plan.pdf; <http://drummoyne-village-voice.whereilive.com.au/news/story/toxins-linger-beyond-the-picket-fence/>, Accessed 30 July 2010.

Source: As noted above.

The wide variation in remediation costs (table 11.8) suggest that the transformation benefits from old industrial land will vary widely depending on the site location and extent of remediation required. We base analysis on remediation costs of \$200 per square metre equivalent to \$2 million per hectare applied to all industrial sites. These costs are subtracted from the transformation benefits estimated in table 11.7. We also add in the additional transformation gains from low density to higher density as

industrial sites are typically developed at higher density. It should be noted that this analysis does not take account of the benefits accrued to the wider economy from retaining critical industrial precincts, such as Botany.

Non urban to residential development

On Sydney's fringe and in some other areas, residential development will occur through developing non-urban land. Non urban land includes agricultural land and small land holdings. Development within the growth centres involves the rezoning of non urban land to residential.

The benefits from transforming non-urban land into urban land were estimated using the same control group approach as used for industrial and higher density residential properties. For non-urban zoned properties, the matching criteria have to be significantly weaker as land is further from existing residential areas. We matched non-urban properties with residential properties within 1000 metres of the non-urban property. The results of the analysis for those LGAs for which it is applicable are shown in table 11.9. Note that the non-urban properties with the lowest 5 per cent and highest 5 per cent of land values per metre squared are removed from the analysis to ensure data quality.

The possible transformation benefits before considering costs of converting non-urban to residential land are relatively constant at \$150 to \$300 per square metre in most of the areas with significant non-urban land (table 11.9). In Camden the transformation benefits are estimated to be significantly lower (a mean of \$19 per square metre, reflecting the low value of residential properties near non-urban land. In Pittwater and Warringah the benefits are estimated to be significantly higher (a mean of \$736 and \$674 per square metre respectively), reflecting the much higher residential property values in these areas. This could overstate the transformation benefits in these areas as a number of developers cited Warriewood (in Pittwater) as an example of an area where the land had higher value in its current state and where they could not compete with the prices offered in the market for these parcels of land. This may reflect inaccuracies in land valuations.

The costs of transforming non-urban land into residential land are high. They include significant costs of excavation, filling etc and subdivision. These costs are likely to vary according to the site, depending on factors such as topography and existing infrastructure. Alternative estimates of the magnitude of subdivision costs include:

- \$82 000 per lot (of 500 square meters) not including the developer profit margin but including selling and holding costs.¹⁰⁷ Including the developers margin as a required return for risk would add an additional \$52 000 per lot; and

¹⁰⁷ Meeting with Landcom, 7 April 2010.

- just over \$40 000 per lot (of 450 to 550 square meters) for land preparation costs.¹⁰⁸ This figure excludes holding costs, a developer return for bearing risk and potentially some of the infrastructure costs required within a Greenfield development.

11.9 Transformation benefits from development of non-urban areas

LGA	Number of non-urban properties used	Land value of non-urban properties	Land value of residential properties	Potential transformation benefit (excluding conversion costs)			
				Mean	Mean	5% CI	95% CI
	no.	\$/m ²	\$/m ²	\$/m ²	%	\$/m ²	\$/m ²
Baulkham Hills	955	41	283	241	582	231	251
Blacktown	575	39	258	219	564	208	230
Blue Mountains	753	25	177	152	619	147	157
Camden	314	80	99	19	24	1	37
Campbelltown	18	31	279	248	803	214	283
Gosford	53	76	276	201	266	177	225
Hawkesbury	1 085	46	252	206	446	200	213
Hornsby	551	53	351	298	562	288	309
Liverpool	553	44	215	171	390	161	181
Penrith	1 315	59	313	254	429	249	258
Pittwater	366	143	879	736	515	720	752
Sutherland Shire	94	45	551	506	1 119	482	530
Warringah	315	101	774	674	670	657	691
Wollondilly	2 366	58	191	133	229	109	157
Wyong	316	69	221	153	222	142	163

Source: The CIE analysis of land value database.

We adopt a mid-range from these possible options of \$82 000 per lot or \$164 per square metre. This excludes developer margins, which if viewed as an appropriate return for bearing risk could also be included in the conversion cost figure, but is high than the land preparation cost figure reported by URBIS. The figure of \$164 per square metre is applied to each area.

Future transformation benefits

Future transformation benefits would not be expected to be the same as current transformation benefits estimated above. Key factors that will impact on future transformation benefits of particular development paths include:

- costs of development;
- preferences and demography;
- the location and type of employment; and

¹⁰⁸ URBIS 2010, *National Dwelling Costs Study Report*, prepared for the National Housing Supply Council, January, p. 20.

- the extent to which LGAs can continue to provide transformation gains as density rises, given both the use of the 'best' sites for redevelopment and the extent to which demand for a particular property type and location will be saturated.

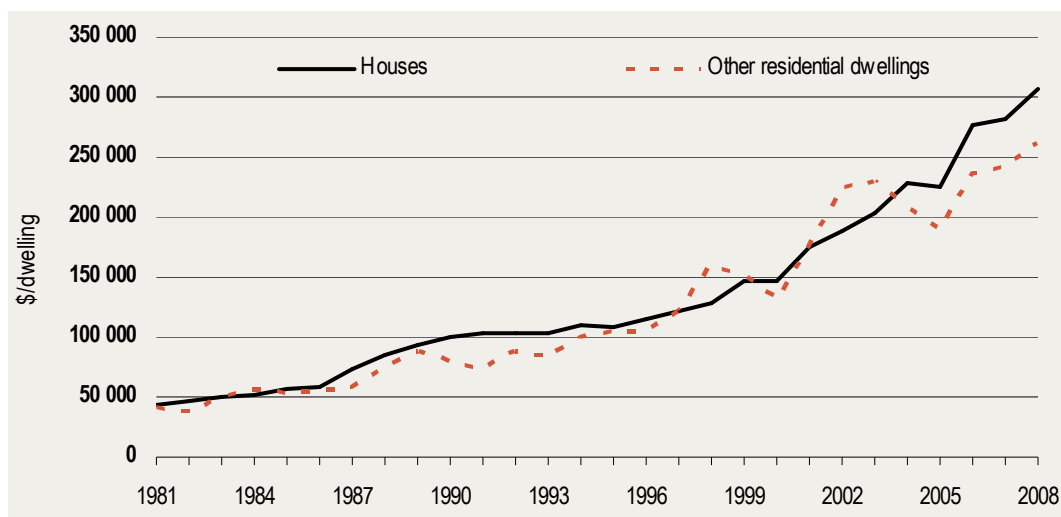
These factors are discussed below.

Costs of development

Costs of development incorporate the costs of negotiating with existing landholders and council, landscaping, building and construction, provision of infrastructure connections to relevant networks, holding costs and a return for the risk taken by developers. These costs can vary across locations. They also vary considerably depending on the nature of the building, with higher density dwellings costing more than twice as much per square metre of floor space provided.¹⁰⁹ For example, residential building costs are similar for houses and units despite units typically being much smaller (chart 11.10).

If there are significant variations in the costs of building different types of development this would be expected to change the transformation gains. For example, if cheaper ways are found to build medium density developments (without changing quality) then this would make these developments more attractive commercial propositions.

11.10 Cost of residential building in NSW



Data source: ABS, Cat. no. 8752.0, *Building Activity September 2009*, Canberra.

¹⁰⁹ Figures provided by the Urban Development Institute of Australia (development toolkit) indicated that high rise residential development (6 storeys and over) would typically cost more than \$2500 per square metre, medium rise (3-6 storeys) would cost \$1200-2500 per square metre and low rise (up to 3 storeys) would cost \$800-\$1500 per square metre.

Preferences and demography

There is a commonplace view from developers and others that there is a movement in preferences away from the suburban block towards the amenities often available in denser development. Whether or not this proves to be long-lived or whether it is a response to prices and availability is unclear.

Demographic change would also be expected to influence the demand for different development types. For example, some people downscale as they get older. This demand driver would also influence future transformation benefits from alternative growth paths.

Employment

Living near high paid employment is a valuable attribute. The current transformation benefits reflect the current and expected pattern of employment across Sydney and the ease with which people can move around Sydney.

Large changes in employment patterns, for example a continued expansion of Sydney as a global services hub would change the demand for land and the benefits of alternative growth paths.

Market saturation and use of major sites

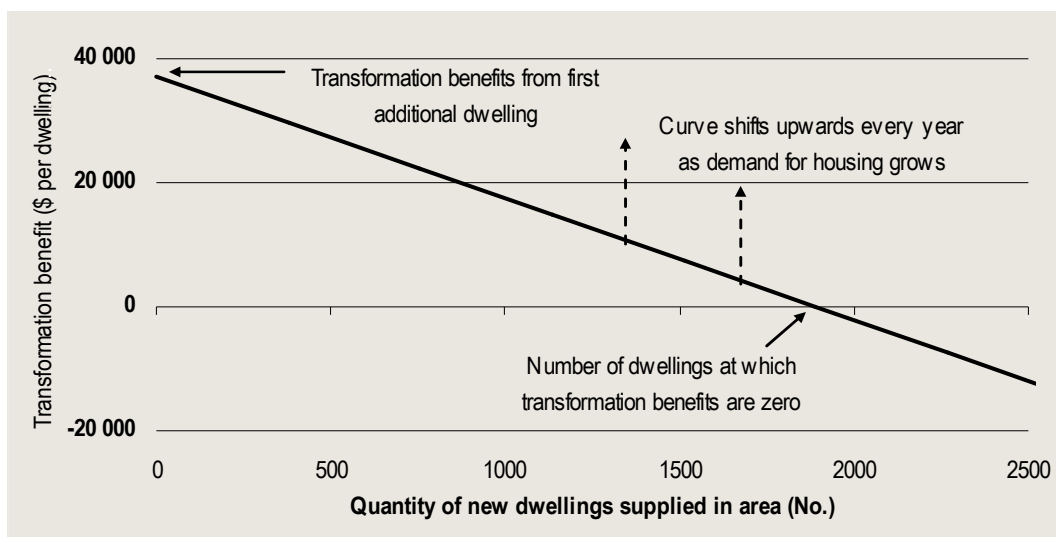
There are both supply and demand side factors that would lead to the expectation that additional transformation gains will depend on the amount of development in the area, as discussed for chart. On the supply side, more development in an area necessitates using sites that are more costly to develop. On the demand side, more development necessitates using sites that are have less value for whatever reason and in targeting households that have weaker preferences for that location. Together these factors suggest that transformation benefits for each new dwelling, or the gap between supply and demand curves in chart 11.1, will be lower for greater levels of development.

There are a number of factors that could offset declining transformation benefits. To some extent, additional development in an area could bring amenities that have value and have not been accounted for elsewhere in this report. This could be particularly true in Greenfield areas. More importantly, across Sydney, population growth would lead to greater demand for housing, higher house prices and therefore greater transformation benefits.

The extent to which these factors change transformation benefits is hard to discern. Given the importance of these influences, we have attempted to model changes in transformation benefits, based on the approach in chart 11.11. This is based on interpolating from the maximum transformation benefits (those from the 'first' / most valued additional dwelling that are estimated by the procedure described above) to

the point at which transformation benefits would equal zero in the absence of changes in demand for housing. This is the black line shown in chart 11.11. Through time the line will shift out as housing demand across Sydney grows.

11.11 Future transformation benefits



Source: The CIE.

The approach in chart 11.11 is estimated using the following method.

- Current transformation benefits within existing areas for each LGA are the maximum of the transformation benefits found from densification of urban areas, and redeveloping industrial areas. Current transformation benefits for Greenfield areas are the estimated for developing non-urban areas. The land size to which uplift figures are applied is 118 square metres for higher density residential development, based on the median across Sydney's LGAs at the moment, and 500 square metres for Greenfield areas.
- In the Growth Centres, developers indicated that there is commercial appetite for most development in the North West and a part of development in the South West. In total, we expect that this would amount to about 100 000 dwellings before transformation benefits became zero. Transformation benefits decline at a rate that would see zero transformation benefits from an additional 100 000 dwellings.
- In existing urban areas, major site data collected by NSW Planning suggests that there are 125 000 potential dwellings from major sites. This data is collected at the LGA level. There are other smaller sites that are commercially feasible for development. Based on the historical level of new dwellings in existing urban areas from major sites (41 per cent), we allow that transformation benefits to decline at a rate that would see zero transformation benefits when the major site limit plus additional commercial opportunities are used. Across Sydney, this would be about 300 000 new infill developments.

- Demand for housing will rise, leading to current transformation benefits understating future transformation benefits. We allow transformation benefits to rise by 3 per cent per year in real terms (i.e. excluding inflation) based on historical data on house price appreciation in Sydney. This partially offsets the declines due to use of major sites and the best Greenfield areas.

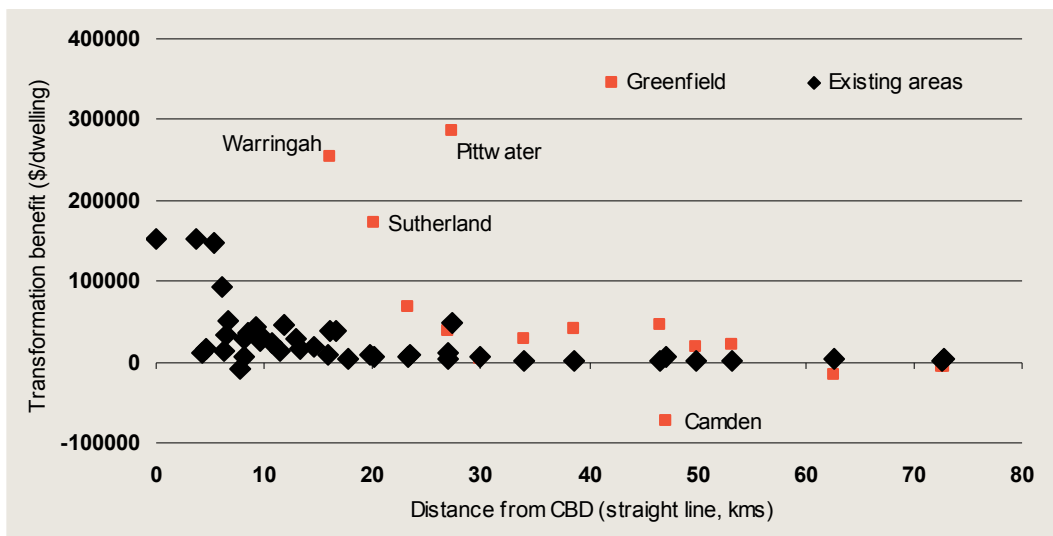
This approach does have limitations. For example, in areas for which current transformation benefits are high, but dwelling targets exceed dwelling projections from the Metropolitan Development Program, additional dwellings have sometimes high transformation costs. This is the case for Sydney LGA for example.

Summary of estimated transformation benefits across LGAs

Using the approach set out above, current transformation benefits are highest for Greenfield land in areas such as Pittwater, Warringah and Sutherland (chart 11.12). These areas have limited amounts of non-urban land available so transformation benefits are likely to fall quickly as new development occurs. There is the possibility that land valuations of non-urban land in these areas are not reflective of market values and hence overstate the possible transformation benefits.

Excluding these areas, transformation benefits tend to be lower for areas further from the CBD, on average, although there is substantial variation across the different LGAs. There are a small number of LGAs near the CBD with high transformation benefits – Botany Bay, Waverley, Leichhardt and Sydney. Camden is estimated to have negative transformation benefits for Greenfield development.

11.12 Transformation benefits and distance from CBD



Data source: The CIE.

The transformation benefits decline most quickly in areas with high estimated benefits but with a small number of major sites or Greenfield capacity.

Limitations of estimation method

The method that we have used is the best method of obtaining estimates of transformation benefits. However, it does have limitations including the following.

- Land value data is likely to incorporate to some extent expectations of possible rezoning. For example, the value of non-urban land near existing residential areas may reflect the possibility of future rezoning.
- The gap between land values for different zoning and property types could reflect the costs of transformation rather than the benefits of transformation, although in practice the market should work to match these. This means that to the extent that there are real economic costs of transformation that are not related to artificial scarcity created by planning restrictions and charges that are ignored we may be overstating the transformation benefits.
- The transformation benefits have been estimated based on a large number of properties. In practice, only a subset of those properties may be redeveloped and these are likely to be those with the highest transformation benefit. This would suggest that estimated transformation benefits may understate achievable transformation benefits, particularly for the next few years.
- There is limited information on whether and to what extent transformation benefits will become smaller as more development occurs. In some areas, additional development may actually increase transformation benefits for a period of time, as more development brings better services. In some areas transformation benefits will fall quickly as there are few attractive or easily developable sites.

Summary

The transformation benefits associated with each scenario, capturing current and expected future transformation benefits, are shown in table 11.13. Transformation benefits are shown relative to the base case – the 2005 Metropolitan Strategy reflecting the uncertainty around the level of transformation benefits.

Transformation benefits from the infill focused scenario are lower than the scenario reflecting the 2005 Metropolitan Strategy. Transformation benefits are lower again from the Greenfield focused scenario. The Greenfield focused scenario has significantly lower transformation benefits as the extent to which transformation benefits can continued to be achieved in Greenfield areas as more development occurs is limited, particularly in the South West. Offsetting this to some extent is that a fringe focused scenario has less development in the Sydney LGA, for which dwelling target levels from the Metropolitan Strategy impose transformation costs and hence fewer dwellings reduces these costs.

The estimates of transformation benefits are uncertain. Current market activity suggests that transformation benefits are likely to be highest when Greenfield development accounts for in the order of 20 per cent of new dwellings, depending on which Greenfield areas people are accommodated in. However, this level of market activity already factors in the current regulatory and policy environment.

11.13 Transformation benefits associated with each scenario

<i>Item</i>	<i>2005 Metropolitan Strategy</i>	<i>Focused on fringe/Greenfield</i>	<i>Focused on urban renewal</i>
Ratio – Infill: Greenfield	70/30	50/50	90/10
	\$m	\$m	\$m
Transformation benefits relative to Scenario 1	0	-1 716	-1 351
	\$/dwelling	\$/dwelling	\$/dwelling
Transformation benefits relative to Scenario 1	0	-3 804	-2 994

Notes: The costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE calculations.

The transformation benefit estimates above are heavily influenced by estimates in two LGAs – Camden and Sydney. In Sydney, transformation benefits are currently high but dwelling targets for the 2005 Metropolitan Strategy are large so that future transformation benefits are negative. In Camden, transformation benefits are low, and in scenarios with more Greenfield development, a significant part of the additional development occurs in Camden. Excluding these areas, transformation benefits between the 2005 Metropolitan Strategy and the fringe focused strategy are similar.

It may also be possible to find better strategies in terms of transformation benefits through linking transport infrastructure to the amount of development in the area. This could have particular benefits in areas that are expected to have high location value, such as Eastern areas close to the beach. These areas would be expected to attract significantly higher values if they could be made more accessible to the CBD.

12 Comparing the scenarios

There are a number of ways in which different growth paths could be compared.

These include:

- total costs, including financial costs, social costs and environmental costs; and
- net benefits (or costs) relative to the 2005 Metropolitan Strategy, incorporating the difference in transformation benefits relative to the 2005 Metropolitan Strategy less the difference in total costs relative to the Metropolitan Strategy.¹¹⁰

The second, net benefits relative to the 2005 Metropolitan Strategy, is the preferred measure as it is the most inclusive, although it also has the widest error bounds, as information on transformation benefits is more difficult to measure.

All measures apply a discount rate to future costs and benefits of 7 per cent. This reflects that delaying costs has value, as financing costs can be avoided.

Net benefits relative to the 2005 Metropolitan Strategy

Of the three scenarios considered, the 90/10 scenario has the highest net benefits, at \$0.8 billion higher than the 2005 Metropolitan Strategy over the period to 2036 (table 12.1). In comparison, the 50/50 scenario has a net cost of \$5.0 billion relative to continuing with the 2005 Metropolitan Strategy. This cost difference is particularly significant as all scenarios are the same until 2016.

The fringe focused scenario has higher costs than the 2005 Metropolitan Strategy. This reflects higher costs related to transport infrastructure and congestion, higher costs related to water and sewerage infrastructure and higher environmental costs.

The 90/10 scenario has the highest net benefits because:

- physical infrastructure costs and transport costs are significantly lower than other scenarios;
- environmental costs are lower than other scenarios; and
- transformation benefits are lower but not enough to offset the lower costs.

¹¹⁰ Note that it is not possible to present the net benefits of each development path as there are many benefits that remain constant for all paths and have not been factored into the analysis. Hence it is only possible to consider net benefits relative to the 2005 Metropolitan Strategy.

In other categories its costs and benefits are relatively similar to the 2005 Metropolitan Strategy, and in any case the net benefits of the two scenarios differ only by a small amount given the uncertainty around the estimates of benefits and costs.

If transformation benefits are not considered the conclusion is the same, with the 90/10 scenario having lower total costs than the other scenarios. In this case however, the gap between a scenario focused on fringe Greenfield areas is slightly smaller than otherwise.

12.1 Costs and benefits of alternative growth paths

Category	2005	Focused on	Focused on	Deviations from	
	Metropolitan Strategy	fringe/Greenfield	urban renewal	Metropolitan Strategy	
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
	\$m	\$m	\$m	\$m	\$m
Transport					
Connecting transport	2 446	4 235	1 382	1 789	-1 065
Major infrastructure/congestion	11 057	11 599	10 786	542	-271
Physical infrastructure					
Electricity	1 903	1 919	1 898	16	-5
Water and sewerage	5 912	6 620	5 204	708	-708
Social infrastructure					
Primary education	2 064	1 922	2 186	-142	122
Secondary education	1 247	1 164	1 298	-84	51
Health	8 651	8 656	8 645	5	-5
Other social infrastructure	103	99	108	-4	5
Local council	6 529	6 695	6 419	167	-110
Environmental					
GHG emissions (relative to Metropolitan Strategy)	0	116	-116	116	-116
Air pollution	889	1 010	857	121	-33
Noise pollution	314	356	302	43	-12
Total costs	41 115	44 391	38 969	3 276	-2 145
Transformation benefits relative to Scenario 1	0	-1 716	-1 351	-1 716	-1 351
Net benefits relative to Scenario 1				-4 992	795

Notes: The benefits and costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE.

Per dwelling costs

Costs attributable to each new dwelling are shown in table 12.2.¹¹¹ Total costs are \$7 300 per dwelling created higher if a 50/50 scenario is chosen rather than a scenario representing the 2005 Metropolitan Strategy. The transformation benefits are \$3 800 per dwelling lower under the 50/50 scenario and \$3 000 lower under the 90/10 scenario, compared with the Metropolitan Strategy.

It is useful also to consider what happens if all development is in Greenfield areas after 2016. In this case, total costs are estimated at \$25 000 higher per dwelling than under the Metropolitan Strategy scenario.

12.2 Per dwelling costs and benefits of alternative growth paths

Category	2005 Metropolitan Strategy	Focused on fringe/ Greenfield	Focused on urban renewal	Deviations from Metropolitan Strategy	
				50/50	90/10
	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling	\$/dwelling
Ratio – Infill: Greenfield	70/30	50/50	90/10	50/50	90/10
Transport					
Connecting transport	5 422	9 387	3 062	3 965	-2 360
Major infrastructure/congestion	24 506	25 708	23 904	1 202	-602
Physical infrastructure					
Electricity	4 219	4 254	4 207	36	-11
Water and sewerage	13 103	14 672	11 535	1 568	-1 568
Social infrastructure					
Primary education	4 574	4 259	4 845	-315	271
Secondary education	2 765	2 579	2 877	-186	113
Health	19 173	19 184	19 161	11	-11
Other social infrastructure	228	219	240	-9	12
Local council	14 470	14 839	14 226	370	-243
Environmental					
GHG emissions (relative to Metropolitan Strategy)	0	257	-257	257	-257
Air pollution	1 971	2 238	1 898	267	-72
Noise pollution	695	790	669	95	-26
Total costs	91 124	98 385	86 369	7 260	-4 755
Transformation benefits				-3 804	-2 994
Net benefits				-11 064	1 761

Notes: The benefits and costs presented in this table reflect the net present value of costs from 2011 to 2036 using a 7 per cent real discount rate.

Source: The CIE.

¹¹¹ New dwellings are discounted in a similar way as costs and benefits to ensure comparability.

Comparison to previous studies

There are a number of previous studies of the costs of infill versus Greenfield development. In Sydney, Travers Morgan and Applied Economics conducted a study in 1991.¹¹² This study used particular case studies to assess how costs and benefits changed for developing Greenfield areas at a higher density and how costs and benefits changed through mixing in some urban consolidation. In today's dollars, the study found that infrastructure costs would be \$36 000 per dwelling lower for urban consolidation compared with Greenfield development. If the building and construction producer price indices were used this would be higher. We find smaller infrastructure cost differences between urban consolidation and fringe development, largely because the scale of the urban consolidation considered requires substantial infrastructure upgrades in existing areas. This can be seen in the large capital expenditure program of Energy Australia and the lack of capacity in social services such as education and health. In 1991, the smaller scale urban consolidation assessed required little infrastructure upgrade.

Travers Morgan and Applied Economics found transformation benefits from specific urban consolidation case studies equivalent to \$20 000 per dwelling in today's dollars. We find higher estimates for the transformation benefits of urban consolidation in some areas, particularly near the CBD and lower in others. This aligns with the stakeholder consultations that suggested there was a shift in preferences towards inner city living. It is also reflected in the steeper declines in house prices from inner to outer areas observed by NSW Department of Planning.¹¹³

A second influential and widely cited study has been that of Trubka, Newman and Bilsborough 2008.¹¹⁴ This study found much higher differences between inner and outer development costs in Perth than found in this study. Some of these differences reflect the inclusion of elements in their study that should strictly be seen as private costs and considered as part of the choices people make about where they live. In terms of infrastructure costs, estimates are relatively similar for roads and water and wastewater. In Sydney, electricity costs were found not to vary much by the growth path as infill development would require upgrades. For Perth, Trubka et al. found that electricity costs were double in outer areas.

¹¹² Travers Morgan and Applied Economics 1991, *Housing Costs Study No. 2: Evaluation of fringe development and urban consolidation*, prepared under the Australian Building Research Grants Scheme.

¹¹³ NSW Government's Metropolitan Strategy, *City of cities: A plan for Sydney's future*, Metropolitan Strategy supporting information, p. 125.

¹¹⁴ Trubka, Newman and Bilsborough 2008, *Assessing the costs of alternative development paths in Australian Cities*, Curtin University Sustainability Institute, for Parsons Brinkerhoff.

The biggest differences in infrastructure costs between Trubka et al and our findings were in social infrastructure. They found education costs of \$33 000 per dwelling for outer areas compared with only \$7 000 in our study (table 12.2). From the figures provided by NSW Education, Trubka et al.'s findings seem implausibly high and may not reflect a least cost approach to providing education facilities. In Sydney, we found that education costs were lower in Greenfield areas both because of lower land costs for schools and lower costs of building schools anew versus extensive upgrading. NSW Health indicated that for Sydney there would be little difference in overall costs for different growth paths, while for Perth outer areas were estimated to cost \$10 000 per dwelling more than inner areas. This could reflect the pattern of capacity availability in Perth.

The environmental impacts estimated by Trubka et al. for outer versus inner development are much larger than we find. Part of this difference is due to the value placed on reductions in GHG emissions (they use \$170 price of a tonne of carbon while we use Australian Treasury estimates of the price of emissions under an emissions trading scheme from \$20 to \$64). Some part must also reflect differences in the level of GHG abated, which could reflect differences between transport in Perth and Sydney. Our findings were based on extensive analysis in Rickwood 2009¹¹⁵ that found that even large changes in land use had relatively small impacts on GHG emissions from transport and dwellings. We also valued air pollution and noise pollution costs under each scenario.

¹¹⁵ Rickwood, P. 2009, *The impact of physical planning policy on household energy use and greenhouse emissions*, submitted for PhD to University of Technology Sydney, October.

13 Least cost growth path and sensitivity

There will be growth paths that are 'better' than any of the scenarios considered above. This could reflect a different pattern of growth at the LGA level or within particular suburbs and centres, as well as different shares of growth in Greenfield and existing areas.

Some of these questions can be addressed in this report, such as variation in outcomes across different levels of Greenfield development. But others are unanswerable without more detailed data about social and physical infrastructure requirements for specific sites across Sydney and highly localised transport modelling.

Share of Greenfield development

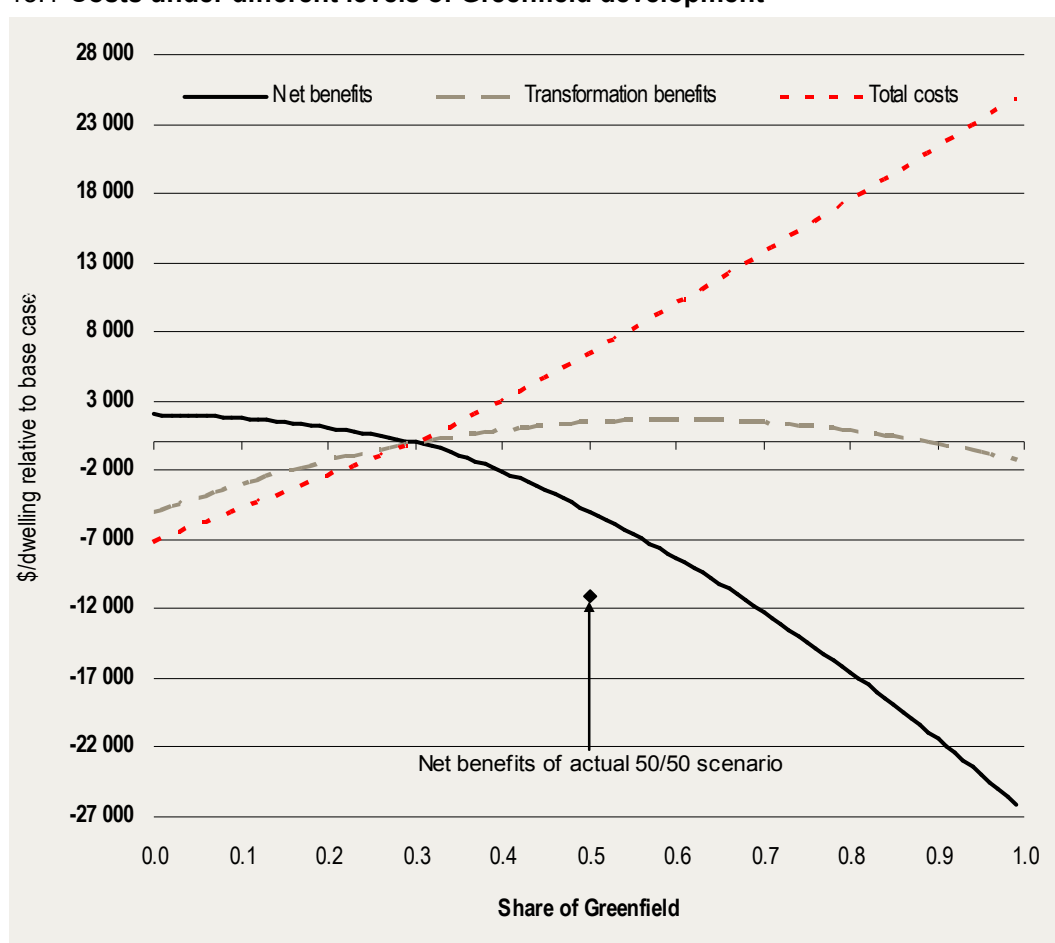
The benefits and costs of scenarios ranging from zero Greenfield to 100 per cent Greenfield development can be measured. There are many different ways of achieving a particular Greenfield share of development, with different allocations of dwellings across Greenfield areas and existing areas. The 2005 Metropolitan Strategy represents one way of accommodating about 30 per cent of new dwellings in Greenfield areas and 70 per cent in existing areas, while the specific 50/50 scenario represents one way of accommodating 50 per cent of the population in Greenfield areas for example. To consider scenarios capturing the range from zero to 100 per cent Greenfield development we use the share of existing area development to each LGA and the share of Greenfield development in each LGA and scale these up according to the proportion of development in Greenfield and existing areas. For example, if 4 per cent of the almost 600 000 new dwellings expected in existing areas under the Metropolitan Strategy were in Parramatta, then under a scenario where twice as many dwellings were expected in existing areas Parramatta would receive the same share (4 per cent) of the higher number of dwellings.

The net benefits, total costs and transformation benefits relative to the 2005 Metropolitan Strategy of alternative shares of Greenfield development are shown in chart 13.1, on a per dwelling basis. Net benefits fall gradually as more Greenfield development is added to about the share of the 2005 Metropolitan Strategy (30 per cent). Net benefits fall more quickly after this point, reflecting higher total costs and lower transformation benefits.

If the allocation of Greenfield development was made on the basis of highest transformation benefits and least cost then there would be a level of Greenfield development above zero that was better than having no Greenfield development.

Total costs for a 100 per cent Greenfield scenario are \$25 000 per dwelling higher than the 2005 Metropolitan Strategy and transformation benefits are \$1200 lower. That is, Greenfield development incurs greater infrastructure, environmental and social costs in order to accommodate people in areas that they place less value on than the dwellings provided under the Metropolitan Strategy.

13.1 Costs under different levels of Greenfield development



Data source: The CIE.

Alternative development paths across LGAs

For some types of costs and benefits it is possible to consider changes in development paths across LGAs. This suggests that there will be considerably better scenarios than any modelled in this study, particularly through considering development paths that have a greater range of outcomes in the Eastern and Northern areas of Sydney.

The model used in this report would suggest that greater development in areas closer to the CBD and potentially in the North and North East subregions could have higher benefits than in other areas. Potentially, transport infrastructure projects could allow the locational benefits of areas close to the beach to be fully realised.

Centres versus spread across existing suburbs

The Metropolitan Strategy aims to build up areas near transport nodes rather than spread new development across all areas. In few areas was information available at a level of aggregation that could shed light on these issues.

Locating people around centres and transport nodes aims to:

- reduce transport demand and shift demand towards transport options that have economies of scale, such as buses and trains; and
- maximise transformation benefits through creating positive amenity impacts and reducing negative neighbourhood effects.

The transport impacts of centres policies were considered by Rickwood.¹¹⁶ Shifting people towards centres did have small impacts on transport use and mode (and resulting environmental impacts).

Locating people around centres and transport nodes may have some unintended consequences through higher localised congestion around these centres, while reducing congestion on major roads. This would be able to be managed to some degree through road changes and connecting public transport services. In the absence of new public transport infrastructure, current services may also be more crowded.

Locating people near centres will also have impacts on other infrastructure. There could be local capacity constraints in water and wastewater and electricity networks requiring network expansions. It is unlikely that schools will co-locate in centres as land will be expensive.

The costs and benefits associated with these issues are unable to be evaluated in this study due to a lack of data about the physical and social infrastructure costs and transport impacts of focusing around centres versus spreading development around existing areas. It would be possible in the future to consider the transformation benefits around centres and further from centres using the valuation data. This would also help to identify the extent to which the targets for dwellings were compatible with commercial feasibility for developers.

¹¹⁶ Rickwood, P. 2009, *The impact of physical planning policy on household energy use and greenhouse emissions*, submitted for PhD to University of Technology Sydney, October.

Key sensitivities

In considering the costs of alternative growth paths, there are many areas for which only partial or incomplete information is available. In other areas, assumptions are made about the future, which are by definition uncertain. For example, there could be innovation in development of medium density that significantly reduces the costs of this type of development, improvements in fuel and emissions technology in cars and in power stations or changes in the industry structure of Sydney. These would all have implications for the preferred growth path for Sydney.

The conclusions drawn in this study are robust to substantial variations in the underlying assumptions, although there are areas that cannot be tested that could be important, such as economies of scale in transport provision, employment patterns and changing preferences.

The results of the economic modelling were tested using variations in each parameter individually by +50 per cent and -50 per cent. The 90/10 scenario remained the preferred scenario under these changes. For example, even if electricity upgrades in existing areas cost 50 per cent more than in Greenfield areas because of difficulties with working within existing areas, then the 50/50 scenario would have net costs of \$4.9 billion compared with the 2005 Metropolitan Strategy (compared to net costs of \$5.0 billion if electricity upgrade costs were the same in existing and Greenfield areas).

Factors such as the discount rate proved unimportant in distinguishing between scenarios.

14 Conclusions

Sydney's future urban growth path will have important social costs and benefits. Providing the housing that people demand and place value on is an important driver of the social benefits, which have to be considered against environmental, social and infrastructure costs.

How much Greenfield?

We find that there are a range of scenarios for the amount of Greenfield development on Sydney's fringe that are relatively similar in terms of their net costs. These scenarios would lead to anywhere up to 30 per cent of new development occurring in Greenfield areas. The net benefits of a 90/10 scenario are about \$0.8 billion relative to the 2005 Metropolitan Strategy.

For growth paths where more than 30 per cent of new development occurs in Greenfield areas would result in higher infrastructure, social and environmental costs to provide housing for which people do not place as much value on and which developers would find difficult to sell under current arrangements. The net costs of a 100 per cent Greenfield scenario, relative to continuing with the 2005 Metropolitan Strategy are estimated at \$26 000 per dwelling. Of this difference, \$25 000 per dwelling is attributable to cost factors and the rest to locating people in Greenfield areas that would not value living there as highly as the costs of producing their dwelling.

This study has not included other potential benefits related to economies of scale in transport provision or productivity gains from agglomeration. These would likely further strengthen the case for increasing the density of existing areas.

Where in Sydney?

Sydney's future growth path could lead to more or less dwelling locating in particular subregions and local government areas. While speculative and requiring further work, we find that there could be additional scope for dwelling targets to be shifted beyond the changes considered as part of the scenarios evaluated in this report. A number of inner areas were found to have particularly high transformation benefits. Potentially, high transformation benefits could be accessed in other areas with locational value, such as near beaches, through linking higher dwelling targets

with major transport infrastructure projects. These areas contrast with the substantial focus on Western Sydney of all development scenarios. Understanding the commercial feasibility of development in alternative locations and the drivers of this is critical to thinking about subregional planning and housing targets.

Incorporating market and social costs and benefits

We have explicitly included market and social costs and benefits in assessing alternative growth paths. In doing so we have undertaken social appraisal of new development, which builds on the commercial appraisal process that is undertaken by developers.

In practice, much of the market information is better obtained through revealed actions of developers rather than estimation. Information on other costs, such as infrastructure provision to each area, is typically obtained through discussions with relevant NSW Government agencies and businesses. In order to effectively balance market and social benefits and costs NSW Department of Planning may need a process to integrate and balance this information in an ongoing way.

Achieving the growth path

Deciding on a growth path will not guarantee that it will happen. This could mean that not enough development occurs to meet Sydney's housing requirements, pushing house prices up and moving people to other cities. Or it could mean that development does not occur in the places that were hoped. This is linked to how NSW Department of Planning and the NSW Government can influence the commercial feasibility of new development.

To achieve the growth path then requires adjustments to planning instruments such as levies, planning processes, zoning and development controls and possibly other mechanisms. We have not considered the changes necessary in this report to achieve each of the growth paths assessed.

One important aspect that is currently limiting the ability of Sydney to adapt to change is the high cost of moving. This includes significant government costs related to stamp duty. Other aspects that were raised in discussions that may limit the specified growth path included the:

- importance of site fragmentation for a growth path focused on urban renewal;
- high cost of purchasing land in some areas. This reflected the high opportunity cost of the land and (in some circumstances) to sellers expectations which not reflect current market conditions;
- relatively higher cost of developing new sites. Much of the lower cost development options have already taken place and the unit cost of future

development is likely to increase significantly. That is, much of the ‘low hanging fruit’ have already been picked; and

- willingness of developers to take on the planning risks (perceived or actual) that exist in certain LGAs.

Funding under alternative growth paths

The analysis has in most cases allowed for funding of whatever new infrastructure is required to maintain service standards for each scenario. If funding arrangements do not align with the preferred growth path then social costs could be higher than otherwise estimated. This may require greater consideration of how infrastructure funding of specific areas such as education needs to change to reflect the preferred way of accommodating population growth.

The details

In many areas that could have substantial social costs and benefits, outcomes will depend on factors much more specific than those considered in this report. This is true of provision of public and community housing, housing affordability, agricultural land and climate change adaptation. Understanding the factors that reduce social costs in these areas should be part of any future growth path.

In some of the areas assessed in this report there may also be scope for efforts to mitigate costs and enhance benefits. This could include dual use open spaces, high-density schools and changes in the provision of other services. These possibilities have not been factored into the analysis and their costs and benefits should be assessed by the relevant agencies.

Key data gaps

There are a number of key data gaps that emerged during the study and that are relevant for future decisions about Sydney’s growth path.

- There has been limited analysis of the linkages between employment patterns, employment lands and the costs and benefits of alternative growth paths. The focus of this study was on residential land. There could be variations in the costs and benefits of alternative residential patterns depending on the spread of employment opportunities. This in turn, is partly influenced by planning decisions.
- The commercial feasibility of alternative development paths is relatively untested. This may mean that paths are not achievable or that policy change is required to allow the market to achieve the best growth path for Sydney. More land will have to be rezoned than to accommodate new dwellings in order to account for the lack

of commercial feasibility in certain areas. Strengthening the linkage between commercial feasibility and dwelling targets is an area for additional work, particularly in consideration of development around centres versus spread throughout existing areas

- There is little evidence of the extent to which variations in council regulations reflect the preferences of people in each area or are aimed at minimising external costs of new development. The land value database that has been used to examine transformation benefits offers a rich source for additional analysis, including in this area. Analysis of land valuations could help to identify the value (or cost) of neighbouring high density properties, alternative levels (and types) of provision of open space, closeness to transport infrastructure and closeness to centres.
- This study has estimated transformation benefits using data on land valuations for different property types and zones. This is a substantial improvement on previous cost benefit analyses of land use decisions. The land valuation information can also point to areas where transformation benefits could be unlocked through transport infrastructure provision. These transformation benefits may be able to be accessed through discussions with councils that link transport infrastructure needs to dwelling targets, potentially providing much higher transformation benefits than estimated in this study.

PART 3

Technical appendices

A Planning instruments

Sydney's planning hierarchy

The purpose of a planning system is to influence the behaviour of people and organisations with the aim of improving social outcomes.

In NSW, the enacting legislation for planning and development processes is the *Environmental Planning and Assessment Act (EP&A Act) 1979*. Underlying the EP&A Act, the NSW planning system is a hierarchy based system.

- Metropolitan Strategy – setting high level, major population and transport and infrastructure development plans across the Sydney metropolitan region. The Metropolitan Strategy outlines:
 - state investment priorities: including state infrastructure strategy;
 - state involvement in strategic places: including identification of strategic places, as well as growth centres release areas and urban renewal sites; and
 - spatial planning: including coordination across subregional areas, and with local councils.
- Ten Subregional Plans – focusing on implementation of Metropolitan Strategy and including more targeted information on the methods to achieve specific goals within the region.
- Local environment plans (LEPs) – administered by local councils, with authority provided by directions and approval from the NSW Minister of Planning, LEPs provide mandatory development controls consistent with the Metropolitan Strategy and the Subregional Plan. Development control plans are the guiding documents through which councils implement the objectives of LEPs through specific and comprehensive requirements for most development types – for example, urban design, heritage precincts and properties. Development control plans outline land use guidelines, including the definition of standard land use zones and activities and building densities that are allowed within each zone.

The Sydney planning system involves the interaction of many different groups, most importantly groups within the NSW Government and local).

The division of responsibility between the NSW Government and local councils is complex. Generally, the NSW Government sets high level planning goals while the councils are responsible for implementation and detail. This combined system attempts to harness the comparative advantages of high level strategic planning and local knowledge of councils. For example, high level strategic planning can run into more localised issues where there are strong local preferences about the characteristics of an area that could limit the scope for further development in a specified area.

The NSW Government retains control over some local government processes through multiple avenues for the hierarchy of responsibilities to be circumvented, elevating the importance of specific development projects above the jurisdiction of local councils. State Environmental Planning Policies (SEPPs), for example, are developed by the NSW Government and outline key issues that need to be incorporated into all LEPs, and how they should be handled. They cover a wide range of issues such as affordable housing, advertising and signage, major projects, the application of the building sustainability index and infrastructure provision. The content of SEPPs also varies widely, depending on the objective of the policy. For example, the recent SEPP (Affordable Rental Housing) provides incentives for the construction of affordable rental properties through increases in the allowable floor space ratios for residential developments that will incorporate such affordable rental housing options. This is in contrast to the SEPP (Building Sustainability Index – BASIX) which provides directives on the required BASIX ratings and sustainability elements that new buildings and developments must meet.

The SEPP (Major Developments) is an important planning instrument in the context of coordination of major developments and identification of developments with significant spill over effects from the local area. The SEPP (Major Developments) also provides direction for such projects to be assessed under Part 3A of the EP&A Act, at which point authority directly passes from local councils to the Minister for Planning. Further discussion of the management and implementation of major, significant and critical projects as well as general infrastructure is presented below.

The NSW Government also has authority over whether to approve LEPs.

Planning tools

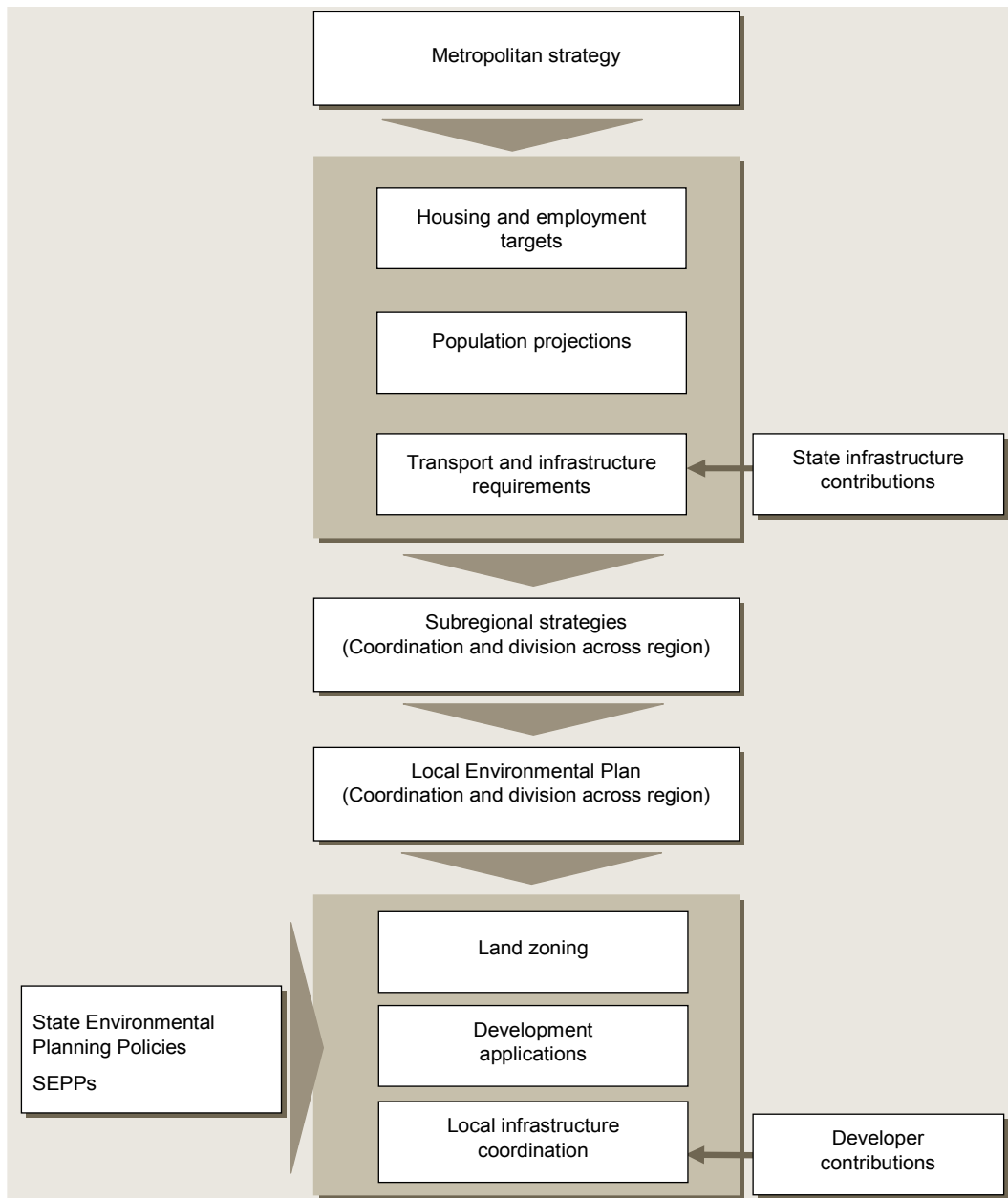
There is a vast array of different tools and mechanisms that may be utilised to achieve planning goals. In general, the planning system in NSW is centred around the dual tasks of initially outlining future development options such as the location and density of developments, and secondly coordinating and sourcing funding for developments. Such a centralised approach is directed at taking advantage of economies of scope and scale in funding, as well as coordination of planning outcomes.

In general, planning tools can fall into a number of categories, utilising both market based incentives and charges as well as threshold regulation such as land restrictions. In the Sydney metropolitan area, the planning tools currently being utilised cover:

- rezoning/land release policies that determine the nature and scale of development that is allowed on a parcel of land;
- land taxes, developer levies and capital contributions which are directed at both providing a broad tax revenue base as well as requiring the internalising of development costs where beneficiaries can be identified;
- infrastructure provision that allows for increased development in certain areas, as well as determining the type of land development that could be supported in an area – which should be utilised in close consultation with land use and rezoning tools;
- government investment in amenity, public domain, streetscape, cultural resources; and
- government-led development and pilot projects (e.g. public housing and Landcom renewal projects).

Together, this suite of planning tools provides a breadth of options to provide guidance on the growth of Sydney's infrastructure and housing services. The interaction of the planning hierarchy and the planning tools available within the system are represented in chart A.1.

A.1 Planning instruments and the plan hierarchy



Data source: The CIE.

Rezoning and land releases

The zoning of land for specific uses is one of the most popular planning instruments in Australia and internationally. Land zoning determines the amount of land that is available for development in any particular area as well as the prescribed uses for which it is available. As dynamic planning tools, rezoning and land releases allow for a change in the amount of land available, essentially increasing the supply of developable land.

Zoning restrictions are a form of quantity based regulation (capping the quantity of land in an area that is available for development). In a region with strong population and economic growth, it is likely that demand for land to develop (for any number of purposes, including residential and retail) will be greater than supply. In these areas, land use restrictions will typically generate artificial land scarcity premiums in land prices, reflecting the restriction of the supply of land.

The major land release areas in Sydney are the North West and South West growth centres as discussed in chapter 1. There are many other areas of Greenfield development on a smaller scale.

Land taxes, developer levies and capital contributions

One alternative regulatory option is to consider pricing controls to manage development (setting a premium on land sales for a given form of development in an area). Such mechanisms may operate where different land taxes are applied to land sales depending on the intended nature of the development, or intended land use. (Box 2.3 discusses the merits of quantity and price based mechanisms in planning.)

In Sydney, price based mechanisms include local infrastructure contributions, state infrastructure contributions and capital and in-kind contributions. Implementing developer levies can restrict development where it is not possible for costs to be passed on to buyers or passed back through lower price expectations of vendors.

These contributions and levies operate on a beneficiary pays model, targeting payments from those who will draw the primary, and often sole, benefits. Such internalisation of the costs into the residential construction and purchasing markets ensures that the costs of supplying infrastructure are included in the decision to develop and reside.

Local infrastructure contributions

Under section 94 of the Environmental Planning and Assessment Act 1979 (EP&A Act), local governments in NSW are provided with the authority to levy developers for the cost of providing infrastructure, services and amenities on new developments that drive the need for this infrastructure investment. The levying and use of these developer contributions are restricted, under Part5B of the EP&A Act, to key community infrastructure that is defined as including:

- local roads;
- local bus infrastructure;
- local parks;
- local sporting, recreational, cultural, civic and social services facilities;
- drainage and stormwater management works;

- land for any community infrastructure (except land for riparian corridors); and
- district infrastructure of the kind listed in (a)–(e) but only if there is a direct connection with the development to which a contribution relates.

Local infrastructure contribution amounts vary considerably, but can be up to \$60 000 per dwelling.¹¹⁷

State infrastructure contributions

Under S94ED and 94EM of the EP&A Act, 1979, State Infrastructure Contributions are levied on developments in the Growth Centres of the North West and South West, and potentially other areas. Operating at a broader level than local developer contributions (direct and indirect contributions), state infrastructure contributions cover infrastructure for the provision of state services such as:¹¹⁸

- new and upgraded regional roads
- new and upgraded heavy rail
- bus services
- educational services
- health services
- emergency services
- Attorney General's services
- provision of conservation lands
- precinct planning and delivery.

These contributions are levied at the rate of \$349 200 per hectare of net developable area for residential land and \$150 000 per hectare of net developable area of industrial land.

These contributions cover 75 per cent of the costs of regional infrastructure, with the remaining 25 per cent to be covered by government contributions. This division is in recognition of the regional benefits derived from the provision of infrastructure in these growth centres¹¹⁹. The NSW Government has recently temporarily reduced the

¹¹⁷ NSW Department of Planning 2009, Local Contributions Review, Letters to councils, July.

¹¹⁸ Growth Centres Commission 2008, Special Infrastructure Contribution practice note, November 2008.

¹¹⁹ Growth Centres Commission 2008, Special Infrastructure Contribution, <http://www.gcc.nsw.gov.au/media/Pdf/Fact%20Sheets/fssic.pdf>.

contribution rate to 50 per cent and adjusted the timing of the payments so that they occur later in the development period.¹²⁰

Capital contributions

Capital contributions are payable by developers wishing to connect a development to a network for the first time, alter an existing connection or to arrange reticulation in a subdivision. In these situations, the developer is required to cover either all or a portion of these costs. In the case of essential services, where connections are mandatory, this is an unavoidable cost of development.

Such capital contributions are calculated back to a defined linkage point in the network to ensure that only those additional capital costs that are associated with the specified development are covered by the developer.

Slight variations on capital contributions are levied in infill developments, where developers are not, in general, required to cover the costs of network augmentation. However, if there is a risk that cost recovery will not be achieved through general tariff revenue, the developer may be required to provide a Guarantee of Revenue to the government ensuring that these additional costs will be recovered.¹²¹

Capital contributions may also be 'in-kind' with developers providing infrastructure for common use as part of negotiations for development approval.

Other NSW Government policies

The NSW Government maintains controls over many alternative tools that can influence land use and employment patterns. These include its decisions as to where to locate its own workforce and the provision of infrastructure such as transport, health and education.

Infrastructure provision has a strong direct link with land use patterns. Greenfield areas are more attractive to developers and new residents if there is good access to transport infrastructure, for example.

Our transport network must do more than cater for growth — it must help shape a compact and efficient city.¹²²

¹²⁰ NSW Department of Planning 2008, Infrastructure levies — questions and answers, December.

¹²¹ Energy Australia 2009, ES 8 Capital contributions and asset relocation works guidelines.

¹²² NSW Government 2010, *Metropolitan Transport Plan: Connecting the city of cities*, February, p. 24.

B Measuring the costs of social infrastructure

Education

Projected enrolments and capacity

The NSW Department of Education and Training (DET) provided individual school level data on projected enrolments in 2014. These figures were aggregated to the Local Government Area (LGA) and used as the base given the assumption that policy changes would not have the capacity to alter projected enrolment outcomes until this time. Upon advice from the DET, schools for specific purposes (SSP) were removed from the data set given specific entry requirements and unique design characteristics of these schools which makes comparison unsuitable.

The current demography of each LGA was taken into account by calculating the average primary and secondary student population as a proportion of the total population in each area. Primary and secondary student enrolments from 2016 to 2036 were calculated by applying these ratios to population growth dictated by the scenarios and adjusted to exclude the Gosford and Wyong LGAs.

Where the DET estimated that enrolment capacity would be in deficit in 2014 (based on projected enrolments and existing permanent teaching space¹²³), capacity was instead assumed to be zero. Additional enrolment requirements relative to 2016 were calculated in five year increments up to 2036 by multiplying derived additional enrolments relative to 2016 and 2014 capacity estimates.

Projected costs

Additional costs were calculated by multiplying additional enrolment requirements relative to 2016 for each scenario by relevant land costs per student (based on estimates from the NSW Valuer General) and building costs (provided by the DET) dependant on the proportion of the LGA that was Greenfields and the proportion that was an existing area.

¹²³ Teaching space demand was derived by the DET from 1 x 'Primary Staff' plus 0.776 x 'Secondary Staff'.

Building costs also varied dependant upon whether the average school size in the relevant LGA was considered adequate. That is, if the average land available per student in each LGA was greater than the benchmark average school size divided by the benchmark number of students per primary and high school. The benchmark school size was assumed to be three hectares per primary school and six hectares per high school in accord with DET school facility standards.

The DET commented that the use of LGA and sub-region data was too broad to assess the full impact of infill development especially the concentrated high density development occurring and proposed around transport centres. Spare capacity of some schools distant from centres development will have only minimal utility for serving future growth in enrolments.

Health

Projected costs of health infrastructure provision

NSW Department of Health provided estimates of hospital separations and related 'bed days' that the population would require out to 2036 based on incorporating the forecast populations into the NSW Health current acute services projection methodology. Estimated costs of health service infrastructure provision were also provided. These rose exponentially consistent with population growth projections and relevant health statistics related to the ageing of the general population.

NSW Department of Health provided figures which suggested that in 2008-09 the number of required 'beds', based on separations which totalled around 936 000 and 'beddays' which totalled around 3 304 000, amounted to approximately 10 700. Based on latest population forecasts it was then calculated that the number of beds required per 1000 population equated to 2.6.

The NSW Department of Health estimated additional costs of 17.2 billion to provide required additional beds out to 2036-37. Given this estimate, the capital cost per additional acute bed was calculated to amount to \$2.3 million.

Estimated costs were then increased by 45 per cent based on NSW Department of Health advice that capital costs would need to be increased by another 40-50 per cent in order to accommodate costs associated with non-acute care and related services. Estimates costs of Greenfield development were also increased to reflect land acquisition costs estimated in the GCC superseded SIC practice note.

Fire

Projected incidents and capacity

NSW Fire Brigades provided individual fire station level 2009 data regarding staff levels, annual incident response rates and regional population serviced. Projected incidents were calculated by multiplying population forecasts yielded from the three scenarios by the ratio of current incidents per population unit. As such, the existing divergences in incident rates per head of population across LGA's were maintained to take into account current socioeconomic trends and building environments.

Existing capacity was obtained by multiplying the maximum incident response rate per fire station (3000 incidents per year) by the number of fire stations in each LGA and subtracting the actual number of incidents responded to in 2009 in each LGA.

Additional fire service infrastructure requirements relative to 2009 were calculated from the projected incident rate yielded from population dictated by each scenario minus incidents recorded in 2009. The capacity to respond to additional incidents was also subtracted from this figure.

Projected costs

To calculate the costs associated with each scenario modelled, the additional requirements found to be necessary relative to 2009 were multiplied by a number of factors listed below. All cost factors were discounted based on the maximum estimated response rate per fire station of 3000 incidents.

- Estimated building and development costs supplied by NSW Fire Brigades. These costs ranged from \$3.0 million to provide a new station, to \$500 000 for a major extension where an additional crew could not be accommodated without the construction of new amenities, and \$100 000 were only minor (internal) works were deemed would be required.
- The amount of land required per fire station multiplied by the cost of land (based on estimates from the NSW Valuer General) to provide new stations in LGA's where it was estimated necessary by NSW Fire Brigades.
- The one-off cost of providing a fire engine, estimated at \$530 000 by NSW Fire Brigades.
- The annual cost of providing staff, estimated at \$2.3 million, multiplied by the number of years they would be required.

For fringe areas, estimated costs were obtained from the Growth Centres Commission superseded special infrastructure contribution (SIC) practice note. This report estimated that provision of necessary fire service infrastructure would cost a total of \$29.1 million for both the NW and SW growth sectors which would service 160 000 dwellings.

Costs calculated for each LGA were adjusted by a scaling factor which took into account the percentage of each LGA which could be classified as fringe and therefore the percentage of each LGA for which the SIC cost estimates should be applied.

C Measuring the costs of transport congestion

The costs of road congestion include time delays for people and businesses, higher pollution and higher fuel use. There are also public transport congestion costs, with service quality declining in some aspects, such as over-crowded buses and trains and lack of seating.

In this appendix we set out how we value road transport congestion costs (or the do nothing conditions). Before setting out the methodology, we note that there are a number of dimensions that are not included in the analysis, as set out below.

- Economies of scale or diseconomies of scale in the provision of infrastructure to reduce transport provision are not accounted for. There is the potential for different types of infrastructure aimed at serving different areas to have significantly different benefit cost ratios. For example, if additional transport infrastructure was subject to economies of scale, then a denser population would be expected to allow the transport task to be undertaken at a lower per person cost to achieve similar outcomes. We have not factored in economies of scale or diseconomies of scale into the analysis but consider this to be an important area for future consideration.
- Congestion on buses and trains related to overcrowding is not directly addressed by the methodology used in this report. (The time costs for bus congestion are factored in.) This is likely to understate congestion costs and there may be differences between alternative growth paths. It is not clear a priori which way the differences would go and whether the infrastructure to avoid road congestion would also alleviate public transport congestion.

In addition to the substantive points above, there is a degree of uncertainty across other areas of the analysis, which has been narrowed as far as possible within the constraints of the project, as discussed below.

- Uncertainty about current congestion costs in Sydney – the Bureau of Infrastructure, Transport and Regional Economics (BITRE) has estimated congestion costs. They use an aggregated model that may not be accounting for the specific local dimensions of congestion. In the absence of an alternative, we use their figures as a starting point. Note that a back of the envelope comparison can be made between congestion hours estimates from the Strategic Travel Model and the estimate from the BITRE, although recognising that congested hours are

only one part of congestion costs (others include fuel use, air and GHG pollution and change of journey) and that the BITRE measure is focused on the avoidable costs of congestion rather than total congestion. The hourly rate that would equilibrate the STM and BITRE measures is just under \$40.

- Uncertainty about where congestion costs are highest now. The NSW Bureau of Transport Statistics has constructed a measure of time delays, based on journey times for travel across the day against journey time in the evening when there is less congestion. Journey time data is based on Sydney's Strategic Travel Model. This provides a relatively good basis on which to form a view of the distribution of current congestion costs.
- Uncertainty about future employment outcomes. Travel demand, particularly in congested times, is highly dependent on where people work and the ability of people to move to be closer to work. The spatial patterns of employment will depend on the types of sectors that grow and decline in Sydney in the future, which is driven by many factors including globalisation and the impact the mining boom has on other industries. Our approach takes an agnostic position by considering that people living in a particular LGA in the future will have the same travel demands, on average, as people living there now. Some policies may reduce frictions in home markets allowing people to rearrange where they live to minimise travel demand, such as lowering costs of moving, including government costs such as stamp duty. Below we set out the implicit employment changes reflected in our approach and used in the NSW Bureau of Transport Statistics modelling.
- Uncertainty about per person demand for transport. Even in the absence of population growth, people may demand more or less transport services in the future. Our approach considers that demand stays constant through time.
- The relationship between transport demand and congestion costs. Transport demand is likely to increase congestion costs more quickly as demand rises, rather than in a linear fashion. We use estimates that we have derived from the modelling conducted by the NSW Bureau of Transport Statistics for this report.

The process we follow to estimate congestion costs is:

- divide the 2006 congestion costs figure estimated by the BITRE (\$4.0 billion) into Sydney's LGAs using information on the total time delay in each LGA – for example Penrith has 5 per cent of the hours delay in 2006 so we allocate it 5 per cent of the estimated Sydney-wide congestion costs;
- increase congestion costs in each LGA according to the relationship (where CC is congestion costs and popn is population):

$$\frac{\Delta CC}{CC} = 1.83 * \frac{\Delta Popn.}{Popn}$$

- this provides congestion costs for each time period (in five year intervals), each local government area and each scenario. These are summed across LGAs and aggregated across time periods using applied discount rates for each scenario; and
- the figures presented in this report are congestion costs relative to 2006 levels.

As a check and to improve our modelling the NSW Bureau of Transport Statistics undertook modelling of the 2036 transport outcomes under the 2005 Metropolitan Strategy scenario and the fringe focused scenario. This modelling was used to derive the figure of 1.83 and to ensure that the broad direction of the analysis was in line with detailed modelling.

Employment patterns

The main approach taken in the analysis of transport congestion implicitly assumes that future journeys to work from each local government area are the same as current journeys to work. The pattern of employment at an aggregate level then reflects only the distribution of people across the different LGAs. An alternative approach is to specify an employment pattern. This is done as part of the baseline modelling used by the NSW Bureau of Transport Statistics. For the detailed modelling of the fringe focused scenario NSW Planning developed employment projections to use for this scenario.

Given the importance of employment patterns in driving transport demand, particularly during peak times, in table **Error! Reference source not found.** we set out the employment growth in each subregion from 2006 to 2036 under the different scenarios and modelling approaches. The main approach used has relatively similar employment growth projections at the subregional level for the 2005 Metropolitan Strategy scenario. The BTS projections expect more employment in the North West and less in the West Central, reflecting the incorporation of information on the Norwest Business Park.

The differences in employment projections between the main approach and BTS modelling are larger for the fringe focused scenario. The employment projections used by the BTS for the fringe focused scenario were developed by Department of Planning and have a substantial shift in employment towards the West Central, North West and South West. In comparison, the employment projections in the main approach have smaller shifts reflecting that the largest population movements between the 2005 Metropolitan Strategy and the fringe focused scenario are between the West Central and Growth Centres rather than from Eastern Sydney to Western Sydney more generally. This employment difference is one of the reasons for the relatively smaller difference in congestion costs from moving from the 2005 Metropolitan Strategy towards a fringe focused strategy found by the detailed modelling compared with the main approach.

C.1 Share of employment growth 2006 to 2036

<i>Subregion</i>	<i>Main approach</i>			<i>BTS modelling</i>	
	<i>Metropolitan Strategy</i>	<i>Fringe focused</i>	<i>Infill focused</i>	<i>2005 Metropolitan Strategy</i>	<i>Fringe focused</i>
	%	%	%	%	%
Sydney	19.8	17.0	21.7	18.5	12.6
East	4.6	4.1	5.1	4.7	2.7
South	5.9	5.3	6.4	6.9	4.3
Inner North	10.0	8.5	10.9	6.7	3.5
North	3.3	3.0	3.5	2.6	1.3
North East	3.1	3.0	3.6	3.1	3.7
Inner West	4.5	3.9	4.8	3.4	1.5
Central West	16.2	14.9	15.6	13.0	16.3
North West	14.8	17.2	12.8	21.0	29.0
South West	12.3	17.8	10.0	13.8	18.9
Central Coast	5.5	5.4	5.5	6.2	6.2
Total	100.0	100.0	100.0	100.0	100.0

Sources: The CIE analysis based on 2006 Journey to Work data; NSW Bureau of Transport Statistics baseline employment projections; NSW Planning employment projections for detailed modelling of fringe focused scenario.

D Potential impact on affordable housing

The growth strategy that Sydney pursues may have implications for housing affordability and social housing. There are a number of channels through which there could be impacts.

- *State Environmental Planning Policy (SEPP) – Affordable Rental Housing 2009;*
- public and community housing;
- changes in average dwelling prices and rents across Sydney and in each region; and
- changes in the pattern of dwelling prices and rents in each region, such as through the replacement of older buildings with newer buildings.

There is no clear picture at present of how patterns of dwelling prices and rents would be impacted by each growth strategy, or even the direction of the changes in affordable housing. This section outlines issues and possible implications of the extent to which certain growth paths may have a greater or lesser impact on the supply of affordable housing.¹²⁴

Overview

Sydney is considered to be the most expensive city for housing in Australia and one of the most expensive cities in the world. In this context housing affordability has been a key issue of concern to the community and has been an issue of focus for both the state and federal governments.

There is believed to be a significant shortfall currently in the provision of affordable housing. A study commissioned by the Australian Housing and Urban Research Institute in October 2003 found that across NSW only 60 per cent of low rent

¹²⁴ There are many other issues not considered in regard to discussion of Affordable Housing and Housing Affordability such as the ability of the developer to provide such housing (which also is dependent on whether their profit margins allow for it). This section tries to only focus on the potential impacts of alternative growth paths on the provision of affordable housing.

dwelling were available for low income households.¹²⁵ A recent update of that paper notes that across Australia

Utilisation of low rent stock by higher income households leaves only one affordable and available dwelling for every five low-income households.

Sydney leads the rest of the capital cities in stock shortage – one affordable and available dwelling for every 15 very low-income households. Comparable figures for Melbourne and Brisbane are one dwelling for every eight very low-income households.¹²⁶

Data from the 2006 Census further showed that over 190 000 lower income households in the private rental market were in ‘housing stress’, paying over 30 per cent of their income on housing. Based on these findings there appears to be a shortfall in affordable housing stock. In this context, the provision of affordable housing is likely to be an issue that needs further consideration irrespective of which growth path is chosen in this study.

Defining housing affordability

In thinking about housing affordability we have to consider carefully how affordability is defined and who it impacts on. In NSW legislation (*SEPP – Affordable Rental Housing 2009*) affordable housing is defined as:

affordable housing means housing for very low income households, low income households or moderate income households, being such households as are prescribed by the regulations or as are provided for in an environmental planning instrument

In this Policy [SEPP – Affordable Rental Housing 2009], a household is taken to be a very low income household, low income household or moderate income household if the household:

- (a) has a gross income that is less than 120 per cent of the median household income for the time being for the Sydney Statistical Division (according to the Australian Bureau of Statistics) and pays no more than 30 per cent of that gross income in rent; or
- (b) is eligible to occupy rental accommodation under the National Rental Affordability Scheme and pays no more rent than that which would be charged if the household were to occupy rental accommodation under that scheme.

Under this definition more than 50 per cent of households are potentially covered by housing affordability provisions. Given the size of this potential market, it would be expected that developers would factor in affordable housing in their development propositions.

¹²⁵ Yates, J., and Reynolds, M. 2003, *Low Cost Rental Study*, commissioned by the NSW Department of Housing, October, p. 8.

¹²⁶ Wulff, Maryann Dhamarlingan, A., Reynolds, M. and Yates, J. 2008, *Australia's private rental market: changes (2001-2006) in the supply of, and demand for, low rent dwellings*

This definition makes affordable housing not about the price at which housing is provided (either through sale or rent) but about who it is provided to. In this case a unit rented for \$200 per week is classified as 'affordable housing' if rented to a single person household with an income of \$50 000 but is not 'affordable housing' if rented to a single person household with an income of \$100 000.

Policies for housing affordability

Housing policy is guided at the national level through COAG and associated working groups and ministerial advisory councils. This is supported by the recent federal government interest in associated urban policy and social inclusion issues, the establishment of the Major Cities Unit within Infrastructure Australia and funding programs that flow from it. In addition the Nation Building Economic Stimulus plan had a direct impact on social housing supply.

Commonwealth Government programs

A summary of some of the Commonwealth Government programs is provided in box D.1 below.

D.1 Affordable Housing Policies — Commonwealth Government

National Affordable Housing Agreement

The National Affordable Housing Agreement (NAHA) includes measures at the Commonwealth, State and Territory and Local Government levels that contribute to housing affordability. The NAHA identifies the roles and responsibilities of each level of government and establishes a performance framework against which the key outcomes of the agreement will be measured.

The NAHA aims to ensure all Australians have access to affordable, safe and sustainable housing that contributes to social and economic participation.

Nation Building Economic Stimulus Package

The Australian Government is investing \$1.9 billion as part of its Nation Building Economic Stimulus Plan to deliver around 6000 social housing homes in NSW by June 2012. On top of this, the NSW Government is investing \$1 billion to deliver an additional 3000 homes. This investment is already having a positive impact on communities by securing jobs across NSW. To date 2182 new dwellings have been approved across 142 separate sites within Sydney

(Continued on next page)

D.1 Affordable Housing Policies — Commonwealth Government (continued)**Housing Affordability Fund**

The Fund's focus is on proposals that improve the supply of new housing and make housing more affordable for home buyers entering the market. The Fund will target Greenfield and infill developments where high dwelling demand currently existing or is forecast.

National Rental Affordability Scheme

The National Rental Affordability Scheme (NRAS) aims to increase the supply of affordable rental accommodation through offering financial incentives to the business and community sector to build and rent dwellings for eligible tenants for a period of 10 years. Incentives will be allocated for up to 50 000 new dwellings across Australia in the first four years, with a further 50 000 to be provided if demand remains high.

NSW Government programs

The NSW Government also has a wide range of policies aimed at improving the provision of affordable housing. A key policy is the NSW Government's new *SEPP – Affordable Rental Housing 2009* which is designed to increase the amount and diversity of affordable rental housing in the state. The policy aims to better encourage home owners, social housing providers and developers to invest and create new affordable rental housing to meet the needs of our growing population and existing residents.¹²⁷

This policy aims to protect current rental accommodation and provide for new rental accommodation.

- It provides floor space bonuses to developers who provide affordable housing. For example if the maximum permitted floor space ration was 2.5:1 on a given piece of land, by providing that 50 per cent of the housing is affordable housing then a developer would be allowed a floor space ratio of 3:1.
- For buildings that were low rental buildings, prior to 28 January 2000, developers may be required to make payments to councils if development reduces the availability of affordable housing within the area. Low rental buildings include residential flat buildings with at least one unit let out for lower than the median rent for the building type in that LGA and boarding houses.

¹²⁷ NSW Department of Planning, <http://planning.nsw.gov.au/PlansforAction/Supportingaffordablerentalhousingpolicy/tabid/313/Default.aspx>.

This policy builds on previous NSW Government initiatives to support affordable housing through the planning system including the Ultimo/Pymont and Green Square affordable housing programs and the St Marys and Rouse Hill Affordable Housing Projects.

A range of other NSW Government housing programs are also in place to target low to moderate income households through homelessness services, public housing and the community housing sector, such as:

- The NSW Homelessness Action Plan which sets the direction for statewide reform of the homelessness service system to achieve better outcomes for people who are homeless or at risk of homelessness.
- Growth of community housing sector. The NSW Government has set an ambitious growth target to grow the community housing sector from 13 000 to 30 000 properties over the next ten years. The expansion of community housing providers will form the foundations for future growth in affordable housing and the government has invested over \$160 million in capital funding for community housing provider to deliver new social and affordable housing projects using a mix of debt finance, equity funds and capital grants.
- Building Stronger Communities Initiative. In 2006 the NSW Government announced this initiative, allocating \$66 million over a four year period to focus government and community efforts on regenerating seven priority communities across NSW which face major social and economic disadvantage.
- Living Communities Projects which are focused on larger, most disadvantaged public housing estates and seek to regenerate these facilities.

Potential impacts of alternative growth paths

Greenfield and infill development could have different implications for the provision of affordable housing, related to both the market and to government policies.

In relation to Greenfield developments, there are currently limited incentives to promote affordable housing developments in these areas. The NRAS does offer some incentives although it requires current access to public transport and tight delivery schedules that Greenfield developments. Therefore, in Greenfield areas developers are not required to take affordable housing needs into account. Only where developments have been undertaken on state owned land has there been any obligation to provide affordable housing.

Housing NSW indicated that public housing is better provided in existing areas due to better service provision, such as public transport. Housing NSW indicated that the floor space bonus (FSB) provisions in the *SEPP – Affordable Rental Housing 2009* would be of greater benefit in higher value areas (but the NRAS subsidy is of lower relative benefit in those areas). That is there was limited benefit in low value areas

where existing dwellings in the area are likely to offer lower rent compared with those dwellings generated by the new development. This is likely to mean that the FSR provisions would have limited impact in Greenfield areas as there was not demand for floor spaces higher than those already allowed.¹²⁸ This implies that SEPP would have less impact on delivering affordable rental housing for growth paths that focused on Greenfield areas.

Voluntary planning agreements for affordable housing provision are likely to be more effective in Greenfield areas. These are voluntary agreements or other arrangements made between planning authorities and a developer under which the developer agrees to make development contributions towards a *public purpose*. *Public purpose* is defined to include the provision of, or the recoupment of the cost of providing affordable housing.¹²⁹

For growth paths that placed a greater proportion of the population in infill areas, there is concern that infill development may replace older buildings in infill development that are affordable housing. While the Affordable Rental Housing SEPP does attempt to mitigate against the loss of affordable rental stock to some extent, Housing NSW is currently undertaking some work on developing an affordable housing strategy for urban renewal areas, including examining the impact of housing affordability in the event of urban renewal in an inner ring location.

While this work is yet to be complete, the modelling relating to the impact on housing affordability in the event of urban renewal is complete. In relation to this modelling work Housing NSW indicated that

The proportion of current and future housing stock that would be affordable to low and moderate income households was estimated by comparing the income profile of each household type with the price/rent distribution of (current and proposed) bedroom types likely to be occupied by specific household types.

The proportion of households under each household/family type that are in a position to rent/purchase their required household structure (number of bedrooms), without experiencing housing stress has been estimated.

The modelling shows that without any intervention to assist affordability, the proportion of housing affordable for all household types falls considerably.

Housing NSW is, therefore, concerned that urban renewal could result in a loss of affordable housing, although it has indicated that this should not be a reason for preventing further infill development. Rather, Housing NSW indicates that there also needs to be focus on the specific mechanisms to address the impact of the alternative growth paths on housing affordability.

¹²⁸ There are also Greenfield developments that are of high value that would not generally be regarded as affordable.

¹²⁹ NSW Department of Planning, http://www.planning.nsw.gov.au/planningsystem/pdf/all_contribution_pns.pdf.

The CIE has not been privy to the detailed modelling commissioned by Housing NSW and, therefore, cannot comment on the analysis underpinning the findings. We do recognise that it is a complex issue and there are a wide range of factors at play, however, it is not clear to us that urban renewal will necessarily lead to a loss of affordable housing.

For example, an old single dwelling property that is currently being used as affordable housing may be replaced by a block of 4 units. If each new unit is offered at the same rental cost as the large single dwelling property then there may not be a loss in the quantity of affordable housing available. Even if a unit attracts a higher rental it may offer greater utility for the renter if it offers a higher quality of living compared with a separate house that needs upgrading - although the extent to which this is true would depend on the rental differential between the two properties. This would depend on a wide range of factors, including whether the units matches the needs of the family that was renting the single dwelling property.

At this stage, there is limited detailed information (by LGA) that would allow a comparison of the rental cost of a new unit compared with that of single dwelling properties that are currently used for affordable housing. There is also limited information on the needs of

While Housing NSW recognises that units can (in principle) offer affordable housing opportunities, it remains concerned given that there is no guarantee that affordable rental housing (when redeveloped) will return to the rental market. Housing NSW believes that,

it is highly likely to be owner occupied (given that around 70% of all dwellings are owner/purchaser occupied¹³⁰)

Other factors that can also affect the provision of affordable housing in infill areas include the following.

- In infill areas the provisions under the SEPP are likely to be more valuable to developers where there is a demand for higher floor space ratios as allowed under the SEPP, leading to greater provision of affordable housing. This is generally the case in infill areas. The SEPP provisions which allow infill in detached housing areas would be of greater benefit in higher value areas where the new development could offer lower rental compared with existing properties in the area.
- Developers can offer a mix of products, ranging from cheap to expensive, depending on the building type, fit-out and size. This could provide a greater range of options for users of affordable housing which may be a beneficial outcome, compared with the provision of run down rental accommodation. Although the extent to which this occurs will depend on whether developers

¹³⁰ Email correspondence from Housing NSW, 9 September 2010.

believe that the profitability of providing affordable rental housing compared with other options. Housing NSW has indicated that it is not aware of any cases of private sector developers providing affordable rental housing without either a requirement or an incentive to do so.

- The flow-on impacts throughout the market of increasing the supply of housing may also translate into lower rental costs across parts of Sydney, compared with a situation where housing supply is constrained supply.¹³¹

It is important to also recognise that it is not just the extent of supply of affordable housing but also on the location of such housing. If the affordable housing is not located close to workplaces then this will diminish the value of the housing for the potential occupants. It could also result in increased travel and time cost, as well as congestion costs. The concept of affordability therefore needs to incorporate notions of locality and accessibility. NRAS and the SEPP both do this by requiring that projects be located close to public transport.

Conclusions

The provision of affordable housing in Sydney is a key concern of the community and for the state and federal governments. It is important for Governments to understand the potential equity impacts on the community of alternative growth paths. The implications of alternative growth paths, with differing mixes of infill and Greenfield development, for affordable housing and rental accommodation are complex.

Given the complexity of the factors that come together to impact on the provision of affordable housing, it is difficult to predict whether development focused on existing areas or development focused in Greenfield areas would have a greater impact on housing affordability. Further detailed analysis would be required to gain an understanding of the potential impacts on affordable housing under alternative growth paths. The work recently commissioned by NSW Housing will provide a good starting point to better understand the potential impact of alternative growth paths on the provision of affordable housing.

The understanding of the potential impact of alternative growth paths on housing affordability could be usefully progressed through, for example, considering:

- the uptake of affordable housing provisions in the SEPP across LGAs;
- the impact of NRAS- almost all affordable housing in NSW is being delivered using these financial incentives, but the stock will revert back to the market after

¹³¹ For a discussion of options to rectify long term problems of 'market imbalance' see Flood, J. and Baker, E. 2010, *Housing implications of economic, social and spatial change*, prepared for the Australian Housing and Urban Research Institute, September.

10 years and may have an impact on supply of housing affordability patterns in various locations; and

- the current stock of affordable housing.

By doing this there would be greater evidence of the pattern of provision of affordable housing creation and destruction across different geographic areas of Sydney. This would provide useful evidence as to the impacts of growth paths that have more or less growth occurring in these LGAs.

E Agricultural Land

The potential additional social value of agriculture on Sydney's fringe has been excluded from the benefit-cost analysis. Rather, the methodology employed uses agricultural land prices as a proxy to determine the value of agricultural land. Land prices will reflect the technical features and the value of production of the land as well as a number of other natural, economic and social parameters such as prevailing interest rates and commodity prices.

It is important to recognise, however, that a range of environmental and social benefits potentially obtained from agricultural land may result in the public value of agricultural land to be higher than the private value as reflected in land prices. For instance, agricultural land may provide open space and visual amenity benefits that are 'captured' by the wider community. Although, given that privately owned agricultural land is unable to be utilised by the broader community, the open-space and amenity value would be derived from its existence rather than its use.

Agricultural land can also have other potential benefits not reflected in the price of the land. This may include, for example, a reduction in transport costs and 'food miles' as well as environmental benefits arising from the use of treated effluent on agricultural land rather than being dispersed directly into river systems. Environmental factors may also be cited which could decrease the public value of agricultural land relative to the private value. For instance, pollutants from agricultural activities entering Sydney's river systems can impact on river health.

At this stage there is no robust quantitative evidence available regarding the magnitude of additional social value of agricultural land on Sydney's fringe that is not factored into the price of the land. It is therefore uncertain how patterns of agricultural land values would be impacted by the inclusion of social and environmental factors.

Further, there is also divergent and often conflicting data on Sydney agricultural activities as identified in a recent study by the Urban Research Centre¹³² and a lack of consensus over appropriate valuation techniques to support the quantitative exclusion of the social value of agricultural land from this study.

¹³² Urban Research Centre 2010, *Sydney's Agricultural Lands: an Analysis* (draft), prepared for NSW Department of Planning, University of Western Sydney, April.

At this stage it is, therefore, not possible to seek to incorporate the social value of agricultural land in this study. Further analysis of this issue could be conducted by NSW Planning following the completion of the study by the Urban Research Centre which should provide a good understanding of the robustness of available data on agricultural activities in the Sydney region.