The Current and Future State of Victoria: a macro perspective
Advice to Infrastructure Victoria
February 2016
Deloitte Access Economics
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glossary</td>
<td>i</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>iii</td>
</tr>
<tr>
<td>1 Setting the scene</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Infrastructure Victoria is a new authority</td>
<td>2</td>
</tr>
<tr>
<td>1.2 The purpose of this study is to provide the strategic context across three streams</td>
<td>2</td>
</tr>
<tr>
<td>1.3 Methodology</td>
<td>4</td>
</tr>
<tr>
<td>1.4 The future state will be driven by megatrends</td>
<td>5</td>
</tr>
<tr>
<td>1.5 Technology in particular will shape future demand for infrastructure</td>
<td>7</td>
</tr>
<tr>
<td>1.6 Melbourne has experienced two recent trends in urban form</td>
<td>10</td>
</tr>
<tr>
<td>1.7 Possible future scenarios</td>
<td>13</td>
</tr>
<tr>
<td>1.8 There are strong interlinkages between the streams and infrastructure</td>
<td>14</td>
</tr>
<tr>
<td>2 Society</td>
<td>19</td>
</tr>
<tr>
<td>2.1 Victoria’s population is in transition</td>
<td>21</td>
</tr>
<tr>
<td>2.2 Health and wellbeing indicators demonstrate a changing future state of health</td>
<td>27</td>
</tr>
<tr>
<td>2.3 Education and training are critical social and economic features of Victoria</td>
<td>33</td>
</tr>
<tr>
<td>2.4 A more equal society is important for Victoria’s communities</td>
<td>38</td>
</tr>
<tr>
<td>3 Economy</td>
<td>47</td>
</tr>
<tr>
<td>3.1 Long term trends influence Victoria’s economy</td>
<td>49</td>
</tr>
<tr>
<td>3.2 Population, participation and productivity are key economic drivers</td>
<td>50</td>
</tr>
<tr>
<td>3.3 The labour market is expected to grow unevenly</td>
<td>55</td>
</tr>
<tr>
<td>3.4 Industry composition has been changing and will increasingly be services driven</td>
<td>57</td>
</tr>
<tr>
<td>3.5 Infrastructure to transport people from home to work is crucial</td>
<td>62</td>
</tr>
<tr>
<td>3.6 Household incomes have been increasing, but so has the cost of living</td>
<td>66</td>
</tr>
<tr>
<td>3.7 Housing affordability is under pressure</td>
<td>67</td>
</tr>
<tr>
<td>3.8 Victoria has a sound fiscal position</td>
<td>69</td>
</tr>
<tr>
<td>3.9 Private sector infrastructure spending has been increasing</td>
<td>71</td>
</tr>
</tbody>
</table>
4 Environment
4.1 Climate change is increasing risk and uncertainty for Victoria
4.2 Conflicting land uses impact on the environment
4.3 Pressures on biodiversity are endangering native fauna and flora species
4.4 Marine and coastal environments are protected but under pressure
4.5 Air pollution is an issue in Melbourne and growing regional cities
4.6 Quality water supply is critical for healthy and prosperous Victoria
4.7 Effective waste management is important for human health and the environment
4.8 There is an important two-way relationship between the environment and infrastructure

5 Scenarios
5.1 Scenario 1: Higher population growth would bring forward infrastructure demand
5.2 Scenario 2: Technological advances may drive a more productive society
5.3 Scenario 3: Carbon emission policy will change Victoria’s economy

6 Conclusion

Appendix A : References

Limitation of our work
Charts

Chart i: Average annual employment growth by SA4 region on a place of work basis, 2015-16 to 2045-46

Chart ii: Employment growth by SA4 region on a place of work basis, additional persons employed, 2015-16 to 2045-46

Chart iii: Average annual employment growth by industry, 2015-16 to 2045-46

Chart 1.1: Growth in population over the last 20 year (1996 to 2015) across Melbourne Local Government Areas

Chart 1.2: Forecast growth in population in the next 10 years (2015 and 2025) across Melbourne Local Government Areas

Chart 2.1: Victoria’s population growth, 1986-2046 (forecast)

Chart 2.2: Victorian age distribution, 2011 and 2046 (forecast)

Chart 2.3: Average annual population growth by region (SA4) 2015-16 to 2045-46

Chart 2.4: Proportion of Victorian population with long term condition, 2011-12

Chart 2.5: Health risk factors by remoteness, 2011-12

Chart 2.6: Proportion of people with post-school qualifications in Victoria. 2004-2014

Chart 2.7: Education related personal education exports, calendar year estimates 1972-2014

Chart 2.8: Backlog of criminal cases pending over 12 months in a financial year by court and year, 2009-10 to 2013-14

Chart 2.9: Real growth in equvalised disposable household income by income quintile in Victoria, 2003-04 to 2013-14

Chart 3.1: Victoria’s civilian working age population growth, 1989-90 to 2045-46

Chart 3.2: Victoria’s labour force participation rate, 1989-90 to 2045-46


Chart 3.4: Labour productivity growth projections for Victoria, 1990-91 to 2045-46

Chart 3.5: Contributions to GSP growth for Victoria, historical and projected, 1989-90 to 2045-46

Chart 3.6: Victoria’s labour market, 1989-90 to 2045-46

Chart 3.7: Average annual employment growth by SA4 region on a place of work basis, 2015-16 to 2045-46

Chart 3.8: Employment growth by SA4 region on a place of work basis, additional persons employed, 2015-16 to 2045-46

Chart 3.9: Average annual employment growth by industry, 2015-16 to 2045-46

Chart 3.10: Melbourne Consumer Price Index (CPI) – selected items, 2000 to 2015

Chart 3.11: Nominal growth in the Victorian economy and Melbourne house prices, 1989-90 to 2013-14
Tables
Table i: Trends in health and wellbeing
Table 1.1: Creating a smart city
Table 2.1: Trends in health and wellbeing
Table 2.2: Number and rate of criminal offences, 2010-11 to 2014-15
Table 2.3: Percentage of private rental dwellings in each category of public transport accessibility, Melbourne, 2012
Table 3.1: Labour force participation rates, 2016-2046, per cent
Table 3.2: Transport infrastructure in Victoria and across Australia
Table 3.3: TomTom Traffic Index – world’s most congested cities in 2014
Table 3.4: Net inflow of workers into each SA4 region (employment by place of work less employment by place of usual residence)
Table 3.5: Mean value of assets and liabilities of households in Victoria, 2013-14 ($ ’000s)
Table 4.1: Summary of key changes to Victorian climate
Table 4.2: Average annual maximum snow depth, historical and projected (cm)
Table 4.3: Victorian land use summary as at 2012
Table 4.4: Summary of threatened species, Victoria

Figures
Figure 1.1: Infrastructure categories
Figure 1.2: Technology cycles
Figure 2.1: Victoria’s population aged 65 years and over, by SA2 (2011 Census data)
Figure 2.2: Current and future state of certain risk factors and conditions
Figure 2.3: Funding models occurring in Australia
Figure 2.4: Higher education changes
Figure 2.5: Relative socio-economic disadvantage by SA4
Figure 4.1: Broad regions of Victoria
Figure 4.2: Parts of Victoria affected by dryland salinity – 1976 to 2011
### Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AURIN</td>
<td>Australian Urban Research Infrastructure Network</td>
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<tr>
<td>BOM</td>
<td>Bureau of Meteorology</td>
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<tr>
<td>CBD</td>
<td>Central Business District</td>
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<tr>
<td>COAG</td>
<td>Council of Australian Governments</td>
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<tr>
<td>CPI</td>
<td>Consumer Price Index</td>
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<tr>
<td>DAE</td>
<td>Deloitte Access Economics</td>
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<td>DEDJTR</td>
<td>Department of Economic Development, Jobs, Transport and Resources</td>
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<td>DTPLI</td>
<td>Department of Transport, Planning and Local Infrastructure</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GSP</td>
<td>Gross State Product</td>
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<tr>
<td>ICT</td>
<td>Information and communication technology</td>
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<td>IOT</td>
<td>Internet of things</td>
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<td>LGA</td>
<td>Local government area</td>
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<td>M2M</td>
<td>Machine to machine</td>
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<tr>
<td>MPA</td>
<td>Metropolitan Planning Authority</td>
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<td>NDIS</td>
<td>National Disability Insurance Scheme</td>
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<td>NIMBYISM</td>
<td>Not-in-my-backyard mentality</td>
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<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
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<td>RIF</td>
<td>Regional Infrastructure Fund</td>
</tr>
<tr>
<td>VIF</td>
<td>Victoria in Future population projections</td>
</tr>
</tbody>
</table>
Executive summary
Deloitte Access Economics has been engaged by Infrastructure Victoria to prepare a report that provides an information base outlining Victoria’s strategic context. This report covers both the current state and a selection of possible future states of Victoria’s society, economy and environment (streams), and discusses the drivers of infrastructure demand for each stream. This will support Infrastructure Victoria’s public consultation for the development of its 30 year Infrastructure Strategy for Victoria.

The streams are of course interdependent with a number of themes (or mega trends) of key importance across all streams, as summarised below.

**Infrastructure demand**

**Population growth**
Population growth, especially in Melbourne, will see higher demand for social and infrastructure services, increased congestion and pressure on the natural environment, and intensifying competition for land use. Choices need to be made around how to accommodate Victoria’s growth.

**Climate change**
Extreme weather events result in greater demand for emergency services, utilities, and agricultural output. Climate change will affect productivity in many sectors, put more pressure on the natural environment (particularly biodiversity and water), while reducing the lifespan of infrastructure. Changing climate will also have a range of health impacts for Victorians. Mitigation actions and policies have the potential to slow the rate of climate change.

**Ageing population**
Ageing of the population will also see increasing demand for government services, such as health and public transport. The ageing population will see Victoria have a higher dependency ratio, putting pressure on government tax revenue. Our tax system makes it expensive to move house, leading to a misallocation of housing.

**Global economy**
Victoria’s economy is affected by global and local trends, including geopolitical developments, environmental pressures, the emergence of Asia as the centre of the global economy, information and capital flows, and technological developments.
The interdependencies necessitate a systems thinking approach to infrastructure planning to be mindful of unintended consequences or benefits. Our report teases out those interdependencies.

The implications of these mega-trends for both infrastructure demand and provision will also critically depend on how we utilise technology and how we design our cities. Hence, this report includes considerable discussion of the role of technology and urban form.

**Technology**
Technology is accelerating faster than ever before, and will help shape demand for infrastructure as well as our choices for infrastructure provision. Future technological advances can assist us in combating the challenges we face by helping us to both make better use of information (for example through smart devices, Internet of Things and sensors, and smart meters), better use of the infrastructure that we already have, while also potentially opening up new possibilities for infrastructure provision.

**Urban form**
Urban form describes patterns of urban development and renewal and how we design our cities. Where people live, work and play has a big role in determining what kind of infrastructure we need and where, but infrastructure also influences urban form. Over the next 30 years, we expect to see continued peri-urban development and densification in Melbourne, as well as a gradual shift toward becoming a polycentric city.

A polycentric city describes a city of more than one centre – it sees employment clusters around Victoria, where workers and employers can continue to benefit from agglomeration and knowledge-spill-overs.

In the future, Victoria’s liveability may trade-off with productivity – bigger cities and economies risk disamenity through increased pollution, congestion and loss of private and public space. Maintaining liveability will be an ongoing challenge in Victoria, with jobs growth projected to be strongest in inner-Melbourne over the next 30 years.

This report outlines the current and possible future states of Victoria across the three streams of society, economy and environment, and the key drivers of infrastructure need for each of these streams. The base future case projects out to 2046 and is based on current and emerging major trends affecting Victoria using population and demographic profile projections from Victoria in Future (2015), and macroeconomic forecasts to match the Victorian Government’s 2015-16 Budget.

Views on the future state need to be couched in terms of uncertainty, particularly when projecting over an extended timeframe of 30 years. But infrastructure assets are also long term assets, so trying to make sense of those longer term uncertainties is important in understanding future infrastructure need. To that end, we have undertaken scenario modelling and qualitative analysis to demonstrate three possible different future scenarios for Victoria. The scenarios test the assumptions of the base future case forecasts and illustrate how key trends identified in this report could affect infrastructure requirements in future.

Overall, delivering infrastructure services is not solely building new infrastructure to accommodate growth or to fix problems. It should also include exploring demand-management alternatives (such as peak spreading) and unlocking latent capacity of existing infrastructure (such as driverless cars). Augmenting existing infrastructure using technology is another option to facilitate greater capacity, although this often still requires substantial infrastructure and build such as digitised signalling for road and rail.

A summary of the key drivers of key themes for Victoria’s current and future state demand are provided below. Broad implications for infrastructure demand are discussed throughout each relevant chapter.
Four key themes are covered in this stream:

- **Demographic:** Victoria’s population is in transition;
- **Health and wellbeing:** Health and wellbeing indicators demonstrate a changing future state of health;
- **Education and training:** Education and training are critical social and economic features of Victoria;
- **Community and social cohesion:** A more equal society is important for Victoria’s communities;

**Victoria’s population is in transition**

Over the last 30 years, Victoria’s population has grown from 4.2 million to 6.1 million. Over the next 30 years it is expected to reach 9.4 million. Growth across Victoria is uneven and is centred in Melbourne – a trend that is expected to continue into the future. Accommodating more people can be done through peri-urban development or densification, both of which have different infrastructure challenges.

In addition, Victoria’s population is ageing, which will continue into the foreseeable future, reinforced by longer life expectancies and relatively slow natural increase (consistent with other developed economies). This will result in a lower proportion of Victorians participating in the workforce, in turn increasing the dependency ratio, and additional demand for the healthcare system.

**Health and wellbeing indicators demonstrate a changing future state of health**

Although the share of Victorians self-reporting their health as ‘excellent’ or ‘very good’, significantly improved over the past 10 years, the prevalence of risk factors (such as sedentary lifestyle) and conditions (such as diabetes) have increased over time across a range of indicators. Prevalence and risk factors are slightly higher in regional Victoria compared to metropolitan areas. This trend is expected to continue to increase, against a backdrop of lack of exercise, poor nutrition and other risk factors.

Key trends in health and wellbeing are shown below under three broad drivers – fiscal pressure and regulation, demographics and burden of disease, and connectivity and information (Table i).

<table>
<thead>
<tr>
<th>Fiscal pressure and regulation</th>
<th>Demographics and burden of disease</th>
<th>Connectivity and information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordability challenge</td>
<td>Ageing population</td>
<td>Telehealth and eHealth</td>
</tr>
<tr>
<td>Funding models and incentives</td>
<td>Chronic disease management</td>
<td>Data and information</td>
</tr>
<tr>
<td>Cost pressure of medical advances</td>
<td>including the role of medical technology</td>
<td>transforming health</td>
</tr>
<tr>
<td></td>
<td>Preventive health</td>
<td>New scientific technologies to create personalised medicine</td>
</tr>
</tbody>
</table>

Source: Deloitte Access Economics
Education and training are critical social and economic features of Victoria

Over 85 per cent of Victorian students currently progress through to the completion of secondary schooling, representing a marked increase over the last five years from 80.5 per cent in 2009, which is in line with other OECD countries.

The way infrastructure supports education in the future will be profoundly different as technology is increasingly incorporated into the classroom and the workforce. This is because technology advancements will significantly change demand for jobs in the future and with it, training requirements. This will challenge a number of existing roles, but at the same time, new jobs will be created due to technology. Education, therefore, must be more responsive to the rapidly changing requirements of the labour market. Victorians will likely see a shift toward lifelong learning, individualised curriculums and a global education marketplace.

A more equal society is important for Victoria’s communities

Inequality is a societal issue that also has implications for the economy and environment. Social cohesion can be enhanced through a more equal and fair society.

Infrastructure and urban design can play an important role in creating a cohesive society that is responsive to current and future patterns of migration. Equally, continued spatial inequality can exacerbate poverty and disadvantage and lead to entrenchment across generations. Addressing this effectively is essential to preventing the development of long term areas of social disadvantage, and instead create a more integrated and socially equal society. Accessible infrastructure – such as public transport – can allow lower income and other marginalised groups to better access education and employment opportunities and more fully participate in society.

Higher education is a key export for Victoria. Institutions will need to keep pace with emerging competitors in Asia who are not only upgrading and scaling up higher education offerings, but they are also becoming interlocutors, partners, and peers for universities in other parts of the world.

Possible future scenario: Higher population growth would bring forward infrastructure demand

The first scenario in chapter 5 tests how infrastructure implications change when population growth is assumed to be significantly higher compared to the base case set out in chapter 2.

Victorian population is assumed to reach approximately 10.4 million people, or one million more people than the base case, driven by global migration trends. Under this scenario, a higher proportion of residents choose to live in the west side of Melbourne. The main infrastructure implication of this scenario is that Victoria would reach the base case projection of 9.4 million people around five years earlier, and a higher level of urban development occurs in Melbourne’s West.

Risk management will be a consideration for government in this scenario: the downside costs of delaying infrastructure build can include congestion and lack of access to services, while building infrastructure too early means that infrastructure is underutilised for a period of time. A potential benefit to delaying infrastructure investment is that the choices we make for investment could be different, for example technological advances can present new options for infrastructure solutions.
The three P’s

In the long-run an economy’s performance in terms of the size of the economy (measured by gross state product) hinges on three factors:

- **Population**: the size of the population helps determine the size of domestic markets and how scale of production can be achieved at lower cost;
- **Participation**: the size of the working age population and the share of this group that is actively employed or looking for employment (labour force participation) is an indicator of the capacity of the economy; and
- **Productivity**: how efficiently we turn inputs into outputs determines the capacity of an economy to produce, compete internationally and sustainably use resources;

The factors are interrelated; population influences the size of the labour force and participation rate, while productivity is influenced by the labour force participation of an additional entrant to the labour force.

Bringing the three P’s together we can distinguish their historical and projected relative contribution to growth in GSP for Victoria:

- Around 63 per cent of the total growth in Victoria’s economy from 1989-90 to 2014-15 is attributable to labour productivity growth, with a series of microeconomic reforms during the 1980s and 1990s supporting productivity growth over that period. The contribution of labour productivity is projected to be moderately lower over the next 30 years;
- Population growth contributed around 52 per cent to total GSP growth historically and is projected to make a stronger contribution to GSP growth to 2045-46, with additional overseas migration contributing notably to that growth;
- A lack of strong growth in labour force participation historically has meant it has not contributed much to overall GSP growth and future trends suggest this will worsen as ageing of the population reduces labour force participation; and
- Average hours worked detracted around 13 per cent to Victoria’s economy over the historical period and this negative influence will be stronger in the future, as more of the workforce shifts to part-time roles.

It implies that growth in Victoria’s economy in the future will be predominantly driven by strong population growth, more so than how efficiently the economy will be transforming inputs to outputs (in the absence of further competition and regulation reform).

Long term trends influence Victoria’s economy

Victoria’s economy is impacted by global and local trends, including geopolitical developments, environmental pressures, the emergence of Asia as the centre of the global economy, demographics such as population ageing and migration, information and capital flows, and technological developments.

These trends bring opportunities and challenges for Victoria. To leverage the opportunities to maximise economic prosperity, Victoria will need to be internationally competitive, which means being more productive. Often this means being smarter in the way goods and services are produced and provided to consumers. Being more productive is a function of many things, including the amount and quality of infrastructure people have at their disposal.

The need for sustainable economic development (particularly in relation to climate change) is also a global trend that will have implications for Victoria’s economy and existing and future infrastructure needs, as well as for Victoria’s competitiveness.

The labour market is expected to grow unevenly

Our analysis of the current and future state of the Victorian economy is underpinned by both Victoria in Future population growth (actual and forecast by SA4 region), as well as employment by sector (actual and forecast by SA4 region).

Chart i shows that Melbourne-West, Melbourne-North East and Melbourne-Inner are forecast to have the highest rate of employment growth, while the Warrnambool and South West SA4 is forecast to have the lowest. The regional distribution of employment will also have implications for infrastructure planning going forward.
Chart ii reveals that Melbourne-Inner is forecast to see the strongest growth in terms of additional persons employed, followed by Melbourne-West and Melbourne-South East. This is a reflection of the size of the existing workforce in each region and the forecast growth rates shown in Chart i.

Source: Deloitte Access Economics projections. Note that these projections show employment according to the region in which people work (i.e. place of work basis) rather than the region in which they live.
Victoria’s industry composition has been changing and will increasingly be services-driven

Victoria is often portrayed as the manufacturing belt of Australia. While it is true that manufacturing is a bigger share of Victoria’s economy relative to its share in other state economies, Victoria has increasingly been making a transition from an industrial economy based on manufacturing to a tertiary economy based on services.

Chart iii shows projected employment growth rates across all major industries. The strongest rates of employment growth in Victoria over the projection period are expected to be seen in the social services areas (health care and social assistance, and education and training), business services (professional, scientific and technical services, and finance and insurance services), and construction. At the other end of the spectrum, the agriculture, forestry and fishing, mining and manufacturing sectors are all expected to see a decline in employment.
Looking ahead, new industries will emerge with different infrastructure needs, while some old industries will decline. For example, the manufacturing industry has a pattern of demand for infrastructure (including a relatively strong demand for electricity) which is quite distinct from the infrastructure requirements of services-based industries.

- The relative decline of manufacturing will mean relatively less demand for electricity and related energy infrastructure.
- Transport infrastructure that meets the needs of services-based industries is expected to see stronger growth.
- Efficiently connecting people across cities and regions is of particular importance to the productivity of the rising knowledge economy in Melbourne.

Housing affordability is under pressure

House prices in Melbourne have recorded very strong rises in recent years, and has notably outstripped growth in Victoria’s GSP since around 2000. Concerns around housing affordability are particularly acute for first home buyers and low income rental households.

Accessible infrastructure such as public transport, can allow lower income and marginalised groups to better access education and employment opportunities and more fully participate in the economy. This is particularly the case since there is evidence that lower income renter households in Melbourne are increasingly concentrated in outer urban locations due to cheaper housing, but where access to public transport is poor.

Housing affordability is important to households but so is being in close proximity to jobs. Diminishing housing affordability raises issues around the extent to which infrastructure should facilitate growth on the urban fringe where housing is cheaper or densification of existing areas which are close to jobs.

Victoria has a sound fiscal position

Victoria’s fiscal position is relatively sound, providing scope for the delivery of further public infrastructure while also meeting public service delivery challenges. Moreover, while general government net debt to gross state product (GSP) has risen over the past 15 years, it is very low by historical and international and domestic comparisons.
Possible future scenario: Technological advances may drive a more productive society

The second scenario in chapter 5 tests how infrastructure implications change when productivity growth is assumed to be higher compared to the base case set out in chapter 3.

The enhanced productivity scenario sees higher than forecast productivity growth of 2 per cent (compared to 1.6 per cent in the base case) owing to an assumed higher uptake of new and emerging digital technologies. The results of this scenario did not point to significantly different infrastructure implications compared to the base case – it was more a case that it built on to the implications of the base case. In both the base and scenario cases, jobs growth centres in Melbourne due to the growing importance of the knowledge economy.

Although Victoria’s fiscal position is sound, there will be mounting pressure on the Victorian budget over time, including fiscal pressure owing to Victoria’s ageing population. Over the long-term, the State’s fiscal position depends on demographics, the economy, policy decisions regarding expenditure, taxation and fiscal federalism.
The importance of the environment to Victoria’s economy and society cannot be overstated. The environment supports the quality of life and wellbeing of the population in myriad ways.

As Victorian living standards have improved over time, so too has the focus on sustainable living and preservation of the environment. Initiatives across all levels of government, industry and households are collectively attempting to reduce the carbon footprint of the Victorian economy, recovering a greater share of our growing waste, conserving habitats that support biodiversity and improving air and water quality.

Natural resources that are under threat are often preserved because decisions affecting the environment do not just impact the wellbeing of current generations, they also affect future generations who will one day inherit the natural environment and rely on it for their survival and wellbeing.

The relationship between the environment and infrastructure is two-way: environmental issues affect infrastructure, and infrastructure affects the natural environment.

The key themes covered in this stream include:

- Climate change;
- Land degradation;
- Loss of biodiversity;
- Air pollution;
- Water resource management;
- Marine and coastal environments; and
- Waste management

Climate change adaptation and mitigation
Climate change is a global environmental issue with implications that transcend the three streams of this report. In recent years, climate change has emerged as a key policy issue in Australia and internationally – heightened recently with the formal agreement between UNFCCC parties at the 2015 Paris Climate Conference.

Projections indicate that Victoria will be particularly affected by climate change, and it is expected to impact significantly on agriculture, tourism, the environment, public health and infrastructure.

In addressing the implications that climate change has on infrastructure needs – or as an issue more broadly – there are two sides to consider:

- The impact a changing climate has on the economy, society, environment, and the implications for infrastructure;
- The impact of actions and policies undertaken by households, industry and government to slow the rate of climate change.

Although linked by the same underlying issue, these two impacts will have different implications for Victorian infrastructure. As temperatures and sea levels rise and extreme weather patterns increase in severity and frequency, existing infrastructure will degrade more rapidly. On the other hand, efforts to reduce climate change will change demand for infrastructure. For example, Victoria will continue to transition towards renewable generations, giving rise to a need for different energy infrastructure in the future. Increased uptake of off-grid power generation coupled with batteries is expected to reduce burden on the electricity network. Other emissions-intensive industries will also transition to more sustainable production methods while consumers will become more educated as to how they too can reduce emissions.

While reductions in global greenhouse gas emissions may constrain global warming, some degree of warming (and associated changes) is considered to be inevitable, meaning future adaptation is required.

Climate change and its associated impacts are expected to directly affect all classes of infrastructure across Victoria (and globally) in one way or another, including:

- Increased maintenance requirements across all classes of infrastructure resulting from increased extreme weather events and rising temperatures;
- Greater need to diversify and increase water supply options to build supply reliance against drought through constructing rainfall independent water sources;
- Increased incidence of heatwaves and fire weather affecting Melbourne’s fringes and regional areas;
- Greater need to upgrade power lines to increase the safety, reliability and resilience of the network during bushfires;
- Freight and logistics networks will need to adapt to accommodate changes in agricultural patterns across the state; and
• Increased maintenance and replacement of all classes of infrastructure in coastal areas which are vulnerable to sea level increases.

The risks that climate change poses to individual assets and sectors should not be considered in isolation because networks are often interconnected meaning that failure in one sector can result in the shutdown of other infrastructure. For example, failure of the power grid could result in the shutdown of the transport and telecommunications networks.

There is a high degree of uncertainty surrounding the timing and extent of these implications for Victoria, resulting from the imprecise nature of climate change projections. Navigating this uncertainty adds complexity to the task of infrastructure planning.

Infrastructure is also expected to play a significant role in facilitating initiatives that mitigate climate change, primarily through reducing greenhouse gas emissions. For example, new infrastructure will be required to build and connect large-scale projects to the electricity grid, such as solar power in the state’s north, or geothermal power in the west. Distributed energy storage infrastructure will also be important for facilitating the penetration of intermittent energy sources, such as wind and solar. On the other hand, other infrastructure assets may become stranded in a decarbonised economy, such as those used by extractive industries.

At the household and small business level, off-grid power generation coupled with battery storage is expected to become more commonplace. There is also potential for greenhouse gas mitigation at the household level by improving the efficiency of Victoria’s existing stock of houses and buildings, many of which were built prior to the introduction of energy efficiency regulations (Sustainability Victoria, 2014).

The impacts of climate change will affect different parts of Victoria in different ways, some region-specific issues are identified below:

• Loddon-Mallee region, which will see conditions change such that agriculture shifts from grain production to livestock, and risks of irrigation, transport and storage infrastructure becoming stranded;

• Barwon South West region, which is at risk from rising sea levels and more frequent and severe extreme weather events;

• Grampians region, where already threatened flora and fauna species will come under further pressure from a changing climate;

• Gippsland region’s significant natural heritage is under threat from decreased water availability, reduced snowfall and higher sea levels;

• Hume region, home to major ski resorts, is expected to see drastic reductions in snow fall over time due to climate change; and

• Regional areas as well as Melbourne’s fringes will be effected by increased heatwaves and fire weather, which are expected to increase threats to public health over the next 30 years, placing additional stress on health and emergency services. Metropolitan Melbourne will also be affected by heatwaves.

**Land degradation**

Conflicts over the use of land are at the heart of many environmental issues facing the state, and they are only expected to worsen. Around one third of Victoria is held for conservation reserves, but it is under growing pressure from demands for higher productivity and development, such as logging and urban development. Infrastructure can exacerbate the environmental effects of land use (such as salinity), especially when poorly planned and placed, but can also be used to manage them when well planned.

**Loss of biodiversity**

Preservation of native species is important not only for the species themselves, but also for supporting current and future generations. Biodiversity in Victoria is under threat from a range of natural and human behaviours. The number of endangered plant and animal species in Victoria has increased over the past decade.

Historically, land clearing was the main threat, but clearing of native vegetation in Victoria has subsided over time, giving rise to new threats. Infrastructure can act as either the problem or assist in reducing biodiversity losses – examples include improving water quality, connecting fragmented habitats and managing pests.
Marine and coastal environments

Victoria’s marine environment covers approximately 1 million hectares, extending around 5.5 kilometres out to sea from the state’s 2,000 kilometres of south-facing coastline. This environment supports over 12,000 known species of marine plants and animals (DELWP, 2015). Within the Port Phillip Bay, upgrading and building port infrastructure should be carefully considered to reduce environmental impact and preserve marine life.

Air pollution

As cities grow, the air quality around them tends to worsen. Air quality is an important factor in the health of both the human population and the natural environment, and for that reason it is closely monitored in major developed cities. While one-off events, such as bushfires and windstorms, can affect air quality across the state, it is Victoria’s built-up and industrial areas that face year-round air pollution problems caused by household and industrial activity.

Water resource management

A reliable and clean supply of fresh water is essential for the long term health and prosperity of any society. At the heart of many decisions regarding water management is a trade-off between the needs of households, businesses and the environment.

The legacy of infrastructure that was constructed during the Millennium Drought highlights how water security is a major driver of infrastructure demand. During the drought, the Victorian Government invested in major projects. Future challenges for Victoria include reducing the reliance on rainwater and improving water security in regional areas for households, agriculture and the environment.

Waste management

The effective management of solid waste is important for the health of the human population and the environment. Victoria manages around 12 million tonnes of solid waste per year, with around two-thirds recovered and the remainder going to landfill. The challenge in future will be managing additional waste generated by a growing population.

Possible future scenario: Climate change mitigation will change Victoria’s economy

The third scenario in chapter 5 focusses on a greater degree of climate change mitigation activities than the base case set out in chapter 4.

This scenario sees a significant shift in energy mix from coal to renewables in response to carbon price signals and with it, increased demand for energy infrastructure that facilitates this shift. Depending on the mitigation policy implemented, there may also be an impact on demand for transport and particularly private car use. This scenario sees relatively low and localised employment impacts.
Chapter 1: Setting the scene
1.1 Infrastructure Victoria is a new authority
Modern, efficient infrastructure that connects people and places is at the heart of any thriving economy and society. Melbourne’s ranking as the world’s most liveable city in part reflects the significant benefits that stem from well thought-out, long term infrastructure planning.

Infrastructure Victoria has been established by the Victorian Government with a mandate to improve public debate and build consensus on priority infrastructure projects in Victoria. This aligns with the recent trend in other Australian jurisdictions to create bodies to advise governments on infrastructure planning.

Infrastructure Victoria is a statutory authority led by a board of seven members comprising four members from the private or non-government sectors, and three from the public sector.1

Infrastructure Victoria’s primary functions include:
- Preparing and publishing a 30 year infrastructure strategy detailing short, medium and long term infrastructure needs and priorities;
- Providing advice to the government on infrastructure matters; and
- Publishing research on infrastructure matters.

1 Infrastructure Victoria was established by the Victorian Government under the Infrastructure Victoria Act 2015.

1.2 The purpose of this study is to provide the strategic context across three streams
Deloitte Access Economics has been engaged by Infrastructure Victoria to outline Victoria’s strategic context – that is both the current and possible future states of Victoria across the three streams of society, economy and environment, and the key drivers of infrastructure need for each of these streams. This work provides an information base to support the development of a 30-year infrastructure strategy for Victoria.

Our approach to analysing the current and future state of Victoria uses two frameworks:

- **Current state and future state:** Here we present the current and emerging major trends affecting Victoria’s society, economy, and the environment. This informs our ‘base case’ future state.
- **Possible future scenarios:** We have undertaken scenario analysis to test a range of possibilities for Victoria’s future state. Here we consider three discrete scenarios based on emerging mega-trends and consider how infrastructure implications change relative to the base case.
Our analysis is focussed on the drivers of physical infrastructure need and how this will evolve over the coming three decades. Broadly, infrastructure in Victoria fits into one of the following categories:

**Figure 1.1: Infrastructure categories**

- Information and Communications Technology
- Education and training
- Transport
- Water and waste
- Cultural, civic, sporting, recreational and tourism.
- Health and human services
- Science, Agriculture & environment
- Justice and emergency services

*Infrastructure and architecture across Victoria*
1.3 Methodology

Current state and base future case
This analysis draws together information about current and emerging economic, social and environmental trends in Victoria from various sources including the Victorian Government, the ABS and other research reports. For the base future case, key forward looking quantitative measures include Victoria’s population and demographic profile, the size and structure of the Victorian economy and a number of fiscal measures.

- Population and demographic profile projections are sourced from Victoria in Future 2015 (VIF, 2015);
- We developed projections of employment by industry on a regional basis across Victoria. Our methodology calibrates Deloitte Access Economics’ broad macroeconomic forecasts to match the Victorian Government’s population and economic forecasts from Victoria in Future 2015 (VIF, 2015) and the Victorian 2015-16 Budget.

Potential future scenarios
Given the uncertainties associated with forecasting for a 30 year outlook, understanding how potential variations to the base future case may impact infrastructure demand is equally important as the central view.

We have undertaken scenario modelling to demonstrate three possible different future scenarios for Victoria. The scenarios test the assumptions of the base-case forecasts, which are modelled through changes to population growth and distribution, and employment by industry and region.

The third scenario, which considers the infrastructure implications of stronger climate mitigation actions has been informed by previous research by Deloitte Access Economics on the impact of carbon policies on the Australian and Victorian economies (2011). This modelling was updated to assess the expected impact of such a policy to Victoria’s economy.
1.4 The future state will be driven by megatrends

Base future case
Having set the scene for the current state, we fast-forward to 2046 describing how drivers will change under a ‘base’ future case. This is underpinned by projections for a smaller selection of the key metrics identified in the current state analysis, including Victoria in Future population projections (VIF), and employment forecasts using a framework applied for whole of Victorian Government employment forecasting.

The base future case provides the anchor against which other possible future scenarios are assessed, to help to illustrate different possible infrastructure implications.

This report focusses on four megatrends: climate change, population growth, ageing population and the global economy. A discussion of each is provided below.

Access to housing for an ageing population

The growing number of older Victorians will change the distribution of the population - it will impact workforce participation rates. Despite this drop in workforce participation, many older Victorians will choose to work for longer compared to previous generations.

A key infrastructure challenge for Victoria’s ageing population is ensuring that we have enough suitable accommodation in the communities where they are needed – this includes smaller dwellings (units and apartments), aged care facilities and assisted living communities. This helps to facilitate better allocation of housing by providing people with more choice around downsizing homes within their communities.

But it is important to recognise that moving home, even within the same local area is costly, not just financially but also in terms of time, effort and ties with the neighbourhood. That said, addressing the issues that land transfer duty creates would remove a strong disincentive for people to sell property, improving labour mobility and potentially unlocking larger homes that are close to the CBD.

Accessibility will be a key focus for accommodating our ageing population, both in terms of urban renewal and development (such as low profile gutters), public buildings and spaces, and public transport.

A further theme relevant to ageing population is the increasing prevalence of chronic disease as people live longer. This will see greater need for accessible health infrastructure, although the extent of increased demand will vary across Victoria.
Victoria’s population is forecast to reach 9.4 million over the next 30 years, which will be distributed unevenly across the state. Higher growth is expected in metropolitan areas (driven in part by Victoria’s continued shift to a knowledge-based economy) and on the fringe (where land is cheaper). In contrast, Melbourne’s middle ring and regional cities and rural towns are expected to see more muted growth. How we accommodate Victoria’s growth, our choices around urban form, has major implications for infrastructure.

The pattern of population growth described is expected to result in continued densification of inner Melbourne, and growth in peri-urban development. These two modes of development have different concerns, opportunities, and infrastructure implications.

As Victoria’s economy has become increasingly integrated into the global economy, we are impacted by global and local trends. These include: geopolitical developments; environmental pressures; the emergence of Asia as the centre of the global economy; demographics such as population ageing and migration; information and capital flows; and technological developments. These trends bring opportunities and challenges for Victoria.

Victoria is well placed to benefit from the rise of Asia’s middle class through trade opportunities. In an increasingly integrated global economy, Victorian businesses and individuals need to be internationally competitive to participate and thrive, making productivity an important consideration.

In line with trends in other developed countries, demographic and broader trends have included the increasing importance of agglomeration, while an ageing population will see participation rates fall and the dependency ratio increasing fiscal pressures for the government.

In addition, global social shifts around family structures, work-life balance and the growth of non-traditional work modes (part-time, casual employment) are also being felt in Victoria, meaning that Melbourne’s infrastructure needs to be adaptable.

The need for sustainable economic development is also a global trend with implications for Victoria’s economy and existing and future infrastructure needs. Notably, climate change will slow the rate of growth of the global and Australian economies if market based mitigation strategies are not adopted — these are usually the most cost effective interventions (CSIRO, 2015).

Victoria, with its traditional manufacturing and coal-fired energy sector is already in the midst of transitioning to a more environmentally sustainable economy.

Climate change is one of humanity’s greatest challenges. Globally, temperatures are rising and extreme weather events are becoming more frequent and severe. Sea levels are also rising, putting pressure on low-lying and coastal areas. Projections indicate that these trends will continue down the same path in the absence of action.

Infrastructure is also expected to play a significant role in facilitating initiatives that mitigate climate change, primarily through reducing and sequestering greenhouse gas emissions. For example, new infrastructure will be required to build and connect large-scale projects to the electricity grid.

Climate change is expected to see a number of different localised infrastructure implications for specific regions, including Loddon-Mallee region, Barwon South West region, Grampians region, Gippsland, Hume region and Greater Melbourne.
1.5 Technology in particular will shape future demand for infrastructure

Technology is accelerating faster than ever before. It is difficult to overstate the potential implications this has for Victorians, the economy, our environment and infrastructure. Figure 1.2 summarises the key technological advancements of the last 50 years, as well as the current ‘era’ (Exponential).

Figure 1.2: Technology cycles

In the lead up to 2020 and beyond, we are moving from the ‘Digital era’ to an era where technological advances are becoming exponential in their impact on society and the economy. The figure above summarises the disruptors in the digital and exponential eras.
As cities become denser, technology can improve their liveability, from the design of houses, offices and public buildings, public spaces through to the city-wide operation of infrastructure. Technology can help people to feel connected, and can "smooth the sharp edges of agglomeration." (Deloitte, 2015).

Smart cities apply digital technology to make better use of infrastructure and public spaces, and to improve public safety. People interact in new ways, stimulating creativity and innovation and contributing to more vibrant neighbourhoods. Smart cities can help to improve the liveability of a place, whether development is through densification or through peri-urban development.

Table 1.1 Creating a smart city

<table>
<thead>
<tr>
<th>Area of ICT application</th>
<th>Technologies</th>
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<tbody>
<tr>
<td></td>
<td>Cheap sensors and actuators: Allow remote monitoring and managing of urban infrastructure services such as transport, telecommunications, energy, water, health and emergency services.</td>
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<td></td>
<td>Connectivity: Mobile data networks are virtually ubiquitous across urban spaces, and are permanently connected to the internet and therefore other devices. Allows for data collection in a continuous and real-time way.</td>
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<td></td>
<td>M2M: Machine-to-machine communication is being developed to assist with the collation, interpretation and management of large quantities of data generated by real time sensors, turning it into information.</td>
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<table>
<thead>
<tr>
<th>Applications</th>
<th>Transportation: Using real-time traffic prediction and other methods of reducing congestion and its by-products. Also, digital signalling for rail to increase capacity.</th>
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<tbody>
<tr>
<td></td>
<td>Services: Using ICT to integrate the information systems of different service delivery organisations; for example in education, health care, public safety and waste management.</td>
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<tr>
<td></td>
<td>Government: Making government data more accessible to the public. Also use of smart cards, e-ID and e-licencing.</td>
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<td></td>
<td>Energy: Using smart meters to analyse customer energy usage to provide customised products and services and real time pricing, in order to improve energy efficiency and maintain sustainable power supplies.</td>
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<td></td>
<td>Water: Monitoring and managing water infrastructure and usage in real time to improve water efficiency and reduce wastage.</td>
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<td></td>
<td>Local economy: Using ICT to create ‘smart’ industrial zones where businesses can share information and administrative services.</td>
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</tbody>
</table>

Source: Deloitte Analysis, 2014
A smart city framework or Masterplan consists of six main components, the ingredients to making a successful smart city (Klingberg, 2015):

- **A smart environment**: green buildings, green energy, green urban planning;

- **Smart living**: Safe, culturally vibrant and happy, healthy;

- **Smart mobility**: Mixed modal access, prioritised clean and non-motorised options, integrated ICT;

- **Smart people**: 21st century education, inclusive society, embrace creativity;

- **Smart economy**: Entrepreneurship and innovation, productivity, local and global interconnectivity; and

- **Smart governance**: ICT and eGovernance, transparency and open data and enabling supply and demand side policy.

All of that said, it is important to stress that the development, uptake and impact of new technologies in the future are all unknowns, and that some of this future analysis involves gazing into a crystal ball. For example, many reports point to the potential benefits of driverless cars, including expected reductions in congestion through optimised driving. However, various modelling and live experiments have shown that depending on the wider ownership model adopted (shared versus private ownership or a mix) and other assumptions, congestion could in fact more than double due to more cars being on the road for longer (Public Transport Users Association, 2015). Another example of uncertainty is the slower than expected uptake of technology that has the potential to significantly improve administration and reporting in a hospital setting. Despite the technology already being available and expectations of a large impact, uptake to date has been muted by the highly regulated operating environment of the health sector.

Moreover, technology on its own cannot solve all of our current challenges. Government has a significant role to play through soft infrastructure – that is, shaping policy and incentives in the economy and society through rules, regulation and taxation (Hatfield-Dodds S. et al, 2015).
1.6 Melbourne has experienced two recent trends in urban form

Where people live, work and play plays a big role in determining what kind of infrastructure we need and where but infrastructure also influences urban form. Urban form includes the composition and location of hard and soft infrastructure in a defined space. Ideally it is designed to facilitate the optimal arrangements for our population and its changing needs.

At a very high level there are two main models for city development: peri-urban development (urban development on the fringe) and densification (or ‘Manhattanisation’).

For the past twenty years Melbourne has seen strong trends in both – that is population growth has been greatest in fringe Local Government Areas (dark blue bars) and inner-Melbourne (green bar), illustrated in Chart 1.1. The middle ring of Melbourne has seen much slower population. These trends are expected to continue, see Chart 1.2.

Chart 1.1: Growth in population over the last 20 year (1996 to 2015) across Melbourne Local Government Areas

Source: ABS 2008, Regional Population Growth (Cat. No. 3218.0) and Victoria in Future (2015).

Choices over Victoria’s urban form will be a major driver for infrastructure going forward, and densification and peri-urban development have very different infrastructure implications. Infrastructure will be heavily influenced by, but can also direct, the future urban form of Victoria, particularly Melbourne.

Complementary to both peri-urban development and densification is a gradual shift from the current monocentric model (where Melbourne’s CBD is the centre), to a polycentric city or a ‘State of Cities’ (Plan Melbourne Refresh, 2015). This shift is very long term in nature and generally occurs gradually.
Polycentric city describes a city of more than one centre with a diverse range of employment and higher-order services. It sees employment clusters around Victoria, where workers and employers continue to benefit from agglomeration and knowledge-spill-overs.

But this model is not exactly a ‘one or the other’ choice – internationally, polycentric cities have great diversity in terms of densification, and the size of the central city relative to its satellite cities. In other words, a polycentric can still have a very large central city (in terms of population, employment and/or geography) with smaller employment ‘hubs’ around it.

It is important to stress that there are pros and cons for these different development modes, and that this report is not judging one as better than the other. The good aspects and the challenges for each mode as we see them in Victoria’s context are summarised in the following table.
<table>
<thead>
<tr>
<th>Peri-urban development</th>
<th>The good</th>
<th>The challenges</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Allows space for larger more affordable detached homes with backyards.</td>
<td>Infrastructure to virgin developments is extremely expensive (roads, transport, utilities) and has significant impacts on the environment (competition for land use, higher emissions, higher energy and water use).</td>
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<td></td>
<td>New developments in Victoria are denser than they were in previous decades (for example, narrower streets). Some level of densification can be achieved through more compact urban design, and smaller lots.</td>
<td>These areas are often lower amenity. Significant urban expansion without appropriately timed infrastructure sees risks of rising social disadvantage and disconnection, and of Melbourne becoming a two speed city.</td>
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<td></td>
<td>With accessible infrastructure services, workers can commute to work and maintain equality of opportunity.</td>
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<tr>
<td>Manhattanisation</td>
<td>Lower commute times bring health and well-being benefits (lower stress, road toll, and risk factors associated with a more sedentary life (such as diabetes, and stroke).</td>
<td>Badly planned, densification can result in higher congestion in the middle and inner ring, and lead to a loss of amenity.</td>
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<td></td>
<td>Well planned densification can see a lower carbon footprint per person, more efficient delivery of additional infrastructure (economies of scale), while maintaining liveability, and improved equality of opportunity. Also the benefits of agglomeration boost the productivity and innovation cycle.</td>
<td>Without a strong emphasis on accessibility, convenience, beauty and shared open spaces, liveability will directly suffer.</td>
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<td></td>
<td></td>
<td>Victorians often prefer homes with larger living spaces and privacy (Grattan, 2011). Densification is (typically predicated on smaller living spaces) can be challenging to people’s sense of privacy.</td>
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<tr>
<td>Polycentric City – ‘State of Cities’</td>
<td>This is complementary to both peri urban development and densification. It allows for better use of existing infrastructure capacity due to the countercyclical flow of traffic with people travelling in, out and across Melbourne to get to work.</td>
<td>The current hub and spoke transport networks do a good job transporting people to where they need to get to (typically CBD for work).</td>
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<td></td>
<td>More dwellings are closer to workplaces, which sees many of the same benefits of Manhattanisation (while still potentially benefiting from agglomeration).</td>
<td>A key challenge in facilitating the shift to a ‘State of Cities’ will be providing multi-modal transport that cuts across Melbourne and between activity centres.</td>
</tr>
</tbody>
</table>
1.7 Possible future scenarios
A number of forces are going to shape Victoria and its need for infrastructure in the coming years. It is important that long term infrastructure planning in Victoria is cognisant of a range of contingencies going forward to better understand possible pathways and how they may affect the State.

The report considers how three possible future scenarios, one for each stream, impact differently on key drivers of infrastructure need compared to the base future case. These scenarios do not reflect the full range of possibilities for Victoria – far from it, but they do focus on areas which have been identified as key drivers for Victoria’s prosperity going forward. The scenarios include:

**Society**
A higher-growth population scenario with a higher proportion of residents choosing to live in the west side of Melbourne than the base future case in Chapter 2.

**Economy**
Technological disruption that leads to a significant improvement in Victoria’s labour productivity compared to the base future case in Chapter 3.

**Environment**
The impact of a greater degree of climate change mitigation activity than the base case set out in Chapter 4.
1.8 There are strong interlinkages between the streams and infrastructure

Infrastructure is critical for Victoria’s growing population and economy, providing the backbone for productivity in the economy. Infrastructure also helps to create a well-functioning society, and a place that people choose to live and work. It does this by connecting people to places, and goods and services, and by providing the physical assets required for services such as healthcare, education, and law and order.

Societies have multiple objectives for infrastructure – economic efficiency and growth on the one hand, and equity and sustainability objectives on the other. Because of the deep interrelatedness of society, the environment and our economy, as well as the interconnectedness of infrastructure (much of which is characterised by networks), long term infrastructure planning necessitates systems thinking. It requires a holistic approach to understanding and weighing up the trade-offs both within the system, as well as the knock-on effects for other infrastructure.

Each of the streams of society, environment and economy have different but interrelated relationships with infrastructure, broadly summarised as:

**Society**
Infrastructure provides facilities and services that underpin a healthy society, including public amenities, cultural activities and transport linkages. It contributes to the welfare and standard of living for Victorians. When the social needs of the community are supported by adequate infrastructure, it promotes productivity, sustainability and liveability.

**Economy**
There is a two way relationship between the economy and infrastructure. Well designed infrastructure facilitates economies of scale, reduces trading costs, and promotes specialisation and efficiency in production and consumption of goods and services. Infrastructure investment also influences an economy’s comparative and competitive advantage, contributing to our growth, and therefore our standard of living.

While bigger is better for the economy, it can deteriorate liveability through disamenity, congestion and pollution. Careful planning around multi-modal transport and urban renewal with open spaces for example can help to maintain or improve liveability as the economy grows and the urbanisation trend continues.

**Environment**
The relationship between the natural environment and infrastructure is typically characterised by trade-offs, often where development cannot go ahead or plans are amended to cater to environmental needs. Also, some infrastructure can achieve environmental outcomes, such as bike lanes and water recycling and renewable energy infrastructure.
Interconnectedness of major trends across society, the environment and economy

<table>
<thead>
<tr>
<th>Key theme</th>
<th>Social</th>
<th>Environment</th>
<th>Economy</th>
</tr>
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<tbody>
<tr>
<td><strong>Population growth</strong></td>
<td>Higher demand for hospitals, education facilities and other social services.</td>
<td>Increasing Melbourne’s urban footprint intensifies land use competition, putting pressure on the natural environment, resources, food production, and water. It can also lead to higher emissions and less efficient delivery of goods and services.</td>
<td>Higher demand for infrastructure including transport, government services, utilities. Time lost to travelling and other congestion costs result in lower productivity and increased health risks (Douglas M, Watkins S, Gorman D, and Higgins M, 2011).</td>
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<td></td>
<td>Lack of affordable housing increases pressure on social housing as a safety net.</td>
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<td>Higher congestion has health and wellbeing costs.</td>
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<td></td>
<td>Lower population growth is projected for Victoria’s regions and there will be a number of regional areas that will instead be faced with addressing population decline</td>
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<tr>
<td><strong>Climate change</strong></td>
<td>More extreme weather equates to greater demand for emergency services, particularly for fire weather in regional and peri-urban areas.</td>
<td>Pressure on the natural environment, flora and fauna biodiversity, higher demand for energy and water (and lower supply due to evaporation rates), and effects on agricultural output.</td>
<td>Traditional infrastructure lifespan reduced. Increased awareness of sustainability (and a potential to move to pricing carbon) will lead to a transition to low carbon infrastructure and potentially a zero carbon economy. It may also see ‘local economy’ making increasing traction – particularly for food.</td>
</tr>
<tr>
<td><strong>Ageing population</strong></td>
<td>Increased need for health and social services.</td>
<td></td>
<td>Higher dependency ratio – lower share of working population means a lower taxable base – will put pressure on government through lower revenues, and higher expenses, especially for health. Despite the falling relative size of the workforce, older people are likely to stay in work longer, and also likely to participate through volunteering.</td>
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<tr>
<td>Key theme</td>
<td>Social</td>
<td>Environment</td>
<td>Economy</td>
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<tr>
<td><strong>Global economy</strong></td>
<td>Global trends related to health and continued urbanisation are occurring in Victoria. Migration to Victoria adds to the diversity of the population.</td>
<td>International pressure for Australia to take strong action to mitigate climate change has intensified, with recent commitments made by the U.S. and a strong global push. This was recently reflected in the Paris Agreement, agreed to by 195 nations in December 2015, committing nations to holding the increase in the global average temperature ‘well below’ 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.</td>
<td>Australia is increasingly integrated into the world economy. Victoria is in a good position to take advantage of opportunities to export to emerging economies, particularly with the rise of Asia’s middle class and the Chinese government’s boosting focus on private consumption. Integration into the world economy also means that new ideas and technology from around the world including new market models can be expected to arrive in Victoria over time.</td>
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<tr>
<td><strong>Technology</strong></td>
<td>Technology will aid active engagement between citizens and government. Over time, it will transform the way government services are delivered. In health for example, predictive analytics tools harness big data to identify high risk patients and forecast capacity issues, and advances in bioinformatics and genomics will lead to personalised medicine.</td>
<td>Biodegradable, ingestible and other types of sensors will proliferate to monitor all aspects of the natural environment. Improvements in battery technology will see continued decentralisation of energy generation and the switch to low carbon technology. Smart meters and real time pricing will take pressure off peak load for electricity generation, with smart household appliances running at the cheapest time of day (which it will sense from the broader network).</td>
<td>Rapid advances in technology will lead to growth in labour productivity, through automation, Internet of Things and better use of data allowing for ‘just in time’ mode of operating. Benefits will spill-over to other industries (agglomeration) reinforcing clustering of businesses.</td>
</tr>
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### Key theme

**Urban form – current trends in Victoria see both densification and peri-urban development**

<table>
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<tr>
<th>Social</th>
<th>Environment</th>
<th>Economy</th>
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<tr>
<td>Peri-urban development can provide more affordable lower density housing options but without appropriate infrastructure can lead to congestion, social isolation, inequality and social disadvantage and possible health effects. Properly planned densification (with an emphasis on liveability, shared spaces and community) allows people to live closer to work. Open spaces encourage organised sport and informal fitness activities, benefits physical and mental health and can build social connection through space for gathering.</td>
<td>Open spaces and green wedges support biodiversity, reduces urban heat and regulates air and water quality; they remind us of our connection to the natural environment; and provide a context for cultural heritage, artistic expression and diversity. Peri-urban developments have become denser over time, making more use of less space and that new housing is built to a minimum six star energy efficiency rating.</td>
<td>Well planned urban renewal and densification can enhance (or maintain) liveability, which facilitates growth, investment and productivity by attracting people to our cities. That workforce supply can help to create new employment. Having large populations on a smaller urban footprint (i.e. densification) enables more efficient delivery of infrastructure services. If well planned, congestion can be lower, improving productivity. Benefits of agglomeration support the innovation cycle.</td>
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Chapter 2: Society
Toward a socially cohesive and prosperous Society.

2016 ➔ 2046

**Victoria is growing**
- Population is growing with migration and people living longer
- Victorians are having fewer children on average than previous generations
- 27% of Victorians were born outside of Australia
- Population growth of 1.7% in 2015.

**6.1 million**

**Risk factors for health and wellbeing are on the rise**
- ...including smoking and lack of exercise
- It is more prevalent in regional and remote areas compared to Melbourne.

Between 2001 and 2012, rises of:
- 56% in mental health and behavioural problems
- 47% in cancer
- 42% in diabetes
- 26% proportion of people exceeding NHMRC lifetime risk guidelines.

**9.4 million**

...and health services are fundamentally changing.
- Preventative health
- Technological advances
- Rising chronic disease
- Fiscal pressure and regulation

...will change the nature of how health services are demanded and supplied in the future

**Victorians are highly educated**
- 85% of Victorians complete secondary school up from 80% in 2009
- 63% of students attend a Government school
- Victoria has the second highest share of population with a Bachelor degree or higher in Australia (33%, up from 23% in 2005).

**3.8 million new university qualifications required between 2015 and 2025 to meet Australia’s demand**
- Tablets, specialised learning websites and almost universal internet access sees more students learning online
- Models of teaching and learning will continue to evolve due to technological advancements. Services will need to be responsive to a rapidly changing labour market, including the need for lifelong learning.

**Disadvantage is locational**
- Locational disadvantage in Victoria, risks accentuating social exclusion and inequality
- Prosperity is directly linked to place through physical and non-physical characteristics.

**...and infrastructure can help break down barriers.**
- Urban planning and design are crucial elements in creating socially cohesive and integrated communities
- Infrastructure helps prevent locational disadvantage through access to services, institutions and cultural infrastructure
- The concept of place impacts on an individual’s sense of belonging, security and contributes to the development of their identity.
Victoria has a lot to offer to its residents with a growing population, accessible health services, education opportunities and a vibrant community. While there are multiple aspects that contribute to a socially cohesive society, this chapter identifies and assesses the current social drivers that underpin Victoria’s liveability and the drivers for a strong society in the future. Four key themes are discussed:

• Demographic changes;
• Health and wellbeing;
• Education and training; and
• Community and social cohesion.

The broad infrastructure implications for each key theme are also described.

Infrastructure enables the provision of facilities and services that underpin a healthy society. Well-designed infrastructure encourages uptake of social and cultural activities and provides public amenities, systems for citizen engagement, and space for people and places to evolve. It contributes to the welfare and standard of living and is an important part of a well-functioning society.

When the social needs of the community are supported by adequate infrastructure, it increases the productivity, sustainability and liveability of the place. Additionally, infrastructure encourages the creation of jobs and services that match areas of need, which helps to mitigate greater prevalence of unemployment, poor transport and connectivity, and entrenched disadvantage.

2.1 Victoria’s population is in transition

Three key population shifts are impacting the demographic composition of Victoria: firstly, driven by migration and natural population increases, Victoria’s overall population size is increasing. Second, longer life expectancies coupled with lower birth rates mean older Victorians are making up a greater proportion of the total population. Third, Victoria’s population is expected to be distributed unevenly across the State, with higher growth in metropolitan areas in comparison to regional cities and rural towns (DEDJTR, 2015).

Changes to Victoria’s population will have far reaching implications for the State, but the slow moving nature of demographic changes affords us with the ability to plan ahead for these changes. How this impacts on society and its make-up is described below, while the implications these demographic changes will have on Victoria’s economy and environment are described in the chapters ahead.

2.1.1 Victoria’s total population is growing, driven by migration

In the last 30 years, Victoria’s population has grown from 4.2 million people to a total of approximately 6.1 million. In recent years, the rate of growth has increased, making Victoria the fastest growing state in Australia in 2015, with a growth rate of 1.7 per cent (ABS, 2015). Growing to 6.6 million in 2021, and 8.3 million in 2036, the State’s population is expected to reach up to 9.4 million by 2046, with the majority of people choosing to live in the Melbourne region (ABS, 2015b).
There are three components of population growth:

- **Natural increase** – excess of births over deaths;
- **Net overseas migration** – net number of migrants to Australia over the number of people emigrating from Australia; and
- **Net interstate migration** – the number of people who come to Victoria over those who depart for other states.

Victoria is currently attracting the most interstate migration compared to other jurisdictions (ABS, 2015b). This increase is reflective of the slowdown in the mining sector, and consequently greater migrant demand for locations which have significant employment opportunities. The cooling mining investment boom, a slow-down in construction, coupled with falling commodity prices, has decreased the attractiveness of the mining states (Queensland, Western Australia, and the Northern Territory) for job seekers. Victoria, as a predominantly service based economy, has been somewhat shielded from this slow down, due in part to its residential construction boom. Consequently, Victoria is becoming a more attractive choice for relocation at least in the short term. However as employment is a key long term driver of interstate migration, Victoria’s interstate migration intake (or losses) will also be dependent on longer term economic trends (discussed in chapter 3).

Victoria is also a highly sought-after destination for international migrants. Victoria receives a large share of overseas migrants in comparison to the other states and territories, with 24 per cent of migrants choosing Victoria in 2014-15 (Australian Government, 2015b). The numbers of migrants who come to Victoria, however, are dictated by the overall national intake. Significant cyclical movements in net international migration have been seen in Victoria in recent years, as the number of international student arrivals and temporary business visa holders have fluctuated considerably. Historically, the natural increase in population accounted for over half of Victoria’s growth. Since 2006, however, net overseas migration has accounted for the majority of the increase in population (ABS, 2015b). That means that a greater share of population growth is subject to broader global and cyclical factors than has been the case in the past.

Typically, a relatively higher proportion of overseas migrants live in metropolitan areas. The City of Melbourne is made up approximately 35 per cent of people born overseas (ABS, 2011b). This distribution contributes to higher urban population levels and its corresponding impacts (such as increased congestion). Over time, though, some new arrivals fan out to other areas, including interstate.
Another component of Victoria’s growth is attributed to a natural increase in population (excess of births over deaths). While the birth rate of Victorians continues to be low, consistent with other developed nations, our life expectancy continues to increase. Just 30 years ago women had a life expectancy of 78.8 years, and men 72.7 years. Today, women can expect to live almost an additional six years to 84.7, while the average life expectancy for men is now 80.7 years of age. In 2046, life expectancy is projected to be close to 89.5 years for women and 87.0 years for men (ABS, 2013).

In summary, the Victorian Government projects Victoria’s population to grow to 9.4 million by 2046, based on the assumption that additional overseas migration will continue to contribute notably to that growth, comprising between 60 and 62 per cent of annual population growth until 2046 (DEDJTR, 2015). Non-migrant driven population growth (natural increase) is expected to stay relatively steady in Victoria, based on the assumption that the fertility rate will remain steady at approximately 1.8 children over the lifetime of the average woman. These growth projections are also consistent with recent historical trends. Over the last 10 years Victoria has had an annual average growth rate of 1.71 per cent, in comparison to a future projected average annual population growth rate of 1.49 per cent between 2016 and 2046 (VIF, 2015).

2.1.2 The population is getting older, affecting workforce composition and services required

The number of older Victorians is steadily increasing as the large ‘baby boomer’ generation ages, reflecting the positive outcome of improved life expectancy. Improvements in health care are only expected to extend life expectancy further, which in turn will increase the number of older Australians. The number of Victorians over 65 is projected to more than double from 2011 to 2046, as the large current 45 to 65 age group gets older.

The growing number of older Victorians will change the distribution of the population - it will impact workforce participation rates. Despite this drop in workforce participation, many older Victorians will choose to work for longer compared to previous generations. For some, this may entail a change in occupation from labour intensive roles (such as trades) to less physically taxing occupations (such as administration). As a result of increases in life expectancy, when older Victorians do retire, they on average will be retired for longer. This has the potential to result in higher levels of volunteerism, as while people are ageing they are also healthier for longer, meaning they can continue to work and volunteer past the typical age of retirement. In terms of overall productivity, the impact of the ageing population will be ambiguous. Older people will be more productive to a point due to the accumulation of knowledge and experience, however, many may choose to work part time or have health concerns as they get older.

Chart 2.2: Victorian age distribution, 2011 and 2046 (forecast)

Source: Victoria in Future (VIF, 2015)
Older Victorians are more highly represented in some areas than others. Younger age groups tend to be located in central and inner suburbs. In central Melbourne, for example, the median age of residents is on average less than 30 years old (ABS, 2011c). In comparison, older age groups are currently concentrated in established suburbs approximately 10 to 15 kilometres away from Melbourne central business district (CBD) (see insert in Figure 2.1).

**Figure 2.1 Victoria’s population aged 65 years and over, by SA2 (2011 Census data)**

![Map of Victoria's population aged 65 years and over](image)

Source: ABS, Population by Age and Sex, Regions of Australia, 2011, Cat No. 3235.0

As older Victorians age and require higher levels of assistance in later years, there is a degree of transition into residential aged care facilities. However, more options for in-home care has reduced the need for relocation to aged care facilities, while some choose to delay to stay in the family home until high care support is required (rather than transitioning first to low care facilities).
2.1.3 Population growth will predominantly occur in cities, driven by a knowledge-based economy

Where Victorians live is another important demographic consideration, as it influences the way in which people form networks and interact with others. In the next 30 years, the bulk of Victoria’s population growth is expected to occur in the Melbourne region (VIF, 2015). While regional areas will experience population growth, it is expected to generally be at a lower rate than metropolitan areas. This trend is driven by Victoria’s shift to a knowledge-based economy (as described in chapter 3), and reflects the desire of firms to benefit from agglomeration. That is, the knowledge spillovers that come from operating in close proximity, allowing for personal interactions between employees and customers, which stimulates more technology development and reinforces the innovation cycle.

Melbourne is expected to see a continuation of current trends for accommodating its growing population – this includes both urban development on the fringes and continued densification of inner-Melbourne. The two modes of development carry different concerns and opportunities, and have very different infrastructure implications.

Peri-urban development

While peri-urban development is associated with larger detached homes, we note that in Victoria developments have become compact in design over time, making more use of less land compared to past generations. Moreover, all new housing in Victoria is built to a minimum of 6 energy star ratings, making them more sustainable (in energy and water use terms) than much of Victoria’s existing housing stock. That said, studies demonstrate that this mode of development is typically more carbon intensive compared to densification (Dodman D, 2009), due to a variety of factors, including car dependence.

Other challenges with increasing Melbourne’s urban footprint includes the need for new infrastructure to support new communities, such as connection to utility networks, waterways and drainage infrastructure, government services (for example hospitals, schools), and multi-modal transport to name a few. Building infrastructure for new developments is expensive, and can create knock-on effects. For example, extending or creating new lines on the train network can increase congestion further down the network.

Without appropriate infrastructure, new communities would see increased congestion and the development of areas with entrenched social disadvantage due to a lack of access to services and infrastructure. For example, the health effects from car dependence to commute long distances to work each day include a higher incidence of road accidents, stress and a more sedentary lifestyle (obesity and diabetes).

Densification

The rise of the knowledge economy will see more people working in inner-Melbourne. Over time, professional workers may increasingly choose to live closer to work to reduce the cost of commuting (both financial and in terms of time) (Edlund, Machado and Sviatchi, 2015). This could see higher density living become more desirable in Melbourne in coming decades.

Planning should facilitate greater diversity of Victoria’s dwelling stock to cater to Victoria’s growing and changing population – for example, more units and apartments in established suburbs would provide additional options for older people choosing to downsize within their communities (or elsewhere), freeing up larger dwellings close to employment for young families or infill development.

Densification can make moving people and goods harder without appropriate levels of supporting infrastructure. The transport network is a prime example of the type of infrastructure that would need to adjust to densification to ease congestion, as discussed further in chapter 3. Deliberate long term planning is needed to ensure that metropolitan areas remain fit for purpose and avoid the dis-benefits associated with higher density living, such as congestion and disamenity.

Indeed, economists Frey and Stutzer (2002) have found that there is a strong correlation between distance to work and satisfaction with life. Conversely, as more people seek to live closer to where they work, the more likely these places are to become crowded, expensive, polluted, and congested.

At the same time, a greater concentration of the population in a smaller area also presents a number of opportunities. The provision of services, for example, can capitalise on economies of scale to reach the same level of quality at a lower cost. There are also economic opportunities for workers in knowledge based
sectors, whose productivity is exponentially increased through close proximity working styles, as described by economies of agglomeration (Bogart, 1998).

**Polycentric city**

The gradual development of a polycentric city (i.e. a city with multiple employment hubs or activity centres) complements both peri-urban development and densification. It can help ease congestion as people are traveling across the city and between hubs (i.e. countercyclical traffic flow), rather than all in the same direction. At the same time, workers and businesses can continue to benefit from knowledge-spill-overs.

**Regional areas**

In contrast, according to Victorian Government population forecasts, lower rates of growth are expected to occur in regional Victoria (VIF, 2015). The growth that does occur will be centred on regional cities. In fact, the local government areas (LGAs) of Greater Geelong, Greater Bendigo and Ballarat are expected to make up approximately 47 per cent of total growth in regional Victoria (VIF, 2015). This is consistent with historical trends, with Melbourne growing faster than regional Victoria annually since 1986-87. Victoria’s rural population, however, is distributed unevenly, influenced by a range of demographic, environmental, economic and social factors. While some areas such as Geelong and Ballarat may need to adapt to cater to a higher population in the future, there will be a number of regional areas which will instead be faced with addressing population decline.

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**Chart 2.3 Average annual population growth by region (SA4) 2015-16 to 2045-46**

Source: DELWP, Victoria in Future Projections
2.1.4 Infrastructure will need to adapt to demographic changes

Ensuring that Victoria is well placed to respond to the significant changes to its demographic profile in the future, infrastructure choices should consider:

- Urban design and transport can be designed to offset some of the negatives that come from a growing city.
- The way in which infrastructure and transportation is designed needs to be accessible and interlinked so that we are creating access to social and community services for older Victorians.
- Long term infrastructure planning can allow government to map out corridors of land needed for infrastructure in the future, potentially saving money and time.
- More retirement living, leisure, community and personal care facilities will be needed to cater for growth in the ageing population.
- Built environments should be designed and constructed to incorporate the needs of older people to a greater degree, through access requirements such as wheelchair access, handrails, smoothing gutters and appropriate lighting.
- Increasing population will impact on the number and density of housing required in Victoria. As Melbourne is projected to experience the bulk of the population growth, the prevalence of higher density housing will increase as detached housing arrangements closer to the city become financially unattainable and lower in supply. This will also see increasing peri-urban development allowing the purchase of affordable detached housing.
- Accommodating more Victorians through increased peri-urban development will see the need to build more infrastructure (such as extending train lines), with accessible infrastructure being a key measure to reduce social disadvantage.
- Congestion of Melbourne’s transport network is likely to be a consequence of population growth and peri-urban development.
- Demographic changes will put greater emphasis on the trade-offs associated with public infrastructure investment.

- Victoria’s regional population must also be adequately supported by right size, and flexible infrastructure. As the population is spread out geographically, it will be important to approach infrastructure decisions in an innovative way, which will ensure communities have access to appropriate levels of services, while considering the government’s fiscal constraints.

2.2 Health and wellbeing indicators demonstrate a changing future state of health

There are a range of indicators of health and wellbeing, including self-reporting health, prevalence of conditions, and risk factors that may lead to increased likelihood of disease or illness. The latest statistics are predominantly from 2011-12, however these still provide useful insight into the current state of health and wellbeing in Victoria.

Most Victorians self-report their health as excellent or very good, with the proportion of people rating their health in this category increasing over time from 52 per cent of the population in 2001, to 71 per cent in 2011-12 (ABS, 2012). The proportion of those reporting their health as ‘good’ and ‘fair or poor’ has remained relatively constant over the same time period.

Despite this increase in self-reporting health as excellent or very good, prevalence of conditions and risk factors have generally been increasing over time across a range of indicators (ABS, 2012). This trend is expected to continue, against a backdrop of expected further improvements in life expectancy over time. Current and future state projections of selected health and wellbeing measures are illustrated in Figure 2.2.
Figure 2.2: Current and future state of certain risk factors and conditions for health

Risk factors – current trends
Smoking as a risk factor has decreased, but all other risk factors have increased and are expected to continue to do so, driven by a lack of nutritious food, sedentary lifestyle and alcohol consumption.

Rates of family violence may decrease, due to strong investment in prevention and response programmes following the Royal Commission into family violence.

Health conditions – current trends
A range of health conditions have been increasing in prevalence, notably mental health issues, cancer and diabetes.

Some long-term conditions have decreased overtime, notably back pain and chronic obstructive pulmonary disease (COPD).

Health conditions – forecast trends
The Victorian Government has forecast that the prevalence of a number of conditions, including stroke, heart disease, cancer and osteoporosis, will continue to increase over time to 2022.

Forecasts from 2008 to 2022 predict:
- 21.8% increase in stroke
- 36.3% increase in heart disease
- 11.9% increase in cancer
- 18.7% increase in osteoporosis

The percentage change in prevalence from 2001 and 2011-12 shows an increase of:

- 72% increase in family violence incidents
  - [658 persons per 100,000 in 2009-10]
  - [1,129 persons per 100,000 in 2013-14]

- 42% increase for diabetes mellitus
  - [148.2 persons per 100,000 in 2001]
  - [210.7 persons per 100,000 in 2011-12]

- 27% increase in prevalence of overweight/obesity
  - [1,688 persons per 100,000 in 2007-08]
  - [2,140 persons per 100,000 in 2011-12]

- 26% increase in proportion of people exceeding NHMRC lifetime risk guidelines
  - [601 persons per 100,000 in 2001]
  - [760 persons per 100,000 in 2011-12]

- 56% increase for mental and behavioural problems
  - [453.3 persons per 100,000 in 2001]
  - [707.5 persons per 100,000 in 2011-12]

- 47% increase for cancer
  - [62.2 persons per 100,000 in 2001]
  - [91.6 persons per 100,000 in 2011-12]

- 26% increase in proportion of people exceeding NHMRC lifetime risk guidelines

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1 ABS, health survey 2011-12, cat. 4364
2 Victoria Police, LEAP data, 2014
There are differences in prevalence of long term health conditions based on remoteness, as can be seen in Chart 2.4. This illustrates that across all long term conditions reported, except for short-sightedness and osteoporosis, metropolitan areas have a lower proportion of the population who report the condition compared to regional areas.

**Chart 2.4: Proportion of Victorian population with long term condition, 2011-12**

These health conditions may be driven by particular risk factors, which can be used as an indicator of wellbeing. Chart 2.5 similarly shows that risk factors are lower in major cities compared to regional areas, with the exception of inadequate fruit and vegetable consumption.

**Chart 2.5: Health risk factors by remoteness, 2011-12**
This forecast increase in prevalence of risk factors and conditions, coupled with nine key trends that are impacting upon the provision of health care, are likely to change the future state of health and wellbeing in Victoria. The key trends can be considered under three broad drivers: fiscal pressure and regulation, demographics and burden of disease, and connectivity and information. Each of these trends is identified in Table 2.1 and discussed in further detail below.

### Table 2.1: Trends in health and wellbeing

<table>
<thead>
<tr>
<th>Fiscal pressure and regulation</th>
<th>Demographics and burden of disease</th>
<th>Connectivity and information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordability challenge</td>
<td>Ageing population</td>
<td>Telehealth and eHealth</td>
</tr>
<tr>
<td>Funding models and incentives</td>
<td>Chronic disease management</td>
<td>Data and information transforming health</td>
</tr>
<tr>
<td>Cost pressure of medical advances</td>
<td>Preventive health</td>
<td>New scientific technologies to create personalised medicine</td>
</tr>
</tbody>
</table>

Source: Deloitte Access Economics

#### 2.2.1 Fiscal pressures are creating an affordability challenge

Health care expenditure has been increasing and is projected to continue to do so, creating an affordability challenge. These pressures stem from a combination of drivers, which include: population growth, population ageing, health inflation above CPI, and increased service provision (through both new and improved services) (Grattan Institute, 2014). Australian Government health spending per person is expected to increase from $2,800 in 2014-15 to $6,500 in 2054-55 (Australian Government, 2015). This trend underpins many of the reforms occurring in the health sector which are re-defining the role of government and the responsibility of the individual.

Maintaining the affordability of Australia’s universal health care system is an ongoing challenge, one that will be managed from both a demand and a supply perspective. Health usage grows in excess of population growth partly because the wealthier we get the more we use health services. Therefore we also need to be more active about controlling supply-side issues in addition to looking at issues of greater demand.

Managing the affordability challenge continues to impact health services funding models and incentives. Figure 2.3 illustrates the changing funding mechanisms at both State and Federal levels, with increasing focus on incentivising individuals and payment by outcomes in the future. This has implications for service providers, who face increasing competition for the consumer’s care needs, and represents a more market oriented approach. An example of where this is currently occurring is the aged care sector reforms. Changing funding structure is not however solely for the purposes of affordability. This also firmly places the consumer at the centre of their care needs, by providing them with greater choice as to how they want to allocate resources toward their health and social care.

Figure 2.3: Funding models occurring in Australia

#### Opportunity and risk to Government

![Figure 2.3: Funding models occurring in Australia](Source: Deloitte Access Economics)
2.2.2 Demographic changes and the burden of disease will place increasing pressure on health services

As previously discussed, ageing continues to be a key driver of demand and cost pressure for the sector. Rising longevity brings with it increasingly complex and chronic health conditions, placing substantial demands on health and social care services.

An older population will mean that there will be fewer workers to support retirees and young dependants. This will place pressure on the economic growth that drives rising living standards. At the same time, this will result in substantial fiscal pressures from increased demand for government services and rising health costs.

Australian Government health expenditure is projected to increase from 4.2 per cent of GDP in 2014-15 to 5.5 per cent of GDP in 2054-55. In today's dollars, health spending per person is projected to more than double from around $2,800 to around $6,500. State government expenditure is also expected to be significantly higher (IGR, 2015). Population growth is anticipated to grow at 1.3 per cent per annum, while the number of times patients seek care will increase by 3.3 per cent per year (Victorian Government, 2011b).

Left unchecked, chronic disease can have significant impacts on individual's quality of life and longevity, with significant downstream costs. Chronic and complex conditions are becoming more prevalent (see Figure 2.2). Medical advances such as new drugs and statins are helping to keep pace with demand, however these drive costs upstream and build greater expectations among consumers. It is therefore imperative that the focus of technology adoption is evidence-based and delivers value to the system.

The increasing rate of chronic disease means there will also be increasing recognition of the importance of preventative health. Preventative health measures include three characteristics: primary prevention, which reduces the likelihood of a disease developing; secondary prevention which prevents or minimises the progress of a disease in its early stages; and tertiary prevention, which stops the progression of an illness or its damage (AIHW, 2014).

The challenge is untangling the web of connections that influence health that are outside the direct span of influence of the sector, including economic status and poverty, education, parenting, the environment, transportation and the economy. In addition, infrastructure has an important role to play in supporting healthy behaviour, for example the provision of cycling paths and recreational facilities that provide the community with opportunities for exercise.

2.2.3 Technological advancement will affect the future of health service delivery

The benefits of e-health (the electronic management of health information) have long been held up as the ‘game changer’ in health in relation to reducing wastage, duplication, fragmentation and improving quality. However the benefits are yet to be realised on a large scale. In the hospital setting, the promise of e-health on the horizon has prompted a number of capital builds to exclude paper based medical records or significantly reduce space. These trends have been slow to be adopted, in part due to the high regulation of the industry.

Massive amounts of data are being generated, but in health care what has changed is the availability of tools to translate that data into relevant information. The trend is therefore an increase in the use of analytics to help sift the data to achieve greater transparency of performance for services and use in planning. Predictive analytics that identifies high risk patients and forecasts capacity challenges, coupled with improved data and information are already beginning to fundamentally change the way that health care systems operate. The implications of this trend are significant, enabling:

• Improved transparency of clinical outcomes among different providers, which:
  - Has been shown to improve results for all;
  - Allows healthcare providers to benchmark their performances to drive improvements;
• The purchasers (or commissioners) of health care to make better investment decisions, potentially shifting to a pay-for-value approach that rewards outcomes;
• Individuals to make more informed choices in relation to their health care needs and services;
• Real-time clinical information; and
• Improved data which facilitates a shift towards integrated care of higher quality and lower cost, with a sharp focus on chronic disease.
Importantly, data and information have the potential to transform the relationship between individuals and their health. Properly harnessed, new information can empower individuals to enhance their own health. It also enables individuals to better manage their condition should they be affected, by chronic disease in particular, and make optimal choices when they need care. This, however, is predicated on the provision of a strong technological base to ensure that the insights generated are credible.

Ensuring an efficient allocation and utilisation of health services is a major goal of both predictive analytics and behavioural economics. Increasing collection of data through health identification cards and IoT will allow unhealthy behaviours to be predicted to a greater extent in the future. In addition, it will be possible to understand the characteristics of those who are high users of services using lifestyle data.

New scientific technologies including in bioinformatics and genomics will facilitate greater use of tailor-made, personalised medicine and personalised health risk-assessments. The implication for government will be an increased role in overseeing and incentivising research, testing and therapeutics, regulation and determining best practice treatment plans. In addition, three dimensional printing has the potential to revolutionise surgical practices, which will likely reduce surgical errors, make surgery cheaper and more customised for patients. Coupled with developments in stem cell research, these technologies will transform patient care needs in the future. At the same time technology may have a contradictory impact as the more we know about health, the more we may consume health services.

Case study: technology and preventative health

Many public health concerns are triggered, or worsened by individual behaviour. Decisions such as tobacco use, insufficient physical activity, poor eating habits and excessive alcohol consumption are linked to a range of conditions, and reduce our overall level of health.

Research has proven that instilling healthy behaviours prior to the onset of illness reduces the costs of health care dramatically. In fact, it has been estimated the $3 million spent on national food reformulation campaigns to reduce salt would get the same health improvements as $1.5 billion spent on antihypertensive drugs (George Institute, 2013). The government takes a variety of actions to promote health decisions and behaviours to encourage better health decision making through enacting policies, funding information campaigns, and other interventions.

New health apps will utilise technologies to assist individuals to transform the management of their health. New apps on the market, for example, allow users to ask their smart watches questions about health, nutrition or exercise. The overarching intent is to enable sustainable behavioural change through prompting healthy behaviours. While these changes may be small (such as helping the user find a healthy restaurant), they also have the potential to create significant change (for example by a reminder for vital medicine). While linkages between self-measurement and preventative behaviours for the most at-risk groups are still unclear, this technology provides the opportunity for a growing majority of the participations with smart devices to consider their health more frequently.
2.2.4 Demand for health service infrastructure will be different and technology will shift infrastructure requirements

As Victorians continue to live longer with enhanced quality of life, it is important that infrastructure that supports the provision of health and wellbeing services adapts to suit changing requirements.

Greater demand for health services as the population ages and the rise in the prevalence of chronic disease will challenge existing infrastructure. Decisions will need to be made about appropriate service levels, the best way to utilise current infrastructure stock, tailoring supply to demand and how to manage supply.

Technology will lead to major disruptions to the way that healthcare services are provided. Increased automation and greater connectivity will remove the need for manual processes and change the way existing infrastructure is utilised. This presents opportunities for optimising existing buildings as, for example, hospitals can fit more beds and fewer administration areas. In addition, as the health care sector increasingly leverages innovative offerings such as medi-hotels (alternative hospital accommodation for patients before, during or after treatment), e-health and telehealth, there are more opportunities to optimise infrastructure spend through influencing demand.

In addition to, and sometimes as a result of technological innovations, new delivery methods are being introduced into the health system. New and existing health infrastructure will need to support different delivery methods in the provision of services.

Another health infrastructure consideration is in regards to where services will be located in the future. An increase in the concentration of the population in metropolitan Melbourne may also see an increase in health infrastructure densification. While there are significant benefits associated with this approach (such as agglomeration benefits), this needs to be balanced with access considerations.

2.3 Education and training are critical social and economic features of Victoria

Education and training play a critical role in fostering social progress. Educational attainment is highly correlated with higher income and greater likelihood of employment, in addition to other social outcomes (Deloitte Access Economics, 2015).

Equitable access to education has the capacity to support long term growth, reduce levels of unemployment, promote competitiveness, and nurture a more inclusive and cohesive society. In addition, education and training contributes to a productive workforce and a strong economy.

Victoria has a high quality education system that offers a number of different learning pathways to students. Over 85 per cent of Victorian students currently progress through to the completion of secondary schooling, representing a marked increase over the last five years from 80.5 per cent in 2009 (ABS, 2009). This is in line with OECD countries, where an average of 84 per cent of today’s young people will complete upper secondary education (OECD, 2014b).

There has also been increased emphasis on higher participation in, and improving quality of, early childhood education through initiatives such as the 2009 establishment of the Council of Australian Governments (COAG) National Quality Framework. Despite this, Australia performs below the OECD average in early childhood participation (OECD, 2014b). Approximately 30,447 4 year olds attended pre-school in Victoria in 2014 out of an estimated total of 74,097 (VIF and ABS, 2015). Evidence suggests that early childhood education is one of the most critical learning stages, and that investment in early childhood produces the greatest return to society (Heckmann, 2011).

Barriers to engaging in education are strongly linked to students’ family background. Research has consistently found that at all stages of learning and development, there remains a strong and persistent link between a young person’s socio-economic status and educational outcomes (Mitchell Institute, 2015). In fact, effects of socio-economic disadvantage can persist post-school as students with a low socioeconomic status background have a higher chance of not finding full-time work and not being in education and training. Despite these barriers, the number of post-school qualifications attained by Victorians continues to rise, see to Chart 2.6. This can be attributed to greater access to education via the growth of providers, greater flexibility in the delivery of education and training, Victorian VET reforms, and the expansion of the Commonwealth’s HECS-HELP scheme to a demand driven model. Levels of attainment have increased at a greater rate for women than men, resulting in a reduction in the gap between genders for post-school qualification attainment. In 2004, the
The proportion of females with post-school qualifications was 52.5 per cent, compared to 59.2 per cent for men. The difference is now less than 2 per cent, with 63.6 per cent of women achieving non-school qualifications against 65.6 per cent for men.

Chart 2.6 Proportion of people with post-school qualifications in Victoria, 2004-2014

School students in Victoria attend a mix of both public and private schooling. Approximately 63 per cent of students in 2014 attended a government primary or secondary school while Catholic and independent schooling comprise 23 per cent and 14 per cent respectively (ABS, 2015d).

Population growth has been, and is expected to continue to be, unevenly spread across Victoria. A number of areas are likely to see strong growth in student numbers (such as the urban growth corridor and areas of urban renewal like the Docklands), which will see increasing demand, particularly for primary and secondary schools (ABS, 2015b). A number of other areas (particularly some regional areas) are likely to see declining student numbers in years to come, consistent with local demographic and population growth profiles.

Victoria is also home to a number of world class universities, which support thousands of students from Victoria, Australia and overseas. These universities are significant export earners for Victoria, as well as contributing to the future skills need of the state.

Indeed, core to Australia and Victoria’s future knowledge economy are workers who have embodied knowledge in the form of greater levels of human capital. These ‘knowledge workers’ are the managers, administrators, professionals, designers and innovators that will drive the future economy and be highly demanded by the labour market. Our universities play a key role in meeting the future demand for knowledge workers by producing both undergraduates and postgraduates that have the capability to develop and transform knowledge in order to create economic value.

A recent report by Deloitte Access Economics (2015) found that, in total, around 3.8 million new university qualifications (2.5 million new undergraduate qualifications and 1.3 million new postgraduate qualifications) will need to enter Australia’s knowledge economy over the period 2015–2025 to meet this demand. This means that on average, Australia will need approximately 227,000 new undergraduate qualifications and 115,000 new postgraduate qualifications each year over this period. Victoria’s universities will be major contributors to these skill needs (Deloitte Access Economics, 2015).
The 21st century skills that Victoria’s education system will provide over the coming decades will be supported by a significant and growing base of built infrastructure. Growing regions and urban areas will demand more schools and training facilities, as Victoria’s population and demography evolves over time. And while the physical need for ‘bricks and mortar’ classrooms is unlikely to change over the coming decades, the nature of the way these spaces enhance and support future education and the integration of technology into learning will be profound.

2.3.1 Educational services will increasingly need to be more responsive to a rapidly changing labour market
Technological innovation will have a significant impact on the demand for jobs in the future and consequent training requirements. Technology will challenge many existing roles but at the same time, technology will lead to the development of new jobs through the creation of higher incomes and lower prices. Recent research suggests technology could make almost 40 per cent of Australian jobs, including highly skilled roles, redundant in 10 to 15 years (CEDA, 2015). Education, therefore, must be more responsive to the rapidly changing requirements of the labour market in order to keep pace with evolving demand.

At present, Victoria’s education and training system is focused on the completion of qualifications at specific stages of life. Rather than undertake education incrementally throughout their lifetime, students often complete the majority of their studies in their earlier years. This model, which has been unchanged for many years, will not necessarily meet the needs of the 21st century workforce whose skills will need to keep pace with changing market demands. Given the pace of technological change and the evolution of the business world, skills obtained early may quickly become obsolete. Consequently, it will be likely that there will be a greater need for continuous learning to support an evolving workforce.

2.3.2 Models of teaching and learning will continue to evolve due to technological advancements
New models for teaching and learning, driven by innovative research and new technology, will fundamentally alter the student experience in the next 30 years. More classrooms are harnessing technology to deliver learning material (OECD, 2015b). The prevalence of interactive whiteboards with better apps, platforms and content is expected to continue to increase as technology is integrated into curriculum further. Harnessing software as a teaching tool will also assist with providing a personalised learning experience. Curriculum will be tailored to individual needs, focus on areas in which students may be struggling, and provide data driven insights to teachers to enable them to better target their assistance. As a result, data will help arm teachers with the ability to make their interactions with students as productive as possible.

For the delivery of post-school based qualifications, there is growing scope for the emergence of alternative education providers. Competency based models, where students can progress through courses at their own pace, have gained some traction through online platforms. Other modes of learning may also increase in prominence in Victoria such as Massive Open Online Courses (MOOCs), which offer the online equivalent to a university experience, or ‘immersive courses’, which are short intensive experiences which allow student to acquire in-demand skills (such as coding boot camps). Opportunities to increase the prevalence of these models of learning will increase as the pedagogy supporting on-line learning improves.

While online learning options have increased significantly in recent years, the rise in technology use in the classroom will not eliminate the classroom. There will be a continued role for physical space for collaborative teaching, researching, the development of soft skills and other types of student experience. In fact, learning spaces are increasingly being adapted to support new models of teaching recognising the fact that space (physical or virtual) can have an impact on learning, and its design can encourage collaboration, interaction, discussion and learning (Oblinger, 2006).
Figure 2.4 Higher education changes

30 years ago

- Reputation driven
  University rankings, campus visits, marketing materials, and advice from family, friends, and teachers served as the main sources of information to guide students’ study pathway decisions.

- One size fits all
  The business of universities was to transfer knowledge to students.

- Three year undergraduate degree
  A bachelor’s degree used to provide enough basic training to last a career

In 30 years

- Big data driven
  Huge strides in analysing, visualising, and disseminating data allow students to employ a far more data-driven approach to choosing a study pathway. Social networks, big data, and analytics shed new light on factors (e.g. student debt, post-graduation salaries etc.), enabling students to analyse the costs and benefits of different educational paths far more effectively.

- “Just right” education
  Students receive access to the latest knowledge via digital platforms, develop their skill sets through mentorship, and learn to probe and push the boundaries of current knowledge and practise through immersive experiences.

- Stackable credentials
  Lifelong learning is a permanent fixture of professional life. Educational records follow students to accurately capture the total sum of their education credentials – both traditional degree and other certifications.
2.3.3 Victoria is a global education marketplace, meaning education has a critical economic role

Victoria has a global reputation for educational excellence, positioning the state as a key destination for international students. The value of the education system rose significantly between the 1990s and the 2000s (as shown in Chart 2.7). Between 2009 and 2013, however, there was a decline in the numbers of international student enrolments across Australia due in part to the strength of the Australian dollar. But the tide has well and truly turned, with a renewed interest in undertaking study in Victoria over the past two years.

University higher education now accounts for approximately two thirds of total education exports in 2014-15 (ABS, 2015). Victoria boasts the location of the most highly ranked university in Australia, in addition to a number of other world-class education providers that have generated consistent demand for courses by international students.

For higher education providers in Victoria, the competition for students will continue to intensify as they compete both nationally and internationally for students. Branding will become an increasingly important component of a university’s profile to support a steady inflow of students. This will enable Victoria to capitalise on increasing demand for education by international students, driven by the growing middle class of emerging Asia. In fact, it has been estimated that the number of students seeking to study abroad could rise to approximately eight million in 2025, which is almost three times more than current international student levels (British Council, 2012).

While this creates significant opportunities for growth, institutions will also need to keep pace with emerging competitors in Asia who are not only upgrading and scaling up higher education offerings, but they are also becoming interlocutors, partners, and peers for universities in other parts of the world (Asian Development Bank, 2014). A further challenge for institutions will be attracting and retaining teaching expertise with an increasingly globally mobile workforce.

Chart 2.7: Education related personal education exports, calendar year estimates, 1972-2014

Source: Australian Bureau of Statistics (2015), Cat. No. 5368.0
Note: Education related personal education exports are revenues from international students enrolled in Australia
2.3.4 Design and technology will be increasingly integrated into education and training infrastructure

Student outcomes are strongly influenced by the design of learning spaces (Blackmore J, et al, 2010). In the future, it is expected that the design of the classroom will dramatically depart from the traditional approach. The classroom should instead leverage available technology to augment curriculum delivery and encourage collaborative learning opportunities. As delivery models become more flexible to a wider audience as people continue to learn throughout their life time, there will be better capacity to utilise existing assets in non-peak periods (such as after business hours). Infrastructure itself will also need to be flexible to ensure that it can adapt as a functional space to changing education and training demands. For example, this may range from ensuring video link capacity is available for the provision of lectures from or to a remote location to providing learning spaces that connect to classrooms around the world.

As the population continues to grow and change, it will be important to ensure that there are adequate education and training facilities to allow for equitable access in growing parts of Victoria, and to support the local economy with a well-trained job market. In particular, it will be important to retain a continued emphasis on ensuring there are adequate educational facilities for the provision of early childhood education, given it is at a crucial stage of life in terms of a child’s physical, intellectual, emotional and social development.

Victoria will need to keep pace with global infrastructure standards in order to maintain its competitive advantage as a provider of international education.

2.4 A more equal society is important for Victoria’s communities

An equal society is defined by both equality in outcome and equality of opportunity. A high level of equality of opportunity means that aspects outside of an individual’s control do not unfairly impact on their quality of life (Dabla-Norris et al, 2015). Equality in outcome describes a fair distribution of income, wealth and expenditure across a population.

Equality is important not just from an ethical standpoint of fairness, but also because a large body of research has identified wide ranging economic and social costs associated with inequality. In societies with high levels of inequality, individual choice in education and jobs can be significantly undermined (Dabla-Norris et al, 2015), which is strongly associated with poor educational and health outcomes. This can translate to reduced social mobility, whereby an individual’s economic prospects are largely determined by the circumstances of their parents (Ostry et al, 2014). Inequality not only limits human capital accumulation, but also restricts accumulation of physical capital and wealth (Galor and Moav, 2004) and IMF studies also suggest that inequality inhibits economic growth (Ostry et al, 2014).

As well as issues of equality, this section also discusses key changes impacting Victorian communities through population growth and ageing of the population.

2.4.1 Meeting the changing housing requirements of Victorians

Household composition has changed considerably over the last 30 years, with a clear move away from bigger households and the traditional nuclear family arrangement. In a trend consistent with other developed nations, Victorians are having fewer children on average. Today, almost no OECD country has a total fertility rate above the population replacement rate of two children per woman (OECD, 2011). In her lifetime, the average Victorian woman is likely to have approximately 1.8 children (ABS, 2015b). This has been a contributing factor to the decrease in household size.

Based on 2011 census data, households consisted of 2.5 people on average (ABS, 2011a). In the next 20 years, family households are projected to have the largest increase in absolute terms, remaining the most common household type in Victoria (ABS, 2015b). However, lone person households are projected to show the largest percentage increase, driven by the increase in older people living alone and individual housing preferences (ABS, 2015e).

The decline in household size has had a subsequent impact on housing demand as the types of houses that Victorians look for changes based on the number of people that are living there. Recent research suggests that the shift to smaller households, coupled with the growing aged population in Victoria, may result in a housing deficit for younger households (Birrell & McCloskey, 2015). Young people typically seek to transition from smaller living arrangements, such as flats and apartments, into detached houses when they start having children.

However, their ability to do so will be increasingly limited by the finite supply of detached houses in high
amenity suburbs (usually within 10 kilometres of the city centre). Moving house is an expensive choice and land transfer duty provides a strong disincentive for people to move. It reduces labour mobility and downsizing, which creates a strong possibility of a developing mismatch in the dwelling needs of households in the future. This is exaggerated by the potential downsides associated with transitioning to smaller housing, such as financial risks (for example, the exclusion of the value of the family home in pension payment calculations provides a disincentive to downsizing), transactions costs, and preferences in relation to inheritance.

There is also a need to recognise the diversity of housing preferences between families in Victoria. While we can make generalisations about overarching trends, it is important to account for differing housing priorities, as some households may choose to value proximity to amenities higher than extra space within the family home, or vice versa. As metropolitan areas continue to increase in density, it will be important to consider the local community’s expectations of housing diversity and other housing priorities.

Beyond issues of housing diversity, housing affordability is a growing issue. Driven by the dramatic increase in house prices over the last two decades, households in metropolitan areas have seen a reduction in the number of affordable locations for low and middle income earners (refer to chapter 3 for further information on housing affordability).

There are significant impacts felt by society when access to affordable housing is limited. For example, lack of affordable housing can impact on the stability of living arrangements and health and wellbeing. Indeed, the proportion of Victorians who had ever experienced homelessness (14 per cent) is higher than the Australian average (13 per cent) (ABS, 2014).

2.4.2 New approaches to justice are being implemented to address increasing rates of crime

Individuals benefit from a society where standards of behaviour are widely accepted and upheld, and where criminal justice systems operate effectively to minimise harm to people and property. At present, Victoria has a crime rate of 7,895 per 100,000 people (469,830 reported crimes in 2014-15), representing a 4.6 per cent increase in the rate from the previous year (Crime Statistics Agency, 2015), see Table 2.2.

Property and deception offences account for the majority of all offences, followed by crimes against the person, justice procedures offences, and then public order and security offences, drug offences and other. In the past 24 months the most significant changes in rates of offending are breaches of orders (up 39.4 per cent), drug use and possession (up 22 per cent), drug dealing and trafficking (20.2 per cent) and other government regulatory offences (down 40.3 per cent) (Crime Statistics Agency, 2015).

There are several drivers for increases in crime rates – population growth may drive up the total crime, while policy changes may affect reporting. For example the current policy focus on family violence may have led to an increased willingness among people to report incidents of family violence to the police. In addition, the focus on drugs, particularly ice, has instigated the establishment of 21 taskforces across Victoria in 2015. This potentially explains the recent increase in drug related offences as resources have been focused on this issue. Drugs may also have flow-on effects to other crime related activity, such as theft, property crime and robbery.

Increasing rates of crime puts greater pressure on Victoria’s courts. Chart 2.8 shows the number of cases pending longer than 12 months expressed as a percentage of the total pending caseload (backlog). This illustrates that the backlog has been decreasing over time, except for the Magistrate’s and Children’s courts which have remained relatively stable. For the Supreme Court non-appeal and County courts, the backlog is greater than the national average.

| Table 2.2: Number and rate of criminal offences, 2010-11 to 2014-15 |
|-----------------|---------|---------|---------|---------|---------|
| Number of Offences | 377,952 | 406,862 | 425,249 | 449,307 | 469,830 |
| Offence rate per 100,000 | 6,824.9 | 7,223.4 | 7,409.4 | 7,691.4 | 7,894.9 |

Victoria has invested in a number of therapeutic jurisprudence programs, which focus on the impacts of the juridical process on a participant’s emotional and psychological wellbeing (Community Law, n.d). In doing so, it represents a shift from the outcome (individual’s criminal behaviour), to recognising and addressing the underlying causes for their behaviour. The aim of this approach is to create better long term outcomes for the individual and their families, and to prevent future criminal behaviour. It therefore often involves additional resources for courts, but with the goal of reducing long term pressure on prisons. Victorian specialist courts include the Koori courts across Victoria, the Neighbourhood Justice Centre in Collingwood, the Court Integrated Services program, the Assessment and Referral Court (ARC) List in Melbourne and the current trial of the Family Drug Treatment Court.

In January 2015 there were an estimated 6,506 people in Victoria’s prisons, with the population expected to continue its upward trend, growing to 8,300 by 2019 (Victorian Ombudsman, 2015). Corrections Victoria (2014) reports that in 2011-12, 44 per cent of people had returned to prison within two years of release. New technology will increasingly offer alternatives to the traditional brick and mortar prison systems in place of innovative virtual systems for low-risk and nonviolent offenders. This will assist with avoiding issues of overcrowding, violence, and the high costs associated with incarceration and result in better outcomes for offenders.

2.4.3 Social exclusion and disadvantage can be accentuated by location characteristics

Income and wealth are important determinants of people’s economic and social wellbeing. Inequality is a societal issue that also has implications for the economy and environment. Social cohesion is enhanced through a more equal and fair society (Kawachi and Kennedy, 1997), while from an economic perspective, an increasing gap may mean greater reliance on debt to manage expenditure (Iacoviello, 2008), and depressed demand for goods and services from lower disposable income.

Wealth inequality is more apparent than income inequality in Australia. A person in the top 20 per cent has approximately 70 times more wealth and five times more income than a person in the bottom 20 per cent (ACOSS, 2015). While wealth inequality has declined since the global financial crisis, it has increased over the longer-term (Dabla-Norris et al, 2015). Going forward, Piketty (2014) theorises that wealth grows faster than economic output, and that slower growth will increase the importance of wealth in society.

Wages and salaries contribute the most to household income and therefore to income inequality before taxes and transfers are taken into account (ACOSS, 2015). In Victoria, as shown in Chart 2.9, while incomes have grown at a relatively even rate over the past decade, the highest income quintile has experienced slightly stronger income growth of 2.8 per cent per annum than the other income quintiles over this period.
This has resulted in the highest income quintile increasing its share of total household income in Victoria from 38.2 per cent in 2003-04 to 39.2 per cent in 2013-14 (ABS 2015f). For comparison, the income level at the top of the lowest income quintile of $511 per week was 40 per cent of the income level of $1,276 per week at the bottom of the highest income quintile in 2013-14.

That said, there are important issues to consider around equitable access to infrastructure across the income distribution, as well as across the broader population. Accessible infrastructure – such as public transport – can allow lower income and other marginalised groups to better access education and employment opportunities and more fully participate in society.

For example, Burke and Stone (2014) have recently shown that lower income renter households in Melbourne are increasingly being concentrated in outer urban locations where renting is more affordable but transport systems are weaker than in the inner city. This marks a change over the past three decades from historical patterns which saw low income renter households concentrated in the inner city where access to transport and other opportunities is much better.

In turn, this is increasingly causing a form of transport disadvantage which limits peoples’ mobility to obtain employment, or to access educational and health resources. The authors argue that the policy responses are complex but will need to encompass transport initiatives and, to a lesser extent, housing initiatives.

To that end, the authors suggest that transport initiatives should emphasise a ‘network’ approach to transport system design, with a focus on buses to tackle this issue rather than fixed rail or tram systems which are less flexible than buses (Burke and Stone, 2014).
Social exclusion and disadvantage has been shown to be geographically concentrated, with regional Victoria showing greater levels of disadvantage than metropolitan areas. The major concern with concentrated disadvantaged is that localities accentuate disadvantage and social exclusion. Inequitable access to public goods impacts on individuals and communities as well as how places function.

In part, this can be attributed to the higher prevalence of population groups that are consistently overrepresented in data about disadvantage, including aged persons, Indigenous people, one parent families, the unemployed and public housing tenants, people with non-English speaking backgrounds, and people with a disability (Australian Government, 2009). Geographically based disadvantage can lead to environments where there is locational segmentation according to:

- Income and wealth;
- Access to affordable housing and safe neighbourhoods;
- Access to resources and facilities;
- Access to labour markets, education and training; and

There is also evidence that lower income renter households in Melbourne are increasingly being located in outer urban locations where access to transport is poor (see Table 3.5 in Chapter 3). Locational disadvantage brings with it the potential for increased social disconnectedness for many low income renter households, but especially for those people who may not drive such as the low income earners who cannot afford the associated costs, the disabled or the elderly. Equitable access to support services is another problem as many support services are disproportionately located in the inner city (Burke and Stone, 2014).

Table 2.3: Percentage of private rental dwellings in each category of public transport accessibility, Melbourne, 2012

<table>
<thead>
<tr>
<th>Public transport accessibility</th>
<th>All flats</th>
<th>Low cost flats</th>
<th>All houses</th>
<th>Low cost houses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor (&lt;5)</td>
<td>21.2</td>
<td>42.6</td>
<td>63.5</td>
<td>77.1</td>
</tr>
<tr>
<td>Marginal (5-14.9)</td>
<td>18.0</td>
<td>23.0</td>
<td>17.5</td>
<td>14.4</td>
</tr>
<tr>
<td>Good (15-19.9)</td>
<td>31.8</td>
<td>24.3</td>
<td>14.0</td>
<td>6.9</td>
</tr>
<tr>
<td>Very good (20+)</td>
<td>29.0</td>
<td>10.1</td>
<td>5.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Burke and Stone (2014).
Infrastructure and urban design can play an important role in creating a socially cohesive society that is responsive to current and future patterns of migration. Equally, continued spatial inequality can exacerbate poverty and disadvantage and lead to entrenchment across generations. Addressing this effectively is essential to preventing the development of long term areas of entrenched disadvantage and instead create a more integrated and socially equal society. An effective example of how this has been achieved in Victoria is the Kensington Redevelopment (see next).
Achieving social cohesion in Kensington

Kensington is a suburb in inner-Melbourne with a high concentration of social housing for low income Victorians, including a high population of newly arrived migrants particularly from the Horn of Africa, which is contrasted with relatively affluent residents who are drawn to the increasingly gentrified area.

Between 2002 and 2012, Kensington’s 15 blocks of affordable flats and three high-rise buildings for low income Victorians underwent redevelopment. Consultation for the redevelopment was extensive and included the local community, including residents, schools, the council and businesses, with the aim of creating a place that:

- People are proud of and want to live in.
- Residents can participate in the community.
- Provides access to opportunities.

The redevelopment removed physical boundaries of the former estate and re-integrated the site into the local area. It has been recognised as successfully creating an integrated and cohesive community. There are a number of features that have facilitated this, including:

- Ensuring the redevelopment looks like any residential development in Australia.
- Creating better pedestrian links and networks between homes and community features.
- Breaking down physical barriers between the previous estate and rest of the community, such as fences.
- Integrating social and private housing so that they are indistinguishable.
- Providing access to open spaces and community recreation areas such as seating, children’s playground, barbeque areas and sporting facilities.
- Environmentally sustainable homes that achieve a 5-star minimum energy rating.

Businesses in the area have also responded to the redevelopment. For example culturally appropriate activities are often held at the local YMCA, such as women’s only swimming, and AMES runs the fifty-six threads social enterprise café, which provides training and employment opportunities for new migrants.

This example demonstrates the way in which urban design and infrastructure can play an important role in creating, or inhibiting the creation of, a socially cohesive community.

2.4.4 Place matters for prosperity
Prosperity is directly linked to place through both the physical and non-physical characteristics of an area. Direct factors such as accessibility and design contribute to prosperity, as do the non-tangible elements such as the values of the surrounding community. Research suggests that the concept of place impacts on an individual’s sense of belonging, security and contributes to the development of their identity (Jack, 2010).

There are three issues that will create the need for trade-offs between prosperity and place in the future:

- **Density** – as density increases in metropolitan areas, public open space per capita is likely to decrease. This has implications for public open space like local parks, gardens, and public golf courses.
- **Peri-urban fringe** – it is important that quality urban spaces are created in areas expecting strong population growth. This means that we need to organise space as an aggregate around services, to ensure accessibility.
- **Growth of regional cities** – regional cities will see conflict of development with other productive agricultural land and environmental preservation. Labour mobility in particular is important, with the growth of regional cities providing opportunities and challenges.

2.4.5 Victoria has a rich and diverse culture
Victoria’s trend of migration driven population growth, as described in section 2.1.1, will have a corresponding impact on diversity in Victoria. Over a quarter (around 27 per cent) of Victoria’s population was born outside Australia. While the majority of migrants were born in the UK, New Zealand or China, Victoria also has higher proportions of residents born in India (2.3 per cent), Italy (1.5 per cent), Vietnam (1.4 per cent), Greece (1.1 per cent) and Sri Lanka (0.9 per cent) than any other state or territory.

Victoria has the second highest levels of overseas born population, behind Western Australia (ABS, 2014). The majority of Victorians strongly agree or agree that it is a good thing for society to be comprised of different cultures (87 per cent) (ABS, 2015).

High levels of cultural diversity have encouraged the development of the state’s wealth of cultural and sporting events, with Melbourne often being considered the ‘cultural capital’ of Australia. Victoria has art galleries, museums, wineries and a sophisticated and varied gastronomic scene. These cultural facilities receive a high level of patronage, with approximately 86.5 per cent of Victorians attending at least one cultural and leisure venue or event in last 12 months. In addition, the number of sporting events that Victorians attend is also higher than the Australian average, with over half (52 per cent) of the population attending a sporting event in the last year (ABS, 2014).

2.4.6 Community infrastructure is critical to supporting a healthy and cohesive community
Family and household structures have infrastructure implications for childcare, education, housing and elderly care. Infrastructure decisions will need to ensure that both housing and services are available to Victorians at every life stage.

Infrastructure projects can have a transformative impact on local communities, regional economies and overall prosperity. Well-resourced areas can create healthy, vibrant and connected communities through the development of physically attractive environments with high levels of social inclusion and sense of belonging within the community (Carpenter, 2006).

Equity in access to infrastructure will become increasingly important, particularly if access to infrastructure is priced. Indeed, infrastructure will also need to support the provision of services in regional Victoria to ensure inequality between areas does not widen.

Equally, it will be critical that we ensure that infrastructure is used to avoid the persistence and creation of long term areas of disadvantage. Lack of investment in local places, in terms of infrastructure, services, facilities and place making, can have negative flow on implications for economic and educational opportunities, health outcomes, affordable housing, and other amenities.

With respect to justice, new approaches to incarceration and punishment will need to be supported with appropriate infrastructure such as monitoring through geospatial analytics.
Striving for a strong and growing Economy.

## 2016 → 2046

### The three P’s are key economic drivers

- **Population** growth contributed 51.7% of total GSP growth historically.
  - Growth contributed 0.6%, population growth contributed 51.7% of total GSP growth historically.
  - Participation contributed 0.6%, employment rate detraeted 2.4%, and a decline in average hours worked detracted 13.4% from total GSP growth.
  - Productivity growth comprised 63.5% of total growth in the Victorian economy from 1989-90 to 2014-15.
  - The contribution of labour Productivity is projected to be moderately lower over the next 30 years.

### Victoria’s industry composition has been changing...

- **Top employing industries:**
  - Health care and social assistance
  - Retail trade
  - Professional, scientific and technical services
  - Manufacturing
  - Education and training

### Employment has clustered in the CBD to take advantage of the benefits agglomeration

- Employment in:
  - Inner Melbourne represents 25%
  - Melbourne suburbs represents 49%
  - Rest of Victoria represents 26%

### Victoria will be increasingly integrated into the global economy...

- Geopolitical developments
- Emergence of Asia as the centre of the global community
- Environmental pressures
- Technological developments (including IoT, use of big data, smart cities and smart infrastructure)
- Information and capital flows
- Demographics - ageing and migration

### Victoria has a sound fiscal position

- Net operating balance has been in surplus for most of the past 15 years
- Ratio of net debt to GSP is very low by historical, international and domestic comparisons.

### and will increasingly be services-driven

- **Top employing industries:**
  - Health care and social assistance
  - Professional, scientific and technical services
  - Education and training
  - Construction
  - Retail trade

### ... will see continued strong growth in employment in the CBD

- Projected employment in:
  - Inner Melbourne to increase to 27% by 2046
  - Melbourne suburbs to decrease to 48% by 2046
  - Rest of Victoria to decrease to 25% by 2046

### As a result net inflow of workers commuting into inner Melbourne is projected to increase 73% by 2046

### ... though there will be mounting pressure on the budget over time

- Ageing population will see a higher dependency ratio - a higher proportion of the population not participating in the workforce
- If more fiscally constrained, the government will have less ability to directly fund infrastructure.
Victoria is Australia’s second largest economy and a leader in many diverse industries that will drive prosperity locally and nationally. In the immediate term, economic growth is forecast to rise to 2.5 per cent in 2015-16 from 2.25 per cent in 2014-15. This is based on improved household consumption and stronger export growth (Treasurer of the State of Victoria, 2015b).

The longer term prospects for Victoria depend on population, participation and productivity, and these will in turn have implications for infrastructure. Deloitte Access Economics has developed projections of employment by industry on a regional basis across Victoria, based on SA4 regions. The forecast methodology calibrates Deloitte Access Economics’ broad macroeconomic forecasts to match the Victorian Government’s population and economic forecasts from Victoria in Future 2015 (VIF, 2015) and the Victorian 2015-16 Budget. This broad outlook is combined with historic data from the ABS, including detailed Labour Force Survey data on employment by industry by region. Detailed labour force projections are then developed using Deloitte Access Economics’ forecast models, consistent with the Victorian budget projections and VIF 2015.

Key forecast outputs developed are employment estimates by industry and by SA4 region on a place of usual residence (PUR) basis – the region employed persons live in. A matching set of detailed employment forecasts by industry on a place of work (POW) basis (the region the employment is located in) are then developed using proportions of PUR to POW based on the 2011 Census of Population and Housing.

There is a two way relationship between the performance of an economy and infrastructure. Physical infrastructure can contribute to economic performance; well-designed infrastructure facilitates economies of scale, reduces costs of trade, and promotes specialisation and the efficient production and consumption of goods and services.

Investment in infrastructure can stimulate economic activity, through direct jobs created through construction and indirect jobs in the construction supply chain including manufacturing, transport and logistics and professional services (Treasurer of the State of Victoria, 2015b). Moreover, infrastructure investment influences an economy’s comparative and competitive advantage as well as promoting intra- and inter-regional integration. Hence infrastructure is a contributor to economic growth and in turn raises living standards.

At the same time the size and rate of growth of the economy can influence the demand for physical infrastructure and the type and quality of that infrastructure. For example, rising population in an economy puts pressure on infrastructure needs of the economy, including the mix between traditional ‘economic’ infrastructure (roads, bridges, ports) and ‘social’ infrastructure (hospitals, education facilities). Rising incomes often involve a growing preference for consumption of services and with that demand for infrastructure to provide these services (for example, cultural events and venues).

3.1 Long term trends influence Victoria’s economy

Victoria’s economy is impacted by global and local trends, such as: geopolitical developments; environmental pressures; the emergence of Asia as the centre of the global economy; demographics such as population ageing and migration; information and capital flows; and technological developments.

These trends bring opportunities and challenges for Victoria. To leverage the opportunities to maximise economic prosperity, Victoria will need to be internationally competitive, which means being more productive.

The opportunities for Victoria are partly a function of being in the right place at the right time, that is, Victoria is geographically located in the fastest growing region of the world; as the ‘Asian century’ continues, this will provide access to significant markets in China, India and closer to home in Indonesia. As these economies transition from industrial basis to consumer oriented economies, demand for goods and services from economies such as Victoria can increasingly drive the local economy.

Yet geographic location is not sufficient to ensure Victoria’s economic prosperity – the increasingly integrated global economy means businesses and individuals need to be internationally competitive to participate and thrive. Often this means being more productive – smarter in the way goods and services are produced and provided to consumers. Being more
productive is a function of many things, including the amount and quality of infrastructure people have at their disposal.

The need for sustainable economic development is also a global trend that will have implications for Victoria’s economy and existing and future infrastructure needs. The most significant of these is climate change, which without market based mitigation strategies (which are usually the most cost effective intervention) will slow the rate of growth of the global and Australian economies (CSIRO, 2015).

Victoria, with its traditional manufacturing and coal-fired energy sector is already in the midst of transitioning to a more environmentally sustainable economy. Moreover, Victoria’s existing infrastructure will come under pressure (for example storage reservoirs, waterways and irrigation; telecommunications and transport) with the need to make infrastructure climate change resilient. For example, the additional costs of making new infrastructure and buildings more resilient to climate change in OECD countries has been estimated to range from $15-150 billion each year (0.05 – 0.5 per cent of GDP) (State of Victoria, 2006). See Chapter 4 for a detailed discussion of climate change and its implications for the economy and infrastructure in Victoria.

Demographic and broader trends have included a continued move towards urbanisation; hence cities are becoming even more important as the engines of innovation, knowledge-intensive activities and overall growth (Deloitte, 2015). As telecommunications and travel have grown steadily cheaper, people have chosen to live closer together and at the same time as incomes have risen, so has the demand for global travel. The era of the global village is here and with it implications for infrastructure. For example, globally mobile ‘knowledge workers’ are increasingly choosing to live and work in cities where the quality and types of infrastructure meet their needs. They are sometimes more likely to move to other ‘global cities’ than within a nation or region for employment.

Moreover, social patterns regarding family structures, work-life balance and the growth of non-traditional work modes (part-time, casual employment) has meant that infrastructure in cities, in particular, needs to adapt to these changing trends. For example, public transport infrastructure is increasingly required 24 hours a day.

3.1.1 Infrastructure will need to enable Victoria’s place in the global economy
The integration of Victoria’s economy into the global economy means that Victoria’s economy will need to be internationally competitive.

In turn, infrastructure will be needed to facilitate international trade in goods and services, from agricultural goods and manufactured goods to tourism and education services. This means that infrastructure will be needed that ensures good connections between Victoria and the rest of the world including port infrastructure and airports. It also means increased demand for related transport infrastructure that allows freight and people to be efficiently moved around Victoria and to be connected efficiently to points of entry/exit such as ports and airports from locations in Melbourne and regional Victoria.

Infrastructure in Victoria’s economy will also need to be built in ways that accommodate environmental pressures and provide sustainable economic growth; this will require technological innovation in the design and delivery of infrastructure.

3.2 Population, participation and productivity are key economic drivers
The three P’s of economic performance
In the long-run an economy’s performance in terms of the size of the economy (measured by gross state product) hinges on three interrelated factors:

- **Population**
  The size of the population helps determine the size of domestic markets and how scale of production can be achieved at lower cost.

- **Participation**
  The size of the working age population and the share of this group that is actively employed or looking for employment (labour force participation) is an indicator of the capacity of the economy.

- **Productivity**
  How efficiently we turn inputs into outputs determines the capacity of an economy to produce, compete internationally and sustainably use resources.
Over the projection period to 2045-46, the growth rate in civilian working age population is expected to be higher than the historical average growth rate, averaging around 1.5 per cent per annum (though the rate of growth moderates over time). This is similar to the expected growth in Victoria’s total population of around 1.5 per cent per annum. The stronger expected growth in Victoria’s civilian working age population and total population is a reflection of expected growth in the migrant population in Victoria.

Despite the positive projections in civilian population growth, it does not mean that different regions of Victoria will uniformly experience these positive trends; there is expected to be disparity across Victoria.

As discussed in Chapter 2, while the population of regional Victoria has continued to grow, there has been an ongoing pattern of stronger population growth in Melbourne relative to regional Victoria.

The factors are interrelated because, for example, population influences the size of the labour force and participation rate, and productivity, at the margin, is influenced by the labour force participation of an additional entrant to the labour force. Victoria’s economy is no different, so it is informative to examine each of these trends.

**Population**

Chapter 2 provided an overview of the expected changes in Victoria’s demographic profile and population growth over the next three decades. From an economic perspective, a larger population is going to mean a bigger economy and at the same time additional pressure on Victoria’s existing infrastructure as well as demand for additional infrastructure.

A favourable trend over the past 25 years has been the relatively stronger growth in civilian working age population compared to non-working age population, rising by an annual average 1.4 per cent (Chart 3.1). Over the projection period to 2045-46, the growth rate in civilian working age population is expected to be higher than the historical average growth rate, averaging around 1.5 per cent per annum (though the rate of growth moderates over time). This is similar to the expected growth in Victoria’s total population of around 1.5 per cent per annum. The stronger expected growth in Victoria’s civilian working age population and total population is a reflection of expected growth in the migrant population in Victoria.

Despite the positive projections in civilian population growth, it does not mean that different regions of Victoria will uniformly experience these positive trends; there is expected to be disparity across Victoria.

As discussed in Chapter 2, while the population of regional Victoria has continued to grow, there has been an ongoing pattern of stronger population growth in Melbourne relative to regional Victoria.

**Chart 3.1: Victoria’s civilian working age population growth, 1989-90 to 2045-46**

![Chart showing the growth of Victoria's civilian working age population from 1989-90 to 2045-46.](source)

Source: ABS data (historical) and DAE projections based on *Victoria in Future 2015* (VIF). Note: ‘Civilian working age population’ is a broad measure of the working age population defined by the ABS. It refers to all usual residents of Australia aged 15 years and over except members of the permanent defence forces, certain diplomatic personnel, overseas residents in Australia, and members of non-Australian defence forces (and their dependants) stationed in Australia.
3.2.1 Infrastructure implications of a growing population

Ongoing population growth, particularly in Melbourne, will necessitate the delivery of new and renewed infrastructure. The impact of demographic change was considered in Chapter 2. As a fundamental driver of economic growth, population growth will drive increased demand for a range of economic infrastructure. This includes increased demand for energy and water infrastructure, transport infrastructure, and telecommunications infrastructure.

For example, demand for transport infrastructure (such as roads, bridges and railways) will increase and will be needed to deal with congestion and promote networks to link people.

Participation

Victoria’s labour force participation rate (the labour force as a share of the civilian working age population) has improved over the past 25 years, rising by approximately 1 percentage point over this period and peaking at 65.6 per cent in 2010-11 (Chart 3.2). However since then, the participation rate has begun to moderate and is expected to decline to just over 63 per cent by 2045-46.

The projected reversal of most of the labour force participation gains over the last couple of decades is a negative development for Victoria. To tackle the labour force impact of ageing of the population (that is, a greater share of the population will be dependent on the smaller share of the population in employment) there needs to be a lift in labour force participation rate. For example, there is potential for higher labour force participation among some women and aged people who tend to have lower participation rates.

While Victoria faces an ageing of population challenge, the projections do allow for this impact to be partly moderated by rising participation rates in older age groups as people increasingly choose to work longer before retiring. Overall however, the labour force participation rate will still likely decline, because of the rise in both the number of older people and the fact that older people tend to have significantly lower labour force participation rates than younger people on average.

Labour force participation rates are not uniform across the state. Melbourne’s participation rate has tended to be slightly higher than Victoria as a whole, while Shepparton and Latrobe Gippsland currently have the lowest participation rates in the State at around 58.2 and 59.3 per cent in 2016 respectively. As a result of the ageing population, there will be pressure on labour force participation rates across all regions in the future. Regional participation rates are projected to decline the most in Hume, the Mornington Peninsula and Warrnambool and South West, and hold up best in Ballarat.


Chart 3.2: Victoria’s labour force participation rate, 1989-90 to 2045-46
### Table 3.1: Labour force participation rates, 2016-46, per cent

<table>
<thead>
<tr>
<th>Region</th>
<th>2016</th>
<th>2021</th>
<th>2031</th>
<th>2046</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballarat</td>
<td>60.8</td>
<td>61.1</td>
<td>61.5</td>
<td>61.0</td>
</tr>
<tr>
<td>Bendigo</td>
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<td>62.6</td>
<td>62.6</td>
<td>61.8</td>
</tr>
<tr>
<td>Geelong</td>
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<td>59.8</td>
<td>59.8</td>
<td>59.2</td>
</tr>
<tr>
<td>Hume</td>
<td>63.7</td>
<td>62.3</td>
<td>61.7</td>
<td>60.1</td>
</tr>
<tr>
<td>Latrobe – Gippsland</td>
<td>59.3</td>
<td>59.0</td>
<td>58.9</td>
<td>58.3</td>
</tr>
<tr>
<td>Mornington Peninsula</td>
<td>61.9</td>
<td>60.9</td>
<td>59.9</td>
<td>58.3</td>
</tr>
<tr>
<td>North West</td>
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<td>60.7</td>
<td>60.7</td>
<td>59.5</td>
</tr>
<tr>
<td>Shepparton</td>
<td>58.2</td>
<td>58.3</td>
<td>58.0</td>
<td>56.6</td>
</tr>
<tr>
<td>Warrnambool and South West</td>
<td>63.4</td>
<td>63.0</td>
<td>62.2</td>
<td>59.9</td>
</tr>
<tr>
<td>Melbourne</td>
<td>65.7</td>
<td>65.2</td>
<td>65.3</td>
<td>64.5</td>
</tr>
</tbody>
</table>

Source: Deloitte Access Economics projections.

### 3.2.2 Infrastructure implications of falling workforce participation

The infrastructure implications of an ageing population were also considered in Chapter 2. From an economic perspective, the ageing of the population is going to put increasing pressure on Victoria’s economy and fiscal sustainability.

The ageing population will mean a small reduction in future growth in economic output per capita and the number of people commuting to work than if the population was not ageing. In turn, this means a slight reduction in demand for certain types of economic infrastructure such as transport infrastructure to meet peak hour commuting demand, but this impact of the ageing population will be far outweighed by strong growth in the population (see Chapter 2 for an illustration of the impact of falling labour force participation on economic growth compared with the impact of population growth). Therefore, the implications of a slight reduction in labour force participation for economic infrastructure can be considered relatively modest compared to the impact of other drivers.

### Productivity

The old adage is that in the long run productivity is everything. This is true for Victoria as it is for every other economy; how efficiently inputs are turned into outputs will determine the living standards and sustainability of our economy.

Productivity is influenced by a number of factors including: human capital accumulation; innovation; framework conditions such as low and stable inflation, developed financial markets, a low tax burden and a low share of distortionary taxes; and open and competitive markets for trade and investment which facilitate the diffusion of technology and remove unnecessary regulatory burdens (Deloitte, 2014).

Infrastructure also plays a role in productivity, particularly in raising the level of productivity by enhancing the amount of capital per worker in an economy.

Victoria’s labour productivity (hours worked basis) has grown by an average annual rate of 1.8 per cent since 1989-90 in line with Australia as a whole. This includes a ‘golden decade’ for Victoria from 1989-90 to 1999-00 when labour productivity growth averaged 2.6 per cent annually, a 0.5 percentage point stronger outcome than Australia as a whole (Chart 3.3) and significantly better than New South Wales and Queensland, the other two largest economies in Australia. However, since the turn of the century, Victoria’s labour productivity growth has waned relative to Australia as a whole (on average 0.3 percentage points a year lower than Australia) and while this has been a better performance than New South Wales, it is less than Queensland.
Waning labour productivity growth for Victoria is of concern given that it is central to long term living standards and growth. Productivity is also a means to ensure that other environmental and social challenges can be addressed because labour productivity gives the economy (and government) more financial resources to address broader challenges.

Higher labour productivity growth is also associated with higher real wages – slower productivity growth can lead to slower growth in real wages. In turn, this could make Victoria a less attractive destination for people to live and work with potentially adverse implications for trends in interstate migration.

Using the historical labour productivity performance for Victoria as the basis for projecting longer-term trends, the average annual rate of growth of labour productivity may be around 1.6 per cent in each of the next three decades to 2045-46 (Chart 3.4).

3.2.3 Infrastructure implications of higher labour productivity
Growth in labour productivity will mean higher economic output – a bigger economy – and higher household incomes which allow for more consumer spending. In turn, there will be increased demand for a range of economic infrastructure. In some respects, this is similar to the implications of stronger population growth, but in other respects the implications of productivity growth will be different. For example, productivity growth can drive higher demand for transport infrastructure due to increased freight movement driven by higher household consumption demand as well as increased production of goods and services to meet export demand, but may not drive higher commuting flows in the same way as higher population growth. Higher incomes may also lead to a demand for higher quality infrastructure, and will provide greater fiscal capacity to finance new infrastructure.

On the other hand, the source of productivity growth is also an important factor to consider. For example, innovation in how things are done and changes in the industry mix could raise productivity growth but might be associated with a reduction in overall demand for infrastructure. Similarly, more efficient use of existing infrastructure could reduce the need for new infrastructure.

As noted earlier, productivity growth itself is influenced by infrastructure but the relationship can be complex. Building more infrastructure can raise productivity growth, but it cannot do so indefinitely due to diminishing returns. Only innovation and human capital can underpin sustained acceleration in the rate of productivity. Yet innovation and human capital often need critical infrastructure – such as telecommunications. Strategic investment in economic infrastructure can make a difference to the productive capacity of the Victorian economy.
There is uncertainty around the rate of productivity growth that Victoria will experience over the long run. While Deloitte Access Economics expects productivity growth to average 1.6% per annum over the next three decades to 2045-46, it is possible that productivity growth will be higher or lower than the base case shown here. That would have implications for infrastructure, as discussed above. For example, if productivity growth disappoints, the economy would be smaller, and household incomes lower (along with a reduced fiscal capacity), with the likelihood of reduced growth in demand for certain types of infrastructure. However, the precise infrastructure implications would depend heavily on what drives lower (or higher) productivity growth. A scenario considering higher productivity growth driven by improvements in technology is illustrated in Chapter 5.

The three P’s together

Bringing the three P’s together we can distinguish their historical and projected relative contribution to growth in Gross State Product (GSP) for Victoria. Chart 3.5 shows around 63 per cent of the total growth in Victoria’s economy from 1989-90 to 2014-15 is attributable to labour productivity growth. The contribution of labour productivity is projected to be marginally lower over the next 30 years. Population growth contributed around 52 per cent to total GSP growth historically and is projected to make a stronger contribution to GSP growth over the next 30 years. A lack of strong growth in labour force participation historically has meant it has not contributed much to overall GSP growth and future trends suggest this will worsen as ageing of the population reduces labour force participation. Average hours worked detracted around 13 per cent to Victoria’s economy over the historical period and this negative influence will be stronger in the future, as more of the workforce shifts to part-time roles.

The implications of Chart 3.5 are that Victoria’s economy is going to get bigger from strong population growth, but relative to the past, less contribution will come from how efficiently the economy will be transforming inputs to outputs.

3.3 The labour market is expected to grow unevenly

The labour market is a key indicator of the health of an economy. Apart from labour force participation discussed earlier, key indicators include the employment rate (persons in employment as a percentage of the civilian working age population) and the unemployment rate. The employment rate, sometimes referred to as the employment-to-population ratio, is influenced by both the labour force participation rate and the employment outcomes of those in the labour force. It is therefore negatively influenced by a higher proportion of the population not seeking work due to the ageing population, as well as economic conditions which may influence employment outcomes.
Chart 3.6 shows that during the economic downturn of the early 1990s, the employment rate declined 6 percentage points to 55 per cent in 1992-93 before recovering strongly in the following decade. The period of the global financial crisis around 2008-09 saw a less severe downturn for Victoria. Over the longer-term, the employment rate is expected to converge to around 60 per cent. The flip side of this story is shown by the unemployment rate – peaking at around 12 per cent in 1992-93 before declining. Over the longer term Victoria's unemployment rate is expected to converge to around 5 per cent a year.

The longer term decline in the employment rate is a negative for Victoria. It is a reflection of the ageing population which will result in a higher proportion of the population not participating in the workforce. The projection of an employment rate of 60 per cent means that only three of every five people of working age in Victoria will actually be in employment. This will put pressure on the living standards of Victorians and also the fiscal position of the Victorian Government. Moreover, it will have implications for infrastructure – if future governments are more fiscally constrained they have less ability to directly fund infrastructure.

At the regional level, there is a considerable spread of employment growth rates. This is a function of different regional population growth rates as well as the industry mix within each region. In general, employment growth within the Greater Melbourne area is forecast to be stronger than in regional Victoria, which broadly reflects expectations for population growth by region.

As shown in Chart 3.7, Melbourne, West, Melbourne, North East and Melbourne-Inner are forecast to have the highest rate of employment growth, while the Warrnambool and South West SA4 is forecast to have the lowest. The regional distribution of employment will also have implications for infrastructure planning going forward. The Melbourne CBD and other inner suburbs are expected to see by far the highest number of additional persons employed over the forecast period.

Chart 3.7: Average annual employment growth by SA4 region on a place of work basis, 2015-16 to 2045-46

Source: Deloitte Access Economics projections. Note that these projections show employment according to the region in which people work (i.e. place of work basis) rather than the region in which they live.
3.4 Industry composition has been changing and will increasingly be services-driven

Victoria is often portrayed as the manufacturing belt of Australia. While it is true that manufacturing is a bigger share of Victoria’s economy relative to its share in other state economies, Victoria has increasingly been making a transition from an industrial economy based on manufacturing to a tertiary economy based on services.

This structural change is not a new phenomenon, but has rather been an ongoing feature of the Victorian economy. Indeed, over recent decades the rate of structural change in the Victorian economy has typically outpaced that at the national level. Meanwhile, a comparison of the current employment by industry structure of the Victorian economy to twenty years ago shows that the Victorian economy has experienced more structural change on this measure than any other state over this period.6 Much of the structural change in the Victorian economy can be attributed to the declining manufacturing sector, which has gradually fallen as a share of total Victorian output and employment over time, while service based industries have increased in importance (ABS (2015), Cat No. 6291.0.55.003).

Structural change in the Victorian economy can be expected to continue in the future. Not only will there be further decline in manufacturing in the near term as car manufacturing in Victoria ceases, but there will also be new growth industries over the longer term.

A recent analysis by Deloitte identified the sectors which will drive Australia’s next waves of growth (Deloitte, 2013). The analysis found that, as global markets shift, Victoria is well placed to benefit from Australia’s export-oriented future growth waves, particularly international education, wealth management, agribusiness and tourism – which along with natural gas have been termed the ‘Fantastic Five’ super growth sectors. The common theme is that these sectors are well positioned to capitalise on Asia’s continuing growth. In addition, Victoria will also be able to draw on its strengths in medical research, ICT, food processing and finance, with these sectors also identified as sectoral hotspots with the potential to lift prosperity over the coming decades.

In order for these and other sectors to succeed as growth engines of Victoria’s economy, infrastructure investment (both private and public sector) will

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6Structural change calculated as the difference in employment by industry structure (averaged over five years) across 1989-1994 compared with 2009-2014.
be required to support their growth. Moreover, infrastructure needs will be different for different industries. For example, the tourism industry will require transport infrastructure such as airports and roads in regional areas, agribusiness will require infrastructure to move agricultural goods, while knowledge-based services will have its own requirements such as infrastructure which lowers commuting costs for knowledge workers.

In recent years the rise of a knowledge-based service economy in Victoria – centred in inner Melbourne – has been a notable development of the economic landscape. Knowledge workers are highly educated, and typically work in teams using sophisticated technologies to solve complex problems and develop innovative products and services. Such knowledge-based services are intensive in ideas, knowledge and skill and tend to be the most highly valued services in a service-based economy. They also exhibit clustering effects, known as economies of agglomeration, which means that the productivity of knowledge workers rises exponentially when they are in close proximity. Their interaction stimulates creativity and innovation – new and different ideas – which in turn drives productivity in the knowledge economy. This suggests that infrastructure will be needed in the future which facilitates the proximity of knowledge workers.

The industry composition of Victoria’s economy will continue to change towards services in future decades. Chart 3.9 shows that by 2045-46, the professional, scientific and technical services and education and training industries together are projected to experience the fastest growth in employment over the next 30 years. Both of these industries benefit from the structural shift occurring towards knowledge services. Melbourne is already a recognised financial services hub and it also stands to gain from the ageing population demanding more superannuation and funds management services. The professional services industry is clustered in inner Melbourne and the south-eastern suburbs and is benefiting from the trend of businesses outsourcing non-core functions to specialised firms in the industry, as well as the influence of new technologies which facilitate such outsourcing.

Health care and social assistance is also projected to significantly increase its share of total industry output of the Victorian economy. The ageing population coupled with increasing life expectancy will help to drive demand for this industry’s services. This demand will be for traditional and allied health professionals as well as complementary medicine (such as vitamins and supplements, naturopathy, acupuncture and remedial massage). An important aspect of this industry is that it is spread across all the metropolitan and regional areas in Victoria, which means that the industry’s strong growth will have implications across all regions of the state.

By 2045-46 the manufacturing industry, is expected to be a niche industry in Victoria. This reflects the ongoing structural shift in the economy away from low-value add manufacturing where there is no cost advantage for local manufacturers towards higher-value add activities. The closure of automotive manufacturing plants will take a toll on the industry in the near term, and while some higher value or niche products, along with food product manufacturing (which will benefit from increased demand for higher quality food from China) have potential for further growth, increasing levels of automation in production will limit employment growth in the industry.

Projected employment growth rates across all major industries are shown in Chart 3.9. The strongest rates of employment growth in Victoria over the projection period are expected to be seen in the social services areas (health care and social assistance, and education and training), business services (professional, scientific and technical services, and finance and insurance services), and construction. At the other end of the spectrum, the agriculture, forestry and fishing, mining and manufacturing sectors are all expected to see a decline in employment.
The changing industry structure in Victoria will also have implications for employment across occupations. Relatively fast growing industries such as health care, finance and professional services will mean relatively stronger growth in the demand for health service workers and a range of white collar professional occupations. In contrast, the occupations which are expected to see fewer additional employed persons include machinery operators and drivers and labourers which have a greater share of their occupation employed in industries where employment is in relative decline including manufacturing, agriculture and mining.

These trends across industries and occupations will also have implications for travel patterns to and from work, as well as for education and training in the State, as employers increasingly look for the most qualified and skilled workers in an effort to raise the productivity of their workforce.

3.4.1 Infrastructure implications of an increasingly services-based economy

Infrastructure will need to respond to structural change of the Victorian economy.

The industry composition in Victoria already has a significant influence on current infrastructure requirements. As an example, while the Port of Melbourne dealt with the highest number of containers in 2012-13, Western Australia, Queensland and, to a lesser extent, New South Wales have much larger quantities of cargo loaded at ports and total domestic freight movement than Victoria. This reflects the higher level of resource exports in these states compared to Victoria, with bulk cargo such as coal and iron ore being transported in these jurisdictions for export overseas. Relative to these states, Victoria has comparatively little exportable resources and consequently much less need for supporting infrastructure.

Looking ahead, new industries will emerge with different infrastructure needs, while some old industries will decline. For example, the manufacturing industry has a pattern of demand for infrastructure (including typically a relatively strong demand for electricity) which is quite distinct from the infrastructure requirements of services-based industries.
The relative decline of manufacturing will mean relatively less demand for electricity and related energy infrastructure. Transport infrastructure which meets the specific needs of manufacturing businesses may also see relatively modest growth. In contrast, transport infrastructure which meets the needs of services-based industries (such as infrastructure to meet commuting demand) can be expected to see stronger growth.

Indeed, proximity and connectivity – efficiently connecting people across cities and regions – is of particular importance to the productivity of the rising knowledge economy in Melbourne.

### 3.4.2 Industry structure across Victoria’s regions

Structural change has also been apparent across Victoria’s regions and this will continue to be the case. Importantly, the industry mix differs across regions – certain industries are more concentrated in some regions than others – and this is reflected in a different outlook for employment across regions. A summary of Deloitte Access Economics’ projections of employment by industry across regions is provided below, which highlights how the industry mix can be expected to change in each region over time.

In particular, the continuation of the shift towards services such as finance and insurance and professional services will mean stronger employment growth in Greater Melbourne, particularly Melbourne-Inner which includes the white collar business districts of the Melbourne CBD and St Kilda Road precinct along with the Port of Melbourne.

Among the other growth industries, health care and social assistance is also an important and growing sector across Greater Melbourne, which reflects the changing needs associated with the ageing of the population. Meanwhile, a growing school aged population will support education sector employment across the suburbs, while a growing higher education sector in areas such as the Carlton university precinct is supported by a strong outlook for growth in international education services.

However, Melbourne does have a large manufacturing base, and the poor prospects in manufacturing will be felt most strongly in the Melbourne-West, Melbourne-South East and Melbourne-Inner regions, which are heavily reliant on the industry.

Due to the closure of car manufacturing in Geelong, along with the broader decline of manufacturing in the Victorian economy, manufacturing in Geelong will also be under pressure. Manufacturing is expected to decline from the fifth largest sector in Geelong to be the eighth largest sector by 2046. The fall in manufacturing employment within Geelong will allow for the transition of current industrial zoned land for other purposes, providing further scope for increased residential development. The fall in automotive manufacturing employment will also be counterbalanced to an extent by growth in the high-tech manufacturing hub at Deakin University’s Waterfront Campus. Longer term, employment growth in Geelong will be supported by growth in health care and social assistance, education and training as well as retail trade, with some national retailers headquartered in Geelong.

**Ballarat** is expected to see population growth around the Victorian average, which also helps to underpin its sound employment prospects. Health care and social assistance is already the largest employer in the region, and its size and strong growth prospects mean that nearly a third of the increase in employed people in the region will be in the health care and social assistance sector. At the other end of the spectrum, farming, which is currently the fourth largest sectoral employer, is forecast to see notable job losses over time. This is consistent with consolidation of agricultural land and falls in the use of labour as agricultural productivity continues to increase.

The largest employers currently in **Bendigo** are health care and social assistance, retail trade and manufacturing. Health care and social assistance is forecast to be one of the stronger growing sectors in the region which will be facilitated by the construction of the new Bendigo Hospital due for completion by the end of 2016. Other fast growing sectors include education and training which has benefited in recent years from the growth in student enrolments at Latrobe University’s campus, with more students choosing to undertake higher education and remain in the Bendigo region. Bendigo is also a major financial services hub in regional Australia; home to the headquarters of the fifth largest Australian-owned bank (City of Greater Bendigo, 2014).
The Hume region is located in Victoria’s north east and contains the regional centres of Wodonga, Wangaratta and Seymour. Hume is expected to have one of the highest proportions of residents aged 65 years or older in the future. The health care and social assistance sector is consequently forecast to have the strongest growth in employment within the region, and will displace retail trade as the largest employer in the region. Manufacturing is expected to be a poorly performing sector in the region.

The Latrobe-Gippsland region covers the eastern parts of Victoria and includes the regional centres of Bairnsdale, Sale and Moe. Retail trade, health care and social assistance and agriculture, forestry and fishing are currently the largest employers by sector in the region. Health care and social assistance and retail trade are expected to remain two of the largest employers in the region in the future. Conversely, the agriculture, forestry and fishing sector is forecast to see its share of total employment decline, largely consistent with state-wide trends. In the baseline projections, the utilities sector is also expected to see relatively strong growth, with the Kipper Tuna Turrum gas development project due for completion in 2016. This will be supported by the $1 billion redevelopment of the Longford gas conditioning plant, which will process gas from the Kipper Tuna Turrum Project, and should continue to support employment in the utilities sector in Latrobe-Gippsland during the operational phase. It should be noted that there are significant risks to the baseline projections of employment in the utilities sector in the Latrobe-Gippsland region if there is a transition away from brown coal to renewable and other energy sources in the future. These risks are considered in more detail in the scenario illustrated in Section 5.3.

The Mornington Peninsula region contains parts of Melbourne’s southern suburbs as well as the residential, industrial and agricultural areas of the Mornington Peninsula. Retail trade, health care and education currently employ the largest number of people within the region. These three sectors are expected to be the major employers in the future as well, but the strong growth expected in the health care sector will likely see it replace retail trade as the largest employer. Tourism in the region should be supported by growth in Melbourne’s population over time. Manufacturing is currently the sixth largest sector, but reflecting state-wide trends, is expected to be a poorly performing sector.

The North West region of Victoria covers the north west corner of the state and includes the regional centres of Mildura and Horsham. Agriculture, health care and retail trade are currently the largest sectors of employment within the region, accounting for around half of total employment between them. The health care sector will be responsible for over half of the increase in employed persons within the region. As with trends expected across the State, job losses in agriculture are expected, and this will eventually see it lose its position as the largest employer in the region. This is due to continued productivity improvements, rather than the poor performance of the sector, although as noted in Chapter 4, climate change may pose risks to agriculture in this region. The Wimmera Regional Intermodal Freight Hub at Dooen, completed in 2012, has helped to facilitate the movement of commodities, including containerised exports, bulk grains and mineral sands, and overcome the constraints of existing facilities in the region.

The Shepparton region covers the north central part of Victoria which surrounds the regional centre of Shepparton. Health care and social assistance is already the largest employer within the region, and due to the ageing of the population and the increasing demand for these services, is expected to remain the largest employer. Education is also expected to be a sector associated with strong employment growth. At the other end of the spectrum, manufacturing and farming have relatively poorer employment prospects. The under-construction $2 billion Northern Victoria Irrigation Renewal Project is due for completion in 2018 and will modernise irrigation infrastructure in the region.

The Wimmera and South West region is expected to experience the slowest employment growth of all regions, which is a reflection of the slow population growth expected for the region. Farming is currently the region’s largest employer, and employs one in every four workers in the region. However, employment within agriculture is expected to fall over time due to continued increases in productivity. By 2046, this region is expected to have the highest proportion of residents aged 65 years or older at around 30.5 per cent of the population, and health care and social assistance is expected to become the largest employer.
3.5 Infrastructure to transport people from home to work is crucial

Transport infrastructure plays a crucial role in facilitating economic activity. That has certainly been true in the case of Victoria, but the sustained growth in the size of Victoria’s economy has also meant a growing demand for the State’s existing transport infrastructure.

Table 3.2 provides a snapshot of transport infrastructure in Victoria and across Australia’s other major states for context.

Table 3.2: Transport infrastructure in Victoria and across Australia

<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
<th>NSW</th>
<th>VIC</th>
<th>QLD</th>
<th>SA</th>
<th>WA</th>
<th>AUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total road length (km)</td>
<td>2013</td>
<td>206,209</td>
<td>145,003</td>
<td>223,762</td>
<td>97,193</td>
<td>157,702</td>
<td>872,849</td>
</tr>
<tr>
<td>Vehicle km travelled – total (billion)</td>
<td>2012-13</td>
<td>71.9</td>
<td>61.6</td>
<td>51.0</td>
<td>16.3</td>
<td>26.8</td>
<td>238.8</td>
</tr>
<tr>
<td>Vehicle km travelled – capital city (billion)</td>
<td>2012-13</td>
<td>39.5</td>
<td>38.9</td>
<td>20.9</td>
<td>10.0</td>
<td>17.2</td>
<td>133.2</td>
</tr>
<tr>
<td>Public transport patronage – heavy rail – capital city (million)</td>
<td>2012-13</td>
<td>306.2</td>
<td>225.5</td>
<td>51.7</td>
<td>10.0</td>
<td>65.7</td>
<td>659.1</td>
</tr>
<tr>
<td>Public transport patronage – light rail – capital city (million)</td>
<td>2012-13</td>
<td>5.7</td>
<td>182.7</td>
<td>-</td>
<td>2.9</td>
<td>-</td>
<td>191.2</td>
</tr>
<tr>
<td>Passenger km travelled – capital city – public transport (billion)</td>
<td>2012-13</td>
<td>8.2</td>
<td>6.1</td>
<td>2.3</td>
<td>0.8</td>
<td>1.8</td>
<td>19.6</td>
</tr>
<tr>
<td>Passenger km travelled – capital city – passenger cars (billion)</td>
<td>2012-13</td>
<td>45.7</td>
<td>45.3</td>
<td>21.4</td>
<td>11.8</td>
<td>19.2</td>
<td>150.9</td>
</tr>
<tr>
<td>Fare paying passengers at major airports (million)</td>
<td>2013-14</td>
<td>38.6</td>
<td>30.9</td>
<td>21.8</td>
<td>7.6</td>
<td>12.9</td>
<td>N/A</td>
</tr>
<tr>
<td>Cargo loaded at ports (million tonnes)</td>
<td>2012-13</td>
<td>172.6</td>
<td>25.5</td>
<td>237.5</td>
<td>25.9</td>
<td>633.3</td>
<td>1,119.2</td>
</tr>
<tr>
<td>Cargo discharged at ports (million tonnes)</td>
<td>2012-13</td>
<td>28.8</td>
<td>28.3</td>
<td>48.1</td>
<td>8.4</td>
<td>21.0</td>
<td>147.2</td>
</tr>
<tr>
<td>Containers exchanged (TEU) – selected ports*</td>
<td>2012-13</td>
<td>2,126,284</td>
<td>2,512,926</td>
<td>1,069,881</td>
<td>339,061</td>
<td>670,296</td>
<td>N/A</td>
</tr>
<tr>
<td>Domestic freight movement – total (billion tonne-km)</td>
<td>2009-10</td>
<td>94.2</td>
<td>58.0</td>
<td>135.3</td>
<td>33.0</td>
<td>253.8</td>
<td>558.8</td>
</tr>
</tbody>
</table>


Notes: * TEU refers to twenty foot equivalent units and data relates to ports of Sydney, Melbourne, Brisbane, Adelaide and Fremantle respectively. Passenger kilometres travelled is a measure of total passenger travel. It is the number of kilometres travelled by a vehicle multiplied by the number of occupants in the vehicle. Individual trips are aggregated to provide estimates for total passenger kilometres traveled.
Of note:

- Victoria has a comparatively smaller total road length, reflecting the relatively smaller size of Victoria. However, more of Victoria’s roads are used on a regular basis, as reflected in total vehicle kilometres travelled.

- In Melbourne, vehicles travelled almost the same total distance as in Sydney despite a lower population in Melbourne suggesting that the average trip distance is longer in Melbourne than in Sydney, or that there are a greater number of trips by car in Melbourne. A similar picture is shown in passenger kilometres travelled which is almost the same in Melbourne and Sydney.

- Passenger kilometres travelled by public transport (i.e. rail, bus, ferry) is more in line with population size across capital cities, although both Sydney and Melbourne account for a disproportionately high share of the national total. This is likely to reflect a combination of more congested roads as well as the greater availability of public transport options in Melbourne compared with some of the smaller capital cities. Melbourne’s light rail system is heavily patronised, but light rail is not usually a public transport option in other capital cities.

Table 3.3 provides an indication of traffic congestion in Melbourne, in comparison to other major cities around the world according to an analysis of GPS data by TomTom. This suggests that traffic congestion is significant in Melbourne, which consequently results in additional time spent commuting and additional economic costs.

- Infrastructure Australia recently estimated the cost of road congestion in the Melbourne-Geelong conurbation at $2.8 billion in 2011;

- And forecasts these costs to grow to $9.0 billion in 2031, based on projected population growth and distribution, and in the absence of any new network capacity and/or demand management (Infrastructure Australia, 2015).

That said, TomTom data in Table 3.3 suggests Melbourne’s evening rush hour congestion is not quite as bad as other major cities, with worse morning peak hour congestion (with a rank of 48) pushing up Melbourne’s overall ranking. The data suggests that Melbourne’s overall congestion levels are lower than in Sydney and the most congested major cities, and similar to congestion in cities such as Berlin, Liverpool, Munich, Miami and Chicago. This has helped to maintain the economic competitiveness of Melbourne and Victoria, but Melbourne’s overall congestion level is higher than in the large US cities of Boston, Houston, Philadelphia and Dallas-Fort Worth, as well as the other Australian capital cities with the exception of Sydney.
Table 3.3: TomTom Traffic Index – world’s most congested cities in 2014

<table>
<thead>
<tr>
<th>World Rank (based on overall Congestion Level)</th>
<th>City</th>
<th>Overall Congestion Level, per cent</th>
<th>Evening rush hour rank</th>
<th>Evening peak congestion Level, per cent</th>
<th>Delay per year with 30-min commute, in hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Istanbul</td>
<td>58</td>
<td>1</td>
<td>109</td>
<td>125</td>
</tr>
<tr>
<td>2</td>
<td>Mexico City</td>
<td>55</td>
<td>4</td>
<td>89</td>
<td>102</td>
</tr>
<tr>
<td>3</td>
<td>Rio de Janeiro</td>
<td>51</td>
<td>8</td>
<td>81</td>
<td>93</td>
</tr>
<tr>
<td>4</td>
<td>Moscow</td>
<td>50</td>
<td>2</td>
<td>103</td>
<td>118</td>
</tr>
<tr>
<td>5</td>
<td>Salvador</td>
<td>46</td>
<td>15</td>
<td>75</td>
<td>93</td>
</tr>
<tr>
<td>6</td>
<td>Recife</td>
<td>45</td>
<td>6</td>
<td>82</td>
<td>94</td>
</tr>
<tr>
<td>7</td>
<td>Saint Petersburg</td>
<td>44</td>
<td>3</td>
<td>96</td>
<td>110</td>
</tr>
<tr>
<td>8</td>
<td>Bucharest</td>
<td>41</td>
<td>7</td>
<td>82</td>
<td>94</td>
</tr>
<tr>
<td>9</td>
<td>Warsaw</td>
<td>40</td>
<td>13</td>
<td>75</td>
<td>96</td>
</tr>
<tr>
<td>10</td>
<td>Los Angeles</td>
<td>39</td>
<td>10</td>
<td>80</td>
<td>92</td>
</tr>
<tr>
<td>21</td>
<td>Sydney</td>
<td>35</td>
<td>39</td>
<td>64</td>
<td>91</td>
</tr>
<tr>
<td>60</td>
<td>Melbourne</td>
<td>28</td>
<td>81</td>
<td>51</td>
<td>78</td>
</tr>
</tbody>
</table>

Source: TomTom Traffic Index. See www.tomtom.com/trafficindex

Notes: Congestion level is measured as the increase in overall travel times when compared to a Free Flow situation (i.e. travel times during non-congested periods).

According to 2011 Census data, the majority of trips to work in Melbourne are done by car. This is a reflection that employment is dispersed across Melbourne. However, Melbourne – Inner is a major work hub accounting for around 34 per cent of total employment in Greater Melbourne, and the majority of trips to work using public transport in Melbourne are to the CBD and surrounding areas. Despite technology enabling more flexible work arrangements, Melbourne-Inner will continue to be a major work hub, drawing in commuters across Greater Melbourne and further afield. This is illustrated in Table 3.4, which shows the expected change in the net inflow of workers into each region.
While many people already commute from the suburbs of Melbourne into inner Melbourne for work, the number of commuters making this journey is expected to increase relatively fast. This represents a continuation of the trend seen over the past fifteen years, and a reflection of relatively fast growth in the number of people working in inner Melbourne compared to the growth in the number of those workers who are expected to be living in inner Melbourne. It also reflects the rise of the knowledge economy in inner Melbourne. Public transport in Victoria is organised as a hub and spoke network, to facilitate moving people from where they want to live (typically in the suburbs) to where they work (typically the CBD). Melbourne has an extensive bus network that cuts across the city. However, as noted above, the majority of work trips are still made by car. Achieving a better balance will require one or more solutions, which might include:

- Continuing to actively facilitate the move to a polycentric city by encouraging and supporting the development of employment hubs and activity centres;
- Network counter-cyclical flows for transport, networks (roads and public transport), which sees more people living in the CBD, but working in the suburbs, therefore travelling against traditional peak hour traffic.

Victorian governments have made concerted efforts to encourage the long term shift from a monocentric city centre (Melbourne’s CBD) to a polycentric city model, which would see employment hubs around the Melbourne area (such as Box Hill, Broadmeadows and Dandenong). Plan Melbourne and the Refresh Discussion Paper signals the importance of making progress toward a polycentric Melbourne (or a ‘State of Cities’). In practice, this shift is very long term with change occurring gradually. It appears that the agglomeration benefits of the inner city hub have proven too strong.

### Table 3.4: Net inflow of workers into each SA4 region (employment by place of work less employment by place of usual residence)

<table>
<thead>
<tr>
<th>SA4</th>
<th>2015-16</th>
<th>2045-46</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballarat</td>
<td>-5,345</td>
<td>-9,961</td>
<td>-4,616</td>
</tr>
<tr>
<td>Bendigo</td>
<td>-8,292</td>
<td>-13,885</td>
<td>-5,593</td>
</tr>
<tr>
<td>Geelong</td>
<td>-17,149</td>
<td>-30,307</td>
<td>-13,157</td>
</tr>
<tr>
<td>Hume</td>
<td>269</td>
<td>2,745</td>
<td>2,476</td>
</tr>
<tr>
<td>Latrobe – Gippsland</td>
<td>-13,472</td>
<td>-20,122</td>
<td>-6,650</td>
</tr>
<tr>
<td>Melbourne – Inner</td>
<td>394,346</td>
<td>681,899</td>
<td>287,553</td>
</tr>
<tr>
<td>Melbourne – Inner East</td>
<td>-29,346</td>
<td>5,442</td>
<td>34,788</td>
</tr>
<tr>
<td>Melbourne – Inner South</td>
<td>-50,885</td>
<td>-50,866</td>
<td>19</td>
</tr>
<tr>
<td>Melbourne – North East</td>
<td>-92,721</td>
<td>-189,620</td>
<td>-96,899</td>
</tr>
<tr>
<td>Melbourne – North West</td>
<td>-19,371</td>
<td>-57,652</td>
<td>-38,281</td>
</tr>
<tr>
<td>Melbourne – Outer East</td>
<td>-80,516</td>
<td>-86,384</td>
<td>-5,868</td>
</tr>
<tr>
<td>Melbourne – South East</td>
<td>-48,236</td>
<td>-137,773</td>
<td>-89,537</td>
</tr>
<tr>
<td>Melbourne – West</td>
<td>-133,533</td>
<td>-292,603</td>
<td>-159,070</td>
</tr>
<tr>
<td>Mornington Peninsula</td>
<td>-41,847</td>
<td>-50,283</td>
<td>-8,436</td>
</tr>
<tr>
<td>North West</td>
<td>2,729</td>
<td>4,981</td>
<td>2,252</td>
</tr>
<tr>
<td>Shepparton</td>
<td>2,017</td>
<td>6,238</td>
<td>4,221</td>
</tr>
<tr>
<td>Warrnambool and South West</td>
<td>5,122</td>
<td>3,713</td>
<td>-1,409</td>
</tr>
</tbody>
</table>

Source: Deloitte Access Economics
for employers to move in significant numbers to date. However, there are building blocks we can plan for to facilitate this long term shift. As noted above, one of the strengths of Melbourne’s transport systems is that it gets people to where they need to go – which at this time is typically the CBD – but a challenge for promoting the shift to a State of Cities is to provide cross-city multi-modal links to facilitate private sector moving to activity centres and National Employment Clusters, where they will still enjoy the benefits of agglomeration.

- New York is an example of a polycentric model with its downtown areas of Manhattan, Queens and Brooklyn, although it is also has ongoing challenges around congestion and some transit areas being poorly serviced.
- Sydney is making headway in moving to a polycentric model with Parramatta. Part of this success is driven by transport infrastructure.

3.5.1 Infrastructure implications of moving to a State of Cities
The long term shift to a State of Cities (or a polycentric city) can be encouraged by well-planned infrastructure, including an increased network of cross-city multi-modal transport links to move people from where they live to where they work.

3.6 Household incomes have been increasing, but so has the cost of living
Household consumption accounts for the largest share of total expenditure in the Victorian economy at around 62 per cent of state output in 2013-14. That share has risen slightly over the period from 1989-90 to 2013-14, and is expected to be stable over the next thirty years. Over the longer term, there has been a gradual rise in the share of consumption accounted for by services. As household incomes have risen, the proportion of the household budget accounted for by food has gradually fallen, while there has been slightly stronger growth in the consumption of recreation and culture services and transport services over time.

The rise in the share of the household budget accounted for by services has reflected a rise in the price of a range of services relative to goods. This is shown in Chart 3.10 below, which shows that the price of utilities (that is, electricity, gas and water), health services (that is, medical, dental and hospital services), and education services have all recorded above average increases over time. This is also true of a number of other services, such as childcare services. The price of these services is generally where cost of living pressures in Melbourne have been concentrated in recent years.

Chart 3.10: Melbourne Consumer Price Index (CPI) – selected items, 2000 to 2015

Source: ABS (2015), Cat No. 6401, Deloitte Access Economics
In contrast, increases in the prices of a number of other items have been far more subdued and have helped to ease cost of living pressures. While prices of food and petrol have been volatile at times, they have broadly recorded around an average rate of increase over the longer term. Assisted by improvements in technology and the increased importation of cheaper goods from countries in Asia, the prices of goods such as clothes, motor vehicles, appliances and computers have fallen relative to other prices over time. That has also encouraged greater consumption of some of these goods such as electrical and computing equipment.

Overall, the rate of increase in consumer prices in Melbourne has been 2.6 per cent per annum over the past fifteen years. That is close to the Reserve Bank’s inflation target for Australia of between 2 to 3 per cent per annum over the course of the economic cycle.

3.7 Housing affordability is under pressure

One of the more prominent cost of living pressures that is not fully captured in the CPI is the cost of housing. In particular, house prices in Melbourne have recorded very strong rises in recent years. As shown in Chart 3.11, the rise in Melbourne’s house prices has notably outstripped growth in Victoria’s GSP – a broad measure of the State’s income – as well as measures of household income in the State. As Chart 3.12 shows, house prices are higher relative to median incomes in Melbourne than in other Australian cities, with the exception of Sydney.

Chart 3.11: Nominal growth in the Victorian economy and Melbourne house prices, 1989-90 to 2013-14

In turn, concerns around housing affordability have become prominent, and these concerns are particularly acute for those who are not currently home owners such as low income households and younger people.

Over the longer term, unaffordable housing relative to competing cities interstate and overseas may act as a competitive disadvantage for a city such as Melbourne. Knowledge workers can be turned away from a place as much by unaffordable housing as by urban disamenities such as congestion, pollution, noise and loss of privacy and amenity. From an economic perspective, the extent to which the downsides of proximity such as unaffordable housing overwhelm the upsides, particularly the agglomeration benefits of proximity, will be central to whether Melbourne will continue to thrive as an economically prosperous city in the future.

In addition to the economic implications linked to housing affordability, there can be significant social impacts. For example, lack of affordable housing can impact on the stability of living arrangements and health and wellbeing (see chapter 2.4.3).

While there are a number of factors that can influence house prices, as noted recently by Lowe (2013), the transport system is one of those factors. A good transport system can expand the supply of land that is considered to be ‘well-located’ in a city. For example, although there may be localised upward pressure on land values in outer areas near where new infrastructure is built, this can also ease the pressure on land values nearer the city due to the expanded supply of ‘well-located’ land. Since house prices are high largely because land prices are high, some such as Lowe (2013) have argued that underinvestment in transport infrastructure can therefore put upward pressure on housing costs (see also Kulish M, A Richards and C Gillitzer, 2011).
This presents complicated issues around infrastructure provision. On the one hand, good transport links to the outer suburbs where houses are generally cheaper lowers commute costs into the inner city, and thus has the effect of increasing the supply of affordable houses available to knowledge workers who work in the city. On the other hand, a deliberate move towards densification may allow various types of infrastructure to be provided more efficiently to the population but may come at the cost of having fewer options to buy a typical suburban family home. Choices in this area will not be easy ones, but they will be important in shaping the future of Melbourne as a city.

For those who are homeowners – around 70 per cent of all occupied private dwellings in Victoria were owned outright or owned with a mortgage according to the 2011 Census – the rise in property values has helped to increase net wealth. Indeed, across all Victorian households, property accounts for the majority of assets held, with a mean value of property held of $557,400 compared to a mean value of superannuation of $156,700. As shown in Table 3.5, households in Melbourne tend to have higher levels of property holdings, although the difference in net worth is not as large owing to higher levels of liabilities of households in Melbourne and a higher level of other assets such as the value of an own business held by households in regional Victoria.

### Table 3.5: Mean value of assets and liabilities of households in Victoria, 2013-14 ($’000s)

<table>
<thead>
<tr>
<th></th>
<th>Melbourne</th>
<th>Regional Victoria</th>
<th>Victoria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
<td>618.5</td>
<td>381.2</td>
<td>557.4</td>
</tr>
<tr>
<td>Superannuation</td>
<td>167.5</td>
<td>125.6</td>
<td>156.7</td>
</tr>
<tr>
<td>Other assets</td>
<td>242.1</td>
<td>302.1</td>
<td>257.6</td>
</tr>
<tr>
<td><strong>Total assets</strong></td>
<td><strong>1028.1</strong></td>
<td><strong>808.9</strong></td>
<td><strong>971.7</strong></td>
</tr>
<tr>
<td><strong>Total liabilities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net worth</strong></td>
<td><strong>874.2</strong></td>
<td><strong>727.2</strong></td>
<td><strong>836.3</strong></td>
</tr>
</tbody>
</table>

Source: ABS (2015), Cat No. 6523.
The growth in Victoria’s economy has been reflected in growth in household incomes in Victoria. As noted in Chapter 2, growth has been relatively even across the income distribution in Victoria over the past decade, and all income quintiles have experienced significant growth in their disposable income. On average, households have experienced real (i.e. inflation-adjusted) income growth of 2.6 per cent per annum over the decade to 2013-14. Even so, and as discussed in more detail in Chapter 2, there are important issues to consider around equitable access to infrastructure across the income distribution, as well as across the broader population. Accessible infrastructure – such as accessible public transport – can allow lower income and other marginalised groups to better access education and employment opportunities and more fully participate in the economy. This is particularly the case since there is evidence that lower income renter households in Melbourne are increasingly being concentrated in outer urban locations which are cheaper but where access to public transport is poor (Burke and Stone, 2014).

3.7.1 Infrastructure implications for housing
Housing affordability is important to households but so is being in close proximity to jobs. Diminishing housing affordability raises questions around the extent to which infrastructure should facilitate growth on the urban fringe where housing is cheaper, versus densification of existing areas which are close to jobs.

3.8 Victoria has a sound fiscal position
Victoria’s fiscal position is relatively sound – providing scope for the delivery of further public infrastructure, while also meeting public service delivery challenges. Chart 3.13 shows the net operating balance has been in surplus for most of the past 15 years.

Chart 3.13 also shows that over this period Victoria’s net operating balance has been relatively stable compared to New South Wales and Queensland, the other two major State economies. A sound and stable fiscal environment allows for better decision making on longer-term public infrastructure investment and provides confidence to businesses and consumers.

Moreover, while general government net debt to gross state product (GSP) has risen over the past 15 years (Chart 3.14), it is very low by historical and international and domestic comparisons. Chart 3.14 shows Victoria’s new debt to GSP ratio is projected to be around 4 per cent by the end of 2018-19, below that of the Federal Government (16 per cent by the end of 2018-19) and all advanced economies (70 per cent by the end of 2018-19).

The stable and low net debt position of Victoria additionally provides scope for successive Victorian governments’ to directly fund public infrastructure while maintaining sound public finances.

Chart 3.13: Net operating balances, $ million, 2004-5 to 2013-14

ABS (2015), Cat No. 5512. Note: General government net operating balances, ABS GFS basis.
Chart 3.14: Victoria’s comparative general government net debt position, per cent of GDP (GSP), 2001 to 2019

Per cent of GDP (GSP)

Sources: Department of Treasury and Finance, Victoria; International Monetary Fund. Data for 2015 onwards are projections.

Longer term pressures on Victoria’s fiscal position
Although Victoria’s fiscal position is sound, there will be increasing pressure on the Victorian budget over time. Victoria’s fiscal position in the longer-term will depend on demographics (population growth, ageing); the economy (broadly defined to include the local, national and international economic developments); policy decisions regarding expenditure (both recurrent and infrastructure); taxation (the level and mix of State taxes); and the fiscal federalism (GST distributions, potential reforms to funding and delivery of public services between the Federal Government and the States).

Over the longer-term operating revenue tends to grow with the size of the economy (in nominal terms) while operating expenses can be influenced by more direct service delivery cost pressures. This sees the drivers of expenses growing at a faster rate than the drivers of revenue, resulting in pressure on the budget.

This pressure on the budget is evident from Chart 3.15, which shows the growth of major areas of Victorian government expenditure (such as health, education and transport) over the past 15 years has outpaced the growth in Victoria’s population and gross state product. Should these growth trends continue without action by government to reign in their growth and/or move their budgets to a more efficient and sustainable taxation base, the scope for investment in service delivery and infrastructure becomes more problematic. Alternatively, net debt will accelerate, further reducing the flexibility of the government to meet longer term challenges.
In assessing Victoria’s economy and the interrelationship with infrastructure, it is worth considering the trends in infrastructure spending.

Chart 3.16 show infrastructure investment by type by the private sector for the private sector in Victoria. They show the substantial investment in electricity generation, transmission and pipelines which was 29 per cent of the total in 2014-15. In addition, investment in telecommunications infrastructure has grown significantly over the period since the early 1990s. The level of infrastructure investment undertaken by the private sector has been influenced by privatisations over time.

In turn, this means that the private sector is increasingly financing investment in certain types of infrastructure which can reduce the requirement of the public sector to invest in infrastructure, as well as the public sector’s fiscal burden of investing in infrastructure. Another development is the use of public-private partnerships (PPPs) for the delivery of infrastructure projects and the use of unsolicited proposal arrangements.

Given the potential benefits and increasing interest of governments in involving the private sector in infrastructure provision, this trend towards greater involvement of the private sector may continue in the decades ahead.

### Chart 3.15: Growth in general government operating expenses, Victoria, index, 1998-99 to 2013-14

![Chart 3.15: Growth in general government operating expenses, Victoria, index, 1998-99 to 2013-14](chart)

ABS (2015), Cat No. 5512. Note: ABS GFS basis.
Chart 3.16: Engineering construction activity, private sector for private sector, Victoria, 1992-93 to 2013-14

Index, average from 1992-93 to 1999-00 = 100

Source: ABS (2015), Cat No. 5512.

Chart 3.17 shows infrastructure investment by type for the public sector in Victoria. They show the concentration of investment in roads and highways; bridges, railways and harbours; and water storage and supply, sewerage and drainage, which are traditional areas of public sector responsibility. There has been growth over time in recreation and other engineering construction activity for the public sector, although it remains a relatively small share of the total.
3.9.1 Infrastructure planning, governance and pricing

Given the intertwined relationship between an economy and infrastructure, the implications of Victoria’s economy are significant. A bigger economy will require greater infrastructure investment but at the same time a bigger economy generates additional demand for infrastructure. Infrastructure will increasingly need to meet objectives around economic growth and improving living standards, as well as equity objectives.

- Victoria will need to become smarter in funding and maintaining infrastructure, and in efficiently utilising existing infrastructure.
- Successive Victorian governments may need to devote more funding to infrastructure, including leveraging private sector finance through continued use of PPPs.
- Becoming smarter in these areas could potentially encompass:
  - Congestion pricing and more use of price signals (such as smart metering) for vital infrastructure such as roads;
- Consider appropriate pricing of related/substitute infrastructure services such as public transport which is currently subsidised, to enable ongoing funding while at the same time meeting social/equity objectives;
- Unwinding rigidities to land supply utilisation (use, density and standards) such as through more transparent planning laws, including less costly and more timely regulatory processes for approval of land development, better utilisation of user charges for infrastructure on greenfield sites and greater clarity around heritage and other overlays on existing sites; and
- Regulatory reform can also unlock better usage of existing infrastructure (for example, Uber) and use of multi-sectoral long term strategies can reduce complexity and time between planning and implementation.
Chapter 4: Environment
### Ensuring a sustainable and healthy Environment.

#### 2016 → 2046

<table>
<thead>
<tr>
<th>Climate change</th>
<th>... transcends all three streams, with particularly significant impacts on:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agriculture</td>
</tr>
<tr>
<td></td>
<td>Public health</td>
</tr>
<tr>
<td></td>
<td>Has implications for infrastructure directly and through the affect of actions and policies undertaken by households, industry and government to slow its impact.</td>
</tr>
</tbody>
</table>

#### Pressures on biodiversity

- The number of endangered and critically endangered plant and animal species in Victoria has increased over the last decade.

#### Melbourne’s water security improved with significant investment in water infrastructure:

- Desalination
- Inter-catchment pipelines

#### Waste production...

- Victoria’s growing waste generation has increased the pressure on existing waste infrastructure.

#### Melbourne’s air quality has improved

- Air pollution is low by international standards
- Cleaner technology and better regulation has led to improvements in recent years

#### Victoria’s marine and coastal environments

- Supports over 12,000 known species of marine plants and animals.

#### Land degradation has many elements that are all trending now and in the future...

- Dryland salinity is a major concern in agricultural areas. Around 2% of the total area of dryland agriculture is affected by salinity, although the total area varies over time with rainfall.

#### Other land degradation issues are more localised and less is known about the state-wide impact.

---

- Will rise with Victoria’s growing population
- But so too will recycling and reuse
- Major vehicle infrastructure impacts on air quality
- Sealing roads prevents particle pollution
- Development of coastal areas
- Dredging
- Climate change
- Pollution
- Mineral exploration

---

Victoria’s growing waste generation has increased the pressure on existing waste infrastructure.

- Will rise with Victoria’s growing population
- But so too will recycling and reuse
The importance of the environment to Victoria’s economy and society cannot be overstated. The environment supports the quality of life and wellbeing of the population in myriad ways. For example, air and water quality impact on public health and productivity; biodiversity provides us with food and medicine; natural environments provide place for recreation and social connection; and Victoria’s economy benefits from a sustainable supply of natural resources.

As Victorian living standards have improved over time, so too has the focus on sustainable living and preservation of the environment. Initiatives across all levels of government, industry and households are collectively attempting to reduce the carbon footprint of the Victorian economy, recovering a greater share of our growing waste, conserving habitats that support biodiversity and improving air and water quality.

Society also places a strong non-use or option value on the environment. Natural resources that are under threat are often preserved. This is because decisions affecting the environment do not just impact the wellbeing of current generations, they also affect future generations who will one day inherit the natural environment and rely on it for their survival and wellbeing. The fact that some current environmental issues are the result of decisions made generations ago highlights the importance of protecting the environment.

This chapter identifies the key themes and issues for Victoria’s environment today and their infrastructure implications. Across the themes, trends have been identified through the use of indicators. Some issues are improving, while others are worsening with time. For example:

- Conservation of important habitats has reduced the rate at which land is cleared, yet a growing number of Victorian flora and fauna species are facing the threat of extinction;
- Melbourne’s water security has been bolstered by new infrastructure but regional communities are still vulnerable to drought; and
- Air pollution has improved and per capita greenhouse gas emissions have declined as technologies become cleaner, but Victoria is getting warmer and extreme weather events are becoming more regular.

In addressing the infrastructure implications, the questions to be addressed reflect the two-way nature of natural environment and infrastructure:

- How does infrastructure impact on the environment, now and into the future?
- How might the environment affect existing infrastructure and future need?

### 4.1 Climate change is increasing risk and uncertainty for Victoria

Climate change is a global environmental issue with implications that transcend the three streams of this report. It refers to long term changes in the properties of the climate, including mean and variability. Changes can arise from natural interactions of physical processes, such as exchanges of heat between atmosphere and ocean; and from external factors, both natural and anthropogenic (CSIRO and Bureau of Meteorology – BOM, 2015).

Our responses to the effects of climate change can be broadly split into two categories:

- **Adaptation** – the impact a changing climate has on the economy, society, environment, and the implications for infrastructure;
- **Mitigation** – the impact of actions and policies undertaken by households, industry and government to slow the rate of climate change.

Although linked, they will have different implications for Victorian infrastructure.

### 4.1.1 Climate change is a global trend that will affect Victoria

**Climate change trends**

According to the Intergovernmental Panel on Climate Change (IPCC, 2014) warming of the global climate system is unequivocal. Since the 1950’s, many of the observed changes are unprecedented. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished and sea level has risen. More specifically (IPCC, 2014):

- Each of the last three decades has been successively warmer at the earth’s surface than any preceding decade since 1850;
- The Greenland and Antarctic ice sheets lost mass between 1992 and 2011, while glaciers worldwide have shrunk since the 1960s; and
The global average sea level rose at a rate of 3.2 mm per year between 1992 and 2010, a faster rate than the average of 1.8 mm per year observed between 1900 and 2010.

A number of trends and recent anomalies indicate that Victoria’s climate is changing:

- Average temperatures in Victoria have risen by approximately 0.8°C since the 1950s (Victorian State of the Environment Report, 2013), and the state recorded its warmest year on record in 2014 (BOM, 2015).
- The severity, duration and frequency of heatwaves have increased since 1950 (BOM, 2014).
- Since 1993, Victoria’s sea levels have risen at an average 3mm per year, similar to the global average, while sea-surface temperatures in South Eastern Australia have increased at a rate of 0.023°C per year, well above the global ocean warming average (Victorian State of the Environment Report, 2013).
- Wet-season rainfall in Victoria (April to November) since 1996 has ranged from below average to driest on record across most of Victoria (BOM, 2014).

**Climate change projections**

Globally, surface temperature is projected to rise by 2100 under all emission scenarios assessed by the IPCC. According to projections, heatwaves will occur more often and last longer, and extreme rainfall events will become more intense and frequent in many regions. The ocean will continue to warm and acidify and the global mean sea level will rise (IPCC, 2014).

Projections from the CSIRO and BOM (2015) for Victoria mirror those of the IPCC. They examine the impact that atmospheric carbon dioxide will have on the Australian climate out to 2100, based on the same alternative greenhouse gas emissions scenarios: a strong emissions reduction (low), a slow emissions reduction (medium) and an emissions increase (high).

For Victoria, the key changes are summarised in detail below and in Table 4.1 and Table 4.2.

- Mean, daily minimum and daily maximum temperatures are forecast to increase throughout this century for southern Australia – with very high confidence;
- Winter and Spring rainfall in southern Australia is projected to continue to decrease – with high confidence;
- Time in drought is projected to increase in southern Australia, in line with the projected decline in average rainfall – with high confidence;
- The intensity of extreme rainfall events (wettest day of the year and wettest day in 20 years) are projected to increase in southern Australia – with high confidence;
- The number of days per year with severe fire danger is projected to increase in southern Australia – with high confidence;
- Snowfall in Victoria is projected to decrease significantly (when compared to natural variability) – with very high confidence; and
- Sea levels for the Australian coastline are projected to rise at a faster rate in the 21st century than they have over the past four decades – with high confidence.

While reductions in global greenhouse gas emissions may constrain global warming, these projections indicate that some degree of warming (and its associated changes) appears to be inevitable in Victoria, meaning future adaptation is required.
### Table 4.1: Summary of key changes to Victorian climate

<table>
<thead>
<tr>
<th>Description</th>
<th>2030</th>
<th>2090</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Average temperature – southern Australia(^a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average increase (in °C)</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Extreme heat days(^b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days p.a. reaching 35°C (Melbourne)</td>
<td>+2</td>
<td>+3</td>
</tr>
<tr>
<td>Days p.a. reaching 35°C (Mildura)</td>
<td>+9</td>
<td>+11</td>
</tr>
<tr>
<td>Days p.a. reaching 40°C (Melbourne)</td>
<td>+0.8</td>
<td>+1.1</td>
</tr>
<tr>
<td>Days p.a. reaching 40°C (Mildura)</td>
<td>+3</td>
<td>+4</td>
</tr>
<tr>
<td>Rainfall: southern Australia(^a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual change (in mm)</td>
<td>-4</td>
<td>-3</td>
</tr>
<tr>
<td>December – February change</td>
<td>-1</td>
<td>-5</td>
</tr>
<tr>
<td>March – May change</td>
<td>-1</td>
<td>-5</td>
</tr>
<tr>
<td>June – August change</td>
<td>-4</td>
<td>-3</td>
</tr>
<tr>
<td>September – November change</td>
<td>-4</td>
<td>-5</td>
</tr>
<tr>
<td>Sea level – Geelong(^a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise in sea level (in metres)</td>
<td>0.11</td>
<td>0.37</td>
</tr>
</tbody>
</table>


### Table 4.2: Average annual maximum snow depth, historical and projected (cm)

<table>
<thead>
<tr>
<th>Site</th>
<th>1980-1989</th>
<th>2040-2059</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Falls Creek</td>
<td>150</td>
<td>50-105</td>
</tr>
<tr>
<td>Mt Hotham</td>
<td>130</td>
<td>40-95</td>
</tr>
<tr>
<td>Mt Buller</td>
<td>95</td>
<td>20-60</td>
</tr>
<tr>
<td>Mt Buffalo</td>
<td>60</td>
<td>10-30</td>
</tr>
</tbody>
</table>

Source: Bureau of Meteorology and CSIRO (2015)
Impacts of climate change

Climate change will affect countries and regions in different ways and to different degrees. At its most extreme, climate change will render some areas uninhabitable. For example, rising sea levels could partially or fully inundate some small island states, salinizing the water table and requiring evacuation and resettlement of its citizens (IPCC, 2007). In other parts of the world, vast areas of currently fertile land may turn into desert, unable to support plant or animal life (Berkeley Energy and Resources Collaborative, 2013).

Current projections indicate that climate change will not make Australia, or Victoria, uninhabitable, particularly not in the next 30 years. Climate change is, however, expected to impact on Australia’s society, economy and environment.

The Garnaut Climate Change Review (2008) outlined five direct impacts that climate change will have on Australia, which are summarised below:

**Agriculture:** Variations in climate, whether natural or anthropogenic, have significant impacts on the profitability of the agricultural sector.

Crop and livestock producers rely heavily on water for plant growth and for animal health. The projected reduction in rainfall during winter and spring is expected to have a negative impact on the industry, given the importance of these rainfall periods for both crop and livestock production. Increased carbon dioxide in the atmosphere will increase the rate of photosynthesis in some plants and improve growth to 2030; however, reduced rainfall is expected to have a larger, negative impact over the longer term. Agricultural industries may become unviable in some regions resulting in redundant infrastructure, such as the road and rail that connects these areas.

**Tourism:** A number of Victoria’s natural landscapes that are important to the tourism industry are under threat from climate change including marine parks, national parks, winery regions and alpine regions.

Victoria’s alpine region is particularly sensitive to climate change, given its reliance on snow for tourist activities. Natural snow conditions have declined slowly over recent decades, causing greater reliance on artificial snow making. Under the scenarios listed in Table 4.2, the average snow season will contract in length significantly, causing a reduction in tourism income for businesses that operate in these areas.

**Infrastructure:** Climate change is expected to hasten the degradation of existing infrastructure through increased extreme weather events.

Reduced rainfall is expected to have a large impact on the water infrastructure required to service large cities and regional centres. Major infrastructure in coastal communities, such as ports, may become inundated by flooding as sea levels continue to rise. Extreme heat events will cause train tracks to buckle and cause other structures to degrade, while increased frequency and intensity of bushfires will affect the operation of airports, water quality, above ground electrical infrastructure and communication towers.

**Human health:** Changes to Victoria’s climate are expected to have a range of impacts on the overall health of the population.

Some impacts will be direct, such as the deaths and injury caused by serious weather events such as bushfires, floods and heatwaves. Others will be indirect; bushfires can impact on air quality, while floods can affect water quality. Climate change could diminish food production, leading to higher food prices and having nutritional consequences that are worse for lower-income households.
Biodiversity: Compounding the impact that human activity has already had on Victoria’s biodiversity and ecosystems, climate change may worsen existing problems and worsen the threat of extinction for some native plant and animal species.

Ultimately, climate change is expected to favour weed and pest species, particularly introduced species, which generally adapt to suit their environments. High altitude species are under greater threat of extinction from climate change, given that some species are already reaching their range limits in terms of altitude, while more frequent bushfires will threaten protected habitats.

How will these impacts across regions in Victoria?
The impacts of climate change will affect different parts of Victoria in different ways. The Victorian Government’s Climate-Ready Victoria publications (2015) analyses how regions will be impacted in different ways. While noting that the five direct impacts identified above will impact all of Victoria, some particular region-specific issues are identified below.

**Figure 4.1: Broad regions of Victoria**

In the Loddon-Mallee region, dryland agriculture (cropping and livestock) and irrigated production are prominent. Conditions are expected to become warmer and drier over the next 30 years. In northern parts of the region, the climate may resemble that of south-west New South Wales which is more suited to livestock over grain production. The region has rail and grain storage infrastructure which may become underutilised or stranded in marginal areas if dryland cropping becomes unviable. Similarly, irrigation infrastructure may become stranded if the supply of water for agriculture becomes too unreliable.

The Barwon South West region has a long stretch of coastline and is home to significant infrastructure around coastal communities, as well as two of Melbourne’s bulk ports. This infrastructure could come under threat from rising sea levels and more frequent and severe extreme weather events. Roads in the region may need to be relocated or protected by new infrastructure, such as sea walls.

The Grampians region is home to a number of threatened flora and fauna species, including the Wimmera Bottlebrush, the Smoky Mouse and the Red-Tailed Black Cockatoo. The pressure on these species will increase by the impacts of climate change, such as increased temperatures, lower water availability and higher bushfire threats.

The Gippsland region contains some of Victoria’s significant natural heritage, including snow fields, wilderness areas, rainforests, beaches and wetlands. These provide benefits to tourism, recreation and biodiversity. These areas of natural significance could come under threat from decreased water availability, reduced snowfall and higher sea levels.
The Hume region is home to Victoria’s major ski resorts, Mount Buller, Mount Hotham and Falls Creek. One study (Bhend et al., 2012) estimated that by 2050, the average snow season will be 30-80 days shorter than the 1980 to 1999 average if global greenhouse gas emissions remain high. This could significantly impact on employment and tourism expenditure for the region, which is estimated to exceed $1.3 billion.

Regional areas (and for some of Melbourne’s peri-urban communities) will also be effected by increased heatwaves and fire weather, which are expected to increase threats to public health over the next 30 years and place additional stress on health and emergency services. The urban heat island in Metropolitan Melbourne will also compound heat stress during heatwaves. Local councils are developing green infrastructure, such as green spaces and cool zones, to help their local residents cope on extreme heat days.

4.1.2 Reducing greenhouse gas emissions is a climate change mitigation strategy with global momentum

In recent years, climate change mitigation has emerged as a key policy issue internationally. The share of global electricity generated from clean and renewable sources increased from 19 per cent to 23 per cent between 2009 and 2014. Over the same period, renewable energy jobs have more than doubled to 7.7 million, while investment in clean and renewable energy projects has increased by around 50 per cent. (Climate Council of Australia, 2015).

The shift in attitude is evident across the world’s major economies. Over the last ten years, the EU implemented an emissions trading scheme and became a leader in climate change policy. The world’s two largest emitters, China and the US, are also the world’s largest producers of renewable energy – they had the highest level of investment in clean energy in 2014. Brazil and India, also major emitters, have pledged to generate 40 per cent and 45 per cent of their energy from renewable source respectively by 2030 (Climate Council of Australia, 2015).

A formal agreement between UNFCCC parties was reached at the 2015 Paris Climate Conference to keep the global temperature “well below” two degrees higher than pre-industrial times and to pursue efforts to limit the increase to 1.5 degrees (UNFCCC, 2015).

In Australia, policies and initiatives to reduce carbon emissions and transition towards renewable energy sources have evolved in recent years. At the federal level, a carbon tax became effective in 2012 but was repealed in 2014. Current policies reflect a preference for incentivising businesses to reduce or offset emissions and encouraging households to switch to renewable energy, rather than a broader incentive scheme such as pricing or capping carbon emissions.

There are some mitigation actions that have positive spill overs that go beyond the environmental impact, including energy efficiency programs which save consumers money in the long run. Greenhouse gas emissions can also be lowered in other ways, some of which have benefits to society and the economy. An example of this is through urban renewal. Well-planned densification that encourages cycling and reduces car dependence can reduce work travel distances and times. In turn, this can lead to a lower carbon footprint and improved productivity, as well as improving access to opportunity and reducing stress. See chapter 2 for further discussion.

Trends in Victoria’s greenhouse gas emissions

The key Victorian trends in terms of greenhouse gas emissions are:

• Total greenhouse gas emissions increased between 1990 and 2013; however this trend has slowed since the mid-2000s (Department of the Environment, 2015).

• Per capita greenhouse-gas emissions decreased from 24 tonnes to 21 tonnes per year between 1990 and 2013; however Victorians are still amongst the world’s largest emitters on a per capita basis (Victorian State of the Environment, 2013).

• The energy and transport sectors account for the largest shares of total greenhouse gas emissions (Victorian State of the Environment, 2013).
Renewable energy
Switching to renewable sources of energy is seen as the key to reducing greenhouse gas emission and mitigating climate change. The Federal, Victorian and even Local Governments have outlined their future targets for renewable energy:

- **Federal** – the target is for renewable sources to generate 23.5 per cent of Australia’s electricity by 2020. In 2014, the actual share of total electricity was 13.5 per cent, down from 14.8 per cent the year before (Clean Energy Council, 2015).

- **State** – the target is for renewable sources to generate 20 per cent of Victoria’s electricity by 2020. The 2020 target is under review and the 2025 target is to be set based on consultations and feedback from the Victorian Government’s Renewable Energy Roadmap (2015). In 2014, the actual share was around 12 per cent, with around 84 per cent of electricity generated from brown coal power plants in the Latrobe Valley and 4 per cent generated from gas.

- **Local** – the City of Melbourne’s target is to source one-quarter of the city’s electricity from renewable energy by 2018, and to achieve zero net greenhouse gas emissions by 2020 (The Age, 2015).

Technology is revolutionising electricity generation and storage for households. ‘Distributed power’, supplied through micro-generators (solar, wind-powered or gas-fired) and paired with in-home storage in batteries, has the potential to reduce the need for centralised power generation and distribution (poles and wires). In-home storage, which is expected to become cheaper and more commonplace in Australia, will smooth the variable supply of renewable energy forms and reduce the burden on the electricity grid by smoothing demand between peak and non-peak times (Clean Energy Council, 2015).

Solar panels in homes and small businesses have already caused a shift in energy. The number of houses and businesses that have installed small-scale solar panels in Victoria has grown significantly in a relatively short period of time. Since 2006, there have been almost a quarter of a million solar power systems installed in Victoria alone (Chart 4.2).
The strong initial uptake of solar panel systems was largely driven by generous tariffs for electricity fed back into the grid. Tariffs of up to 60 cents per kWh were offered between 2009 and 2011, but in recent years tariffs have been reduced. However, the price of solar panels is expected to continue to fall in future which will shorten the period required to pay back the installations and continue to drive greater uptake (Deloitte, 2014).

Large-scale renewable energy sources in Victoria are expected to play a prominent role in mitigating climate change. The current sources of Victoria’s renewable energy are:

- **Wind power**, which uses airflow to generate electricity through large wind turbines. Wind was Victoria’s largest renewable energy source in 2014, accounting for 5 per cent of total electricity. The share of power generated by wind is expected to grow over the next 50 years, both in Victoria and globally (DEDJTR 2015a, Origin Energy, 2015).

- **Hydro power**, which converts flowing water into electricity, often using dam infrastructure. Hydroelectricity accounted for 3 per cent of electricity generated in Victoria in 2014, and varies annually with water availability. Victoria’s hydroelectric potential is significantly developed, leaving limited potential for future growth (DEDJTR, 2015a).

- **Bioenergy**, which utilises wood and wood waste from the pulp and paper industry. The bioenergy sector is expected to expand in the coming decades. Bioenergy accounted for 2 per cent of electricity generated in Victoria in 2014.

- **Solar power**, which is at an earlier stage of development than other large-scale renewable energy generation technologies. Large-scale solar accounted for 2 per cent of electricity generated in Victoria in 2014, but this share is expected to grow in future (DEDJTR, 2015a).

There has yet to be major investment in large-scale marine power generation in Victoria, and it is unlikely to contribute significantly to energy generation in the short to medium term. Similarly, geothermal power is still in the early exploration stage in Victoria, and is not expected to contribute significantly to Victoria’s electricity supply in the near future (DEDJTR, 2015b).

Supporting new large-scale energy sources will require infrastructure to adapt with it. New infrastructure will be required to connect large-scale renewable projects to the electricity grid.

Decarbonising electricity generation could also pave the way for reducing the carbon footprint of vehicles as electricity replaces petrol and gas. New forms of infrastructure might be required to allow vehicles to recharge, while more innovative forms of transport infrastructure could also generate electricity. For instance, solar bike paths and roads are being trialled in the Netherlands, with a view to developing solar roads which can wirelessly charge electric cars as they drive, although this technology is not expected to be a cost-effective option for at least another five years (ABC News, 2014).
Carbon sequestration and storage
Revegetation of native bushland can mitigate climate change carbon by absorbing (sequestering) carbon and reducing the amount in the atmosphere. In recent years, farmers have been incentivised to revegetate land through native habitat funding through the emissions reduction fund. Revegetation also has flow on effects. By restoring native habitats for carbon sequestration, extinction risk can reduce for endangered biodiversity while land use problems such as salinity and erosion can also be negated.

Another way of mitigating greenhouse gas emissions involves capturing carbon that is released by major emitters, compressing it and storing it underground. In Victoria, feasibility studies are currently underway to explore the potential for capture and storage in offshore storage sites near Gippsland. The project would require significant new infrastructure in the Latrobe Valley before becoming operational.

4.1.3 Infrastructure can play a role in mitigating climate change, and climate change impacts infrastructure
Climate change and its associated impacts are expected to directly affect all classes of infrastructure across Victoria (and globally) in one way or another. In a report for Infrastructure Australia, GHD (2015) outlined a number of ways in which climate change will impact on infrastructure, including:

• Increased maintenance requirements across all classes of infrastructure resulting from increased extreme weather events and rising temperatures;
• Greater need to diversify and increase water supply options to build supply reliance against drought through constructing rainfall independent water sources;
• Greater need to upgrade power lines to increase the safety, reliability and resilience of the network during bushfires;
• Freight and logistics networks will need to adapt to accommodate changes in agricultural patterns across the state; and
• Increased maintenance and replacement of all classes of infrastructure in coastal areas which are vulnerable to sea level increases.

The risks that climate change poses to individual assets and sectors should not be considered in isolation. Infrastructure networks are often interconnected, meaning that failure in one infrastructure sector can result in the shutdown of other infrastructure.

For example, failure of the power grid could result in the shutdown of the transport and telecommunications networks (The Climate Institute, 2012).

There is a high degree of uncertainty surrounding the timing and extent of these implications for Victoria, resulting from the imprecise nature of climate change projections. It is difficult to predict with certainty future global greenhouse gas emissions. Even if future global emissions were known, modelling climate impacts also has a degree of uncertainty, particularly over longer projection periods.

Navigating this uncertainty adds complexity to the task of infrastructure planning. Using the impact of sea level increases on transport infrastructure as an example, the mean sea level is projected to rise by 26-55 cm for a low emissions scenario and 45-82 cm for a high emissions scenario by 2100. Furthermore, changes to the Antarctic ice sheet could increase projections by several tenths of a meter (BOM and CSIRO, 2015). Victoria has over 3000 kilometres of road and 100 kilometres of rail and tramway at risk from a 1.1 meter increase in sea level rise (Australian Government, 2011). The uncertain future sea level adds a dimension of complexity to any decision regarding this at-risk transport infrastructure, which could be redundant (in its current form) by the end of the century.

Infrastructure is also expected to play a significant role in facilitating initiatives that mitigate climate change, primarily through reducing greenhouse gas emissions. For example, new infrastructure will be required to build and connect large-scale projects to the electricity grid, such as solar power in the State’s north, or geothermal power in the west. Distributed energy storage infrastructure will also be important for facilitating the penetration of intermittent energy sources, such as wind and solar (AECOM, 2015). On the other hand, other infrastructure assets may become stranded in a decarbonised economy, such as those used by extractive industries (OECD, 2015).

At the household and small business level, off-grid power generation (such as rooftop solar panels) coupled with batteries is expected to reduce the burden on the electricity network. There is also potential for greenhouse gas mitigation at the household level by improving the efficiency of Victoria’s existing stock of houses and buildings, many of which were built prior to the introduction of energy efficiency regulations (Sustainability Victoria, 2014).
Improving the resilience of infrastructure to cope with short term crises

Long term infrastructure planning must look at ways to embed resilience into our infrastructure. Planning for “average” is no longer an adequate approach to infrastructure planning— to make communities safer in a world that is changing at an increasing pace, planning must include consideration of pre-disaster investment.

The past decade has seen a number of significant natural disasters around Australia including the Black Saturday bushfires in Victoria, Cyclone Yasi in Northern Queensland, and widespread flooding across Queensland, Victoria, Tasmania and NSW, claiming hundreds of lives, and directly affected hundreds of thousands of people. Recognising that governments acting alone cannot address these challenges, a number of businesses and the Australian Red Cross formed the Australian Business Roundtable on Disaster Resilience and Safer Communities to support the development of a more sustainable, coordinated national approach to making communities more resilient and Australian people safer (Deloitte, 2013a).

In 2012 alone, the total economic cost of natural disasters in Australia is estimated to have exceeded $6 billion. Further, these costs are expected to double by 2030 and to rise to an average of $23 billion per year by 2050, reflecting population growth, concentrated infrastructure density and the effect of internal migration to particularly vulnerable regions. These projections did not consider the potential impact of climate change (Deloitte, 2013a).

Research by Deloitte demonstrates that the budgetary impact of responding to and recovering from natural disasters could potentially be significantly reduced through carefully considered and directed investment in pre-disaster resilience.

For example, an annual program of Australian Government expenditure on pre-disaster resilience of $250 million at the national level has the potential to generate budget savings of $12.2 billion for all levels of government (including $9.8 billion for the Australian Government) and would reduce natural disaster costs by more than 50 per cent by 2050. These estimates will only increase as extreme weather events that become more frequent due to the effects of climate change.

Natural disasters physically effect infrastructure (either by destroying or damaging it), resulting in denial of (or reduced) access for people, businesses and government. There are many other different potential triggers of crisis events that can result in limited access to infrastructure, such as:

- Deliberate cyber attacks or sabotage threatening ICT infrastructure;
- Terrorist attacks potentially seeing large areas physically cordoned off;
- Trigger events for financial crisis can result in denied access to liquidity delaying significant investment in infrastructure, or planned investments being abandoned; and
- Pandemics can put significant pressure on health infrastructure, while potentially denying business access to its labour force. People may be denied access to public transport and spaces, as they may choose not to travel into central business districts.
So what does embedding resilience look like?

Planning for short term crisis can assist with better responses, or averting the effects of crisis altogether. Building resilience into our infrastructure can also help to minimise the effect of crisis on infrastructure, people, business and government.

Having sufficient latent capacity in emergency services to cope with short term crises is an important first step, but there are also many examples of building resilience into infrastructure. A couple of examples are provided below:

- **More frequent bushfires**
  Transmission line bushfire risk reduction through targeted “undergrounding” and network redundancy to allow de-energising lines during high hazard periods.

- **Terror attack**
  An incident inside the City Loop would have enormous implications for Melbourne’s train network – planning around getting trains in and out of CBD without using the loop could assist.

- **Pandemic**
  Having suitable ICT infrastructure in place to allow people to work remotely as required to minimise disruption.

- **Global financial crisis**
  Having a pipeline of shovel-ready projects for stimulus.
4.2 Conflicting land uses impact on the environment

The majority of Victorian land serves one of three purposes: to produce food and fibre, to support urban communities and to conserve natural resources (Table 4.3).

Table 4.3: Victorian land use summary as at 2012

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Million hectares</th>
<th>per cent share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parks and Reserves</td>
<td>3.98</td>
<td>18</td>
</tr>
<tr>
<td>State forests</td>
<td>3.14</td>
<td>14</td>
</tr>
<tr>
<td>Marine and coastal parks and reserves</td>
<td>0.87*</td>
<td>0.3</td>
</tr>
<tr>
<td>Other public land</td>
<td>1.10</td>
<td>5</td>
</tr>
<tr>
<td>Private</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dryland cropping and grazing</td>
<td>11.50</td>
<td>51</td>
</tr>
<tr>
<td>Irrigated agriculture &amp; horticulture</td>
<td>1.04</td>
<td>5</td>
</tr>
<tr>
<td>Urban areas</td>
<td>1.13</td>
<td>5</td>
</tr>
<tr>
<td>Plantation forest</td>
<td>0.52</td>
<td>2.3</td>
</tr>
<tr>
<td>Total</td>
<td>22.70</td>
<td></td>
</tr>
</tbody>
</table>

Source: Victorian Department of the Environment and Primary Industries. * Area includes land and sea floor

Conserving the natural environment

Conservation of parks and forests is important for achieving a number of environmental objectives that are covered throughout this chapter, such as preserving biodiversity, preventing land degradation, absorbing atmospheric carbon and improving water and air quality. Along with these, it is also important for the amenity that the natural environment provides for Victoria’s population.

Victoria’s parks and reserves cover around 4 million hectares of land, which equates to 18 per cent of the State. State forests cover 3.1 million hectares of land, and have less stringent rules in place regarding recreation activity.

Recent trends suggest that the value placed by the community on Victoria’s natural environment is increasing. Between 2008 and 2013, the area covered by parks and reserves increased, with a corresponding decrease in the area of state forest, while the area of private land under conservation agreements also increased (State of the Environment, 2013). Within Melbourne, green wedges have been established to prevent urban areas from encroaching on the city’s limited natural resources (Victorian Government, 2015).

Producing food and fibre

Around 51 per cent of land in Victoria is used for dryland agricultural production, with a further five per cent of land used for irrigated agriculture and horticulture. The primary irrigated agriculture regions of Victoria are in the north of the State, where water is irrigated from a series of rivers that are connected to the Murray Darling Basin. Plantation forests cover around 2 per cent of the State.

The large area of land dedicated to agricultural production is the result of significant land clearing that occurred over the 19th and 20th centuries, but slowed significantly in recent decades. The capacity to expand further in recent years has been constrained by urbanisation pressures and conservation of public land (VEAC, 2011).

Despite this, land uses on existing agricultural land change as a result of factors such as water availability, changes in the climate and commodity prices. Between 2008 and 2013, the area covered by irrigated agriculture increased, with a corresponding decrease in dryland agriculture, which partly reflects the increase in water availability (State of the Environment, 2013).
Urban areas

Urban areas in Victoria have consistently increased since settlement. Metropolitan Melbourne is the largest urban area, covering around 1 per cent of Victoria and home to around three-quarters of the population. Population growth has driven development in peri-urban areas in Melbourne and regional centres, as well as in coastal areas.

Melbourne is an expanding city, with growth areas around its fringe. An urban growth boundary has been established around Melbourne, designed to constrain urban sprawl and prevent land speculation in peri-urban areas (Victorian Government, 2015).

Future land use trends

Conflicts between these three land uses are at the heart of many environmental issues facing the state, and they are only expected to worsen. Many of the trends that have driven changes in land use over time are expected to continue:

- Population growth: Urban communities will need to continue growing to support Victoria’s growing population, and is expected to result in increased urbanisation of land around Melbourne and other regional centres
- Agricultural profitability: The profitability of agricultural industries will continue to drive changes in land use over time. Profitability will be impacted by global trends. Globally, demand for Australian produce from Asian markets will continue to rise with incomes, while climate change and its associated impacts could drive down productivity of crop and livestock production
- Societal attitudes towards conservation: The importance that society places on preserving biodiversity in future will impact on decisions about the conservation of parks, forests and reserves.

4.2.1 Salinity and other issues arise from land clearing

There are number of issues affecting the quality of land across Victoria, including eutrophication (where run-off of land-based nutrients degrade the quality of waterways and habitats), acidification, erosion, topsoil loss and the spread of noxious weeds. While some of these issues are quite localised, they can generally be linked back to some extent to the clearing of native vegetation, either in adjoining or distant areas.

An issue that is widespread across parts of Victoria is salinity, which is the presence of salt in soil brought about by rising water tables. While some saline areas of Victoria are naturally occurring, the majority have been caused by land clearing (dryland salinity) or excess irrigation (wetland salinity).

Dryland salinity is caused by land clearing – water that was previously absorbed by plants can now rise through the soil, bringing salt deposits with it. It affects around 2 per cent of the total area used for dryland agriculture in Victoria. The most affected areas are in the north and west of the State, thought to be because of the flatness of the land and the relatively greater land conversion that has occurred there. Areas affected by salinity change as variations in rainfall cause groundwater levels to fluctuate.
4.2.2 The implications for land degradation on infrastructure are two-way

Land degradation issues can impact on existing infrastructure. An example of this is the impact of salinity on existing infrastructure. Salt crystals form on buildings, roads and pipes, causing corrosion shortening the life of the structure.

Infrastructure can also be built to manage land degradation issues. Salt interception schemes divert groundwater and drainage water away from river systems and into distant salt management basins. There are a number of salt interception schemes to prevent the salinization of the Murray River in North-West Victoria. Improving irrigation infrastructure and building dams to prevent surface water runoff can also prevent wetland salinity. (Murray Darling Basin Authority, 2015). Salinity-monitoring infrastructure is also important for managing the issue.

4.3 Pressures on biodiversity are endangering native fauna and flora species

Biodiversity in Victoria is under threat from a range of natural and human behaviours. Historically, land clearing was the main threat, resulting in the loss of habitat and the decline in many species. However, clearing of native vegetation in Victoria has subsided over time (Victorian Environmental Assessment Council, 2011). As a society, our understanding of the natural environment has improved with research and education, and policy decisions with respect to preservation of biodiversity are better informed.
Preservation of native species is important not only for the species themselves, but also for the health of current and future generations. Biological diversity is important for sustaining human health in a number of ways. Many of the products that allow humans to survive and thrive such as crops, domesticated animals, pharmaceuticals, chemicals, building materials and fuels come from plant and animal species (DSEWPaC, 2011).

Australia is one of seventeen countries that have been described as ‘megadiverse’. This group of countries supports over 70 per cent of the biological diversity on earth, despite covering less than 10 per cent of its land mass.

Despite this, there is a growing number of species that are considered under the threat of extinction. The conservation status has worsened for a number of plant and animal species during the last decade, as illustrated in Table 4.4.

Table 4.4: Summary of threatened species, Victoria

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of species</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertebrate fauna</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extinct</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Extinct in Victoria</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Extinct from the wild</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Critically endangered</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>Endangered</td>
<td>51</td>
<td>58</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>71</td>
<td>84</td>
</tr>
<tr>
<td>Threatened</td>
<td>66</td>
<td>63</td>
</tr>
<tr>
<td>Poorly known</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>268</strong></td>
<td><strong>293</strong></td>
</tr>
</tbody>
</table>

Plants

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of species</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presumed Extinct in Victoria</td>
<td>49</td>
<td>41</td>
</tr>
<tr>
<td>Endangered in Victoria</td>
<td>270</td>
<td>350</td>
</tr>
<tr>
<td>Vulnerable in Victoria</td>
<td>475</td>
<td>498</td>
</tr>
<tr>
<td>Rare in Victoria</td>
<td>804</td>
<td>822</td>
</tr>
<tr>
<td>Poorly known</td>
<td>228</td>
<td>232</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2007</strong></td>
<td><strong>2013</strong></td>
</tr>
</tbody>
</table>

Source: Department of Environment and Primary Industries (2013, 2014). Note that the decrease in the number of plants presumed extinct in Victoria reflects the discovery of species thought to be extinct.
One initiative to assist in preventing loss of biodiversity has been the conservation and preservation of parks and forests. The policy framework around clearing of remnant vegetation has also strengthened since the introduction of conservation laws in the 1990s and early 2000s. Under current laws, any clearing of native vegetation in Victoria cannot create a net loss in terms of the overall contribution made to biodiversity. This law requires that any application to remove vegetation includes an assessment of the loss of habitat, an assessment of the habitat importance and a strategy to offset the loss of habitat (Department of Environment and Primary Industries, 2013).

As these policies surrounding land clearing have strengthened, the focus has shifted to new and different threats to Victoria’s plant and animal species, such as:

- Climate change may worsen existing problems and worsen the threat of extinction for some native plant and animal species;
- Introduced invasive species are the number one cause of animal extinctions in Australia, and pose a significant threat to rivers, wetlands and threatened ecosystems (DELWP, 2015). Management programs are in place for a range of introduced species in Victoria, such as horses, cats, dogs, foxes and rabbits;
- Logging has contributed to the critical endangerment of species such as the Leadbeater’s Possum, whose habitat has also been affected by bushfires (ABC, 2015a); and
- Pollution of water from household waste, litter, sewerage, industrial and agricultural activity also impact on the health of animal and plant species.

4.3.1 Well planned infrastructure can help to preserve biodiversity

Preserving biodiversity and the need for infrastructure planning are often characterised by trade-offs, as achieving one objective comes at the expense of the other. The environmental impacts of infrastructure projects are assessed prior to commencing construction and can result in the relocation or cancellation of the project.

Land clearing also causes fragmentation of habitat, which threatens species. Wildlife corridors, such as those described above, are important for building resilience against climate change. Species will require greater mobility to migrate to different habitats, but the environments which connect them can restrict movement (DSEWPaC, 2012).

To this issue, infrastructure can act as either the problem or the solution. An example that highlights this was the fragmentation of habitat caused by land clearing for roads and ski resorts in Victoria’s Alpine region, which affected the habitat of the mountain pygmy possum. It was discovered that the females inhabited higher, colder places than the males, and that paths between the males and the females were becoming blocked. To rectify this, tunnels and corridors were constructed to allow possums to leave and find new habitats, which significantly improved the species’ survival (Parker, 2000).

Similarly, infrastructure can impact, either positively or negatively, on the quality of water which supports marine and coastal habitats. Victoria’s water treatment plants play a critical role in ensuring that the waste water generated by communities does not adversely affect the State’s river systems or marine parks. An ancillary benefit of one such water treatment facility in Werribee is the habitat that it provides for native birds. Not by design, it is now an internationally recognised wetland for a number of endangered migratory bird species.

4.4 Marine and coastal environments are protected but under pressure

Victoria’s marine environment covers approximately 1 million hectares, extending around 5.5 kilometres out to sea from the State’s 2,000 kilometres of south-facing coastline. This environment supports over 12,000 known species of marine plants and animals (DELWP, 2015). There are 30 marine protected areas that protect environmental, historical or cultural features, which make up 11.7 per cent of the Victorian marine environment. There are two broad categories of marine protected area in Victoria:

- **Marine national parks and marine sanctuaries:** Victoria’s marine national parks were established in 2002 to protect and preserve marine biodiversity. Swimming, diving and boating in these areas are allowed, but fishing, oil and gas extraction and waste discharge are not. Marine sanctuaries were established to protect natural features, such as rock formations. Restrictions in marine sanctuaries are the same as those in national parks, but pipelines and seafloor cables are also prohibited. Victoria has 11 marine national parks and 13 marine sanctuaries.
• Marine and coastal parks, marine parks and reserves: Victoria’s marine and coastal parks, marine parks and reserves were established between 1984 and 1986 to conserve or sustainably manage marine biodiversity. Protections in these parks and reserves are less strict than those of national parks and sanctuaries: recreational fishing and limited commercial fishing is allowed.

• Climate change is an issue that is expected to impact on marine environments worldwide. Acidification, warming and deoxygenation will collectively all affect the breeding cycles, abundance, distribution and migrations of marine plants and animals (Brierley, 2009).

4.4.1 Port infrastructure comes at a cost to marine and coastal environments
Port infrastructure impacts on the marine and coastal environment. Dredging is often required to allow large ships to access ports. Port Phillip Bay was dredged in 2008 to improve access of super-sized shipping containers to the Port of Melbourne. In the years that followed, trade volumes of the Port of Melbourne increased, although the contribution that dredging made to the increase is unclear (Victorian Auditor General, 2012).

However, it comes at a cost to the environment. Seabeds which support marine life can be lost directly in dredged areas. Sedimentation can impact water quality, disturb marine life and disturb water nutrient levels which can result in algal blooms (DELWP, 2015).

Other forms of infrastructure in coastal and marine areas can also impact on environmental outcomes. Groynes are built to avoid sand erosion on beaches, acting as a physical barrier to stop sand shifting along a shore. Sea walls protect coastal assets and environments from being disrupted or washed away. Wastewater treatment also limits contamination of water in marine and coastal areas.

4.5 Air pollution is an issue in Melbourne and growing regional cities
As cities grow, the air quality around them tends to worsen. Air quality is an important factor in the health of both the human population and the natural environment, and for that reason it is closely monitored in major developed cities.

Air quality can be affected by natural events and human activity alike. According to the Victorian State of the Environment report (2013), the main sources of air pollution are:
• Industrial activity;
• Woodheaters;
• Windblown dust;
• Bushfires;
• Planned burning activities; and
• Motor vehicles, especially diesel exhaust.

While one-off events, such as bushfires and windstorms, can affect air quality across the state, it is Victoria’s built-up and industrial areas that face year-round air pollution problems caused by household and industrial activity. For this reason, the Victorian Environmental Protection Agency (EPA) only monitors air quality in Metropolitan Melbourne (12 sites), Geelong and the Latrobe valley (1 site each).

Even within cities, air quality problems are highly localised, particularly in industrial areas. In Melbourne’s West, the Brooklyn Industrial Precinct exceeds national air particle pollution standards more frequently than anywhere across the state. The Victorian Government has recently sealed problem roads and has been working with industry to address these issues.

4.5.1 Melbourne’s air quality has improved with technology, but localised issues still remain.
The Victorian State of the Environment (2013) reported positively on Victoria’s air quality. Where monitored, air pollution is low by international standards, and has improved significantly in recent decades despite Melbourne’s considerable population growth. Levels of some gaseous pollutants, particularly those caused by car and truck emissions, have decreased since 1996, while particle pollution has been relatively stable over the same period (Chart 4.4).
In 2014-15, the EPA assessed Victoria’s air quality as ‘generally good’:

- For pollution of small particles of PM10, which are typically caused by industrial activity, dirt and dust, there were 22 days where the daily average exceeded the national standard. Seventeen of these days occurred in the Brooklyn Industrial Precinct.
- For pollution of small particles of PM25, which are typically caused by plant burning and vehicle exhaust, there were eight days where the daily average exceeded the national standard. The reasons for these eight breaches were identified as either bushfires, planned burning and cold weather which led to wood-fire burning.

Future trends in pollution will be influenced by a number of factors. From a state-wide perspective, the major drivers will be:

- **Climate change** – as the frequency and intensity of heatwaves in Victoria increases over the course of this century, so too will the level of pollution associated with bushfires.
- **Vehicle use** – Melbourne’s population is projected to increase to 9.4 million by 2046, which is expected to result in greater air pollution caused by vehicle use. However, overall improvements in vehicles’ emissions may offset this trend as the share of hybrid and electric cars on the roads increases.
- **Victoria’s evolving economy** – Generally speaking, service industries contribute less to air pollution than industries such as mining, manufacturing and electricity generation. Projections to 2046 indicate a continued shift towards service-based industries such as finance and insurance, professional services, and health care and social assistance (see Chapter 3).

### 4.5.2 Reducing air pollution can be achieved through targeted infrastructure

Infrastructure plays an important role in monitoring and minimising air pollution. Air pollution monitoring stations are a clear example of infrastructure that can improve air quality by improving information and decision making.

Other forms of infrastructure impact on air quality, both directly and indirectly. For most, improvements to air quality are just one of many benefits delivered.

One such example is infrastructure that reduces vehicle traffic and emissions, such as sealed bike and foot paths or public transport infrastructure. Sealing roads can also impact on air quality by reducing wind-blown dust, which is one way that Government has reduced air pollution in the Brooklyn industrial estate.

Infrastructure which reduces the risk of bushfire can also impact on air quality. Underground power lines indirectly reduce air pollution in this way. Above ground power lines are a bushfire risk on hot, windy days, and have been the cause of some of Australia’s most catastrophic bushfires in the past (ABC, 2013). Underground networks reduce bushfire risks and build resilience in the electricity network to safely operate on hot days and during other weather events, such as storms and floods.
4.6 Ensuring the water supply is of high quality is critical for a health and prosperous Victoria

A reliable and clean supply of fresh water is essential for the long term health and prosperity of any society. At the heart of many decisions regarding water management is a trade-off between the needs of households, businesses and the environment.

4.6.1 Water security will increasingly be an issue in regional Victoria

Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (United Nations, 2013).

In Victoria, agriculture accounted for two-thirds of all water consumption in 2012-13. The remaining one third was split between industrial uses (12 per cent), sewerage and drainage (13 per cent) and households (8 per cent). Within agriculture, the dairy industry, followed by the horticulture and broadacre cropping and livestock industries consume the most Victorian water.

The legacy of infrastructure that was constructed during the Millennium Drought highlights how water security is a major driver of infrastructure demand. During the drought, the Victorian Government invested in major projects:

- Wonthaggi desalination plant;
- Goldfields Super-pipe;
- Melbourne to Geelong pipeline; and
- North-South pipeline.

These new infrastructure projects were built to help Victoria’s larger communities cope with low water storage levels during periods of drought, and as such, have been mostly dormant since water storage levels recovered in 2010. Together, these projects mean that fresh water can be generated and distributed to areas in distress during periods of drought. In particular, the Wonthaggi desalination plant has reduced Melbourne’s reliance on rainwater, and is expected to service its growing water needs in future. With this

Fresh water availability in Victoria has been a significant issue in recent years. The Millennium Drought, which spanned from 1997 to 2009, saw Melbourne’s water storages fall to 26 per cent of its roughly 1,800 billion litre capacity, while some storages in central and western Victoria fell to as low as 10 per cent (Victorian State of the Environment, 2013).

Between 2006 through to 2010, restrictions at various levels were put in place across areas of the state which limited or banned the use of water for gardening, car washing and filling of swimming pools. Permanent restrictions surrounding the use of hoses and sprinklers for gardens and for car washing were put in place in Melbourne in 2012.

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Chart 4.6: Melbourne’s water supply as a share of capacity, 1990-2014

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Fresh water availability in Victoria has been a significant issue in recent years. The Millennium Drought, which spanned from 1997 to 2009, saw Melbourne’s water storages fall to 26 per cent of its roughly 1,800 billion litre capacity, while some storages in central and western Victoria fell to as low as 10 per cent (Victorian State of the Environment, 2013).

Between 2006 through to 2010, restrictions at various levels were put in place across areas of the state which limited or banned the use of water for gardening, car washing and filling of swimming pools. Permanent restrictions surrounding the use of hoses and sprinklers for gardens and for car washing were put in place in Melbourne in 2012.
new infrastructure adding generation capacity of 150 billion litres for the Melbourne and Geelong areas, metropolitan water scarcity is not expected to be a major issue in the short to medium term.

The majority of Melbourne’s water comes from protected catchments, areas to the north and east of the city. These catchment areas cover national parks and state forests, whose soils and roots filter the water before it is released into the rivers and streams which carry it to reservoirs. Melbourne’s water supplies are also treated to remove impurities and tested regularly to ensure that they meet framework requirements. Melbourne has some of the highest quality drinking water in the world (Melbourne Water, 2015).

Unlike Melbourne, water security is a significant ongoing concern for Victoria’s regional towns and cities. The smaller water utilities in regional Victoria are more vulnerable during times of drought. During the recent Millennium Drought, storages in the Campaspe, Glenelg, Wimmera, Loddon, Maribyrnong and Werribee basins fell to below 10 per cent of capacity. Other catchments, including the Ballarat, Bendigo, Broken, Geelong, Goulburn and Murray systems fell to levels between 10 and 20 per cent of total capacity (State of the Environment, 2013). Storage levels in these catchments have recovered since the drought, although levels in north-western catchments are, as of 2015, once again feeling the impacts of drought.

4.6.2 Victoria’s inland river health is important for agriculture and biodiversity

Victoria’s inland river systems are important for supporting biodiversity, and supporting agriculture and tourism in Victoria’s regional areas.

Agricultural industries in northern Victoria depend on water for irrigation. The Murray Darling Basin, which produces an estimated 40 per cent of Australia’s agricultural income, covers approximately half of Victoria. Prominent industries in the north of the state, such as dairy and horticulture, rely on water irrigated from this system of connected rivers. In 2015 there are projects underway in Victoria to modernise outdated irrigation systems in the Murray Darling Basin (DELWP, 2015). Climate change projections indicate that there will be continued demand for upgrades in the future, given the importance of irrigation efficiency in water conservation.

Many of Victoria’s plant and animal species rely on healthy river systems. There are an estimated 35 bird species, 16 mammal species and a range of fish and plant species that live within the Murray Darling Basin that are endangered. During periods of drought, these species come under greater stress, as water availability for environmental flows decline (Murray Darling Basin Authority, 2015a).

The Victorian Department of Primary Industries (now DELWP) assessed 29,000 kilometres of Victorian rivers and streams in the Index of Stream Condition Report (2013). The key findings of this report were:

• Across the state, 32 per cent of river length was assessed as poor or very poor, 43 per cent was assessed as moderate and 23 per cent was assessed as good or very good.

• Compared with 2004, overall river condition across the state did not change substantially. This was viewed as a positive result, given that the 6 year period between assessments coincided with the Millennium Drought.

• The majority of the 29 catchments had poor riparian zone condition for 50 per cent or more of the stream length. The catchments in the east had a greater percentage of river length with good or excellent condition than those in the west.

• River condition of catchments in the west was typically in worse condition than those in the east.

4.6.3 Wastewater recycling is an important process for protecting marine environments

Wastewater recycling is an important process in minimising the impact that wastewater has on the environment and increasing environmental flows in rivers and streams.

Upgrades to Victoria’s infrastructure have led to a significant increase in the volume of water recycled over the past 20 years. However, the volume (and share) that is actually recycled year-on-year is also driven by need. Victoria recycles up to 25 per cent of its wastewater during periods of drought, and as little as 11 per cent during higher rainfall years (Victorian State of the Environment, 2013). Recycled water can play an important role for security of supply by substituting potable water for certain uses (such as some types of agriculture, and for household outdoor use and toilet plumbing through third pipe reticulation in some areas).
Wastewater and its biogases also contain energy which exceeds the energy that is required to treat it. The Western Treatment Plant reduces the carbon footprint of the treatment process. In the absence of electricity generation, an environmental trade-off exists between improving marine environments (through wastewater recycling) and reducing greenhouse gases (Melbourne Water, 2015b).

4.6.4 Improving infrastructure and managing water demand can both result in greater water security

In ensuring a secure and clean water supply for Victoria, infrastructure and policy both play an important role. Infrastructure connects water supplies across the State, generates fresh water from otherwise unusable water sources and increases the capacity to store rainwater.

Given that investment in new infrastructure and upgrades can be costly, there is a strong incentive for governments to manage water demand to get the most value out of existing infrastructure.

One way this can be done is through efficient pricing in the water sector, which can result in scarce water being allocated to where it is of most value. Another way to manage demand is through water restrictions and regulations, which have been a preferred mechanism for the Victorian Government in recent drought years. Education campaigns and sponsored appliance upgrades (such as low-flow shower heads) for households and businesses also encourage less water use.

4.7 Effective waste management is important for human health and the environment

Effective waste management minimises the negative impacts that waste can have on the environment, public health and amenity. There are also economic benefits for businesses that recover waste resources. Ensuring that waste is generated, recovered and managed in a sustainable way is important for Victoria’s future prosperity, and infrastructure plays a significant role.

4.7.1 Population growth and technological advancement are driving increased waste production

Victoria currently manages around 12 million tonnes of solid waste per year, with around two-thirds recovered and the remainder going to landfill. Of that, around 10 million tonnes is produced and managed in Melbourne. The largest share, 44 per cent, comes from demolition and construction work. Commercial and industrial activity accounts for 32 per cent of Melbourne’s waste, while household and municipal waste accounts for 24 per cent.

Data published by Sustainability Victoria on waste generation and management, between 2002-03 and 2011-12 reveals the following trends (Chart 4.7):

- Waste generation in Victoria increased from around 8.5 million tonnes to 12 million tonnes, and increased from 1.76 tonnes to 2.06 tonnes on a per-capita basis;
- The recovery rate of solid waste increased from around 51 per cent to 68 per cent; and
- The volume of landfill waste decreased from 4.1 million to 3.6 million tonnes.
In future, the volume of waste generated and recovered will reflect three key drivers:

- **Population growth** will continue to drive household waste generation. By 2041, Melbourne is expected to generate an additional 6-7 million tonnes of waste per year (Melbourne Waste and Resource Recovery Group, 2015).

- **Technological advances and attitudes towards waste generation** to drive trends such as rapid turnover of mobile phones, computers and home appliances.

- **Effectiveness of waste management** through improvements to infrastructure, technology and recovery practices.

### 4.7.2 Waste infrastructure is critical to service growing pressure

Infrastructure plays an important role in the collection, sorting, recovery and disposal of solid waste. Victoria’s waste infrastructure operates as a ‘hubs and spokes’ network (Statewide Waste and Recover Infrastructure Plan, 2015).

- Facilities that manage or recover material waste are referred to as hubs, which vary in size and activity depending on how local waste infrastructure network is managed.

- The activities that involve the movement of materials from the source (the generators) to the hubs are referred to as spokes.

Effective planning of waste management infrastructure requires careful consideration of a range of factors, some of which are trade-offs. For example, shortening the distance between the generators of waste and the hubs can shorten the distance of spokes, resulting in cost efficiencies. However, living standards in surrounding areas can be adversely affected if facilities, particularly landfills, are located nearby.
Waste recovery is central to an effective waste management system. It reduces the need to extract limited resources from the natural environment and limits the amount of manufactured waste which ends up in finite landfill space. Recent trends in Victoria highlight this point—increased recovery resulted in less landfill waste, despite population and per capita waste generation both increasing.

While recovering waste is the more desirable outcome, landfills are an important part of the waste infrastructure network. Landfill sites need to be located and managed appropriately to mitigate the impacts on human health and surrounding environment. Landfill capacity in Melbourne is relatively limited and declining, particularly in the south-east. Encouraging households and businesses to minimise waste will relieve pressures on existing infrastructure.

As of 2014-15, there were 21 operating landfills. Melbourne’s landfill capacity is around 250 million tonnes, which includes sites currently acting as landfill and available space for new landfills. Capacity is expected to fall to 160 million tonnes over the next 30 years, while capacity in the south-east is expected to be lost completely. This means that waste streams currently destined for these landfills will need to be transported further in future (Melbourne Waste and Resource Recovery Group, 2015).

4.8 There is an important two-way relationship between the environment and infrastructure

Traditionally, environmental objectives and infrastructure planning have been characterised by trade-offs. Pursuing environmental objectives has in the past meant that infrastructure is not built, or relocated. However, infrastructure also plays an important role in achieving environmental objectives.

Infrastructure can be designed, built and managed in ways that manage the trade-off between economic or social objectives and environmental objectives. For example, the role of greenery and open space in cities has traditionally been viewed as favourable but non-essential (City of Melbourne, 2015). However, a recent study commissioned by a number of Melbourne councils suggests that this mindset is evolving. An Economic Framework for Green Infrastructure was released in November 2015 to help local governments better understand and improve investment decisions surrounding “urban greening” (Victoria Institute of Strategic Economic Studies, 2015).

Society’s attitude towards the environment also impacts on infrastructure needs. People’s desire to improve the natural environment can be a catalyst of behavioural change that impacts on the demands placed on infrastructure. This can be demonstrated across a number of the themes covered in this chapter. For example:

• The desire to reduce air pollution or greenhouse gas emissions can encourage people to change transport mode or install in-home solar panels, altering demand on road and electricity infrastructure;

• The desire to preserve fresh water supplies can encourage people to moderate their water use in homes and businesses, delaying the need to upgrade water storage infrastructure; and

• The desire to reduce the amount of waste going to landfill encourages people to limit the amount of waste they generate, reducing the demands placed on waste infrastructure.
A number of forces are going to shape Victoria and its need for infrastructure in the coming years. It is important that Infrastructure Victoria consider a range of contingencies going forward to gain a better understanding of possible pathways and how they may affect Victoria.

Scenario modelling has been undertaken to test the assumptions of the base-case forecasts and to illustrate how three key trends identified in this report could affect infrastructure requirements in future. These scenarios do not reflect the full range of possibilities for Victoria – far from it – but they do focus on areas that have been identified as key drivers for Victoria’s prosperity going forward:

- A greater than predicted rate of population growth;
- An enhanced productivity profile driven by technological change; and
- A climate change mitigation policy (price on carbon).

Importantly, these scenarios have been modelled discretely to isolate the differing possible effects of these mega-trends on Victoria. Therefore, they are to be interpreted as individual scenarios, and not an interaction.

5.1 Scenario 1: Higher population growth would bring forward infrastructure demand

While population projections are generally regarded as more reliable amongst a set of future indicators, there is still considerable uncertainty, particularly when forecasting over such a long timeframe. There are a range of plausible scenarios around the central population projection used in this report. That is true both on the high side and the low side. The alternate scenario presented here (of a higher rate of population growth) should not be seen to imply that higher-than-forecast population growth is any more likely than lower-than-forecast. For infrastructure requirements, the high case can contribute to a more relevant examination as it can bring forward additional infrastructure requirements.

Stronger population growth in Victoria, focused on western Melbourne

Under the alternate population growth scenario, just over one million more people would be added to Victoria’s population by 2046 above original projections. The scenario, which has been developed based on scenario analysis undertaken by Department of Economic Development, Jobs, Transport, and Resources (DEDJTR), is driven by large increases to Australia’s (and consequently Victoria’s) migration intake led by geopolitical shifts.

It is assumed that the high rate of population growth drives the densification of the Melbourne region, with the inner city and CBD continuing to be attractive locations to live and work. The bulk of growth, however, will accrue to Melbourne’s west, where residents flock to suburbs that are close to the city while remaining more affordable. As growth in the east and south of Melbourne has already extended beyond 30 kilometres of the CBD, there is still significant scope for population growth out to the west of the city, delivering a lifestyle that offers both access to employment and reasonable living costs.

This of course, is an extension of the profile of population growth already expected in the base case projections. The scenario takes that trend of population growth favouring the west of Melbourne and amplifies it. Indeed, over the past decade, the growth of Melbourne has shifted westward, with the western region now accounting for much of Melbourne’s booming demographics. Its population has almost doubled since the early 1990s and is approaching 1 million residents (ABS, 2015).
Implications for Victoria

By 2046, Victoria’s population is projected to reach approximately 10.4 million people, growing at an annual average rate of 1.77 per cent between 2016 and 2046. This is notably higher than the base case, where total population was forecast to rise by an annual average rate of 1.52 per cent. This scenario would see the population grow to 6.6 million in 2021, and approximately 7.8 million in 2031, from a current base of approximately 6.1 million in 2015. There is assumed to be no change in the relative age distribution of the population from the base case in this scenario.

Based on the assumptions in the scenario, the three fastest growing regions are Melbourne – West, Melbourne-Inner and Melbourne-North West. The fastest growing Statistical Area Level 4 (SA4), Melbourne-West, would grow from 765,189, people in 2016 to 1.74 million people by 2046, implying an average growth rate of 2.79 per cent per annum. This is well above the base case growth of 2.13 per cent.

Chart 5.1 shows the difference in population by region between the scenario and the base case by the end of the forecast period. By 2046, Melbourne-West is forecast to have an additional 305,074 people compared to the base case, while Melbourne-Inner and Melbourne North-East are projected to have an extra 272,136 and 90,855 people respectively.

The share of residents living in Melbourne’s western suburbs is projected to increase significantly over the forecast period. At the same time, the share of the population residing in the east is projected to decline.

Under this scenario, the population shares in the west and east start to converge – by 2046, the share of residents in Melbourne West and North West is forecast to reach around 24 per cent of the total population (a considerable increase from around 18 per cent in 2016). Conversely, the share of the population residing in the east is projected to fall gradually over the forecast period, albeit still constituting a considerable share of the State’s total population, from 36 per cent in 2016 to 33 per cent by 2046.

Chart 5.1: Difference in population relative to base future case in 2045-46

![Chart 5.1: Difference in population relative to base future case in 2045-46](chart.png)

Notes:
- SA4s are ABS defined regions designed to reflect labour markets within each State and Territory.
Total employment in Victoria is projected to grow at an average rate of 1.75 per cent per year over the forecast period, from 2.80 million in 2016 to 5.15 million in 2045-46. This is notably higher than total employment growth in the base case (1.48 per cent). Increases in employment are largely driven by the availability of additional workers who both contribute to the supply and demand (through consumption) of the labour market.

Chart 5.2 shows the difference in employment by region in 2045-46 in the scenario compared to the base case. Melbourne’s inner and inner-west regions would see the largest change to employment at the end of the forecast period compared to the base case. Indeed, these two regions alone account for almost 60 per cent of the total increase in employment compared to the base case. Conversely, Melbourne South East and Melbourne North-East are projected to have fewer workers in 2045-46 compared to the base case. This reflects the continuation of centralised job growth in Melbourne’s CBD, while also suggesting that the workplace opportunities in Melbourne’s west increase.

**Chart 5.2: Population scenario – difference in employment relative to base future case, 2045-46**

- Melbourne – Inner
- Melbourne – West
- Melbourne – Outer East
- Melbourne – North West
- Melbourne – Inner South
- Melbourne – Inner East
- North West
- Mornington Peninsula
- Latrobe – Gippsland
- Hume
- Ballarat
- Warrnambool and South West
- Geelong
- Bendigo
- Shepparton
- Melbourne – South East
- Melbourne – North East

Difference in employment in 2045-46 (Scenario – base case)
Chart 5.3: Population scenario – difference in employment by industry relative to base future case (place of work), 2045-46

- Health Care and Social Assistance
- Professional, Scientific and Technical Services
- Education and Training
- Construction
- Retail Trade
- Accommodation and Food Services
- Public Administration and Safety
- Transport, Postal and Warehousing
- Financial and Insurance Services
- Manufacturing
- Administrative and Support Services
- Wholesale Trade
- Other Services
- Information Media and Telecommunications
- Arts and Recreation Services
- Rental, Hiring and Real Estate Services
- Agriculture, Forestry and Fishing
- Electricity, Gas, Water and Waste Services
- Mining

Difference in employment (POW) in 2045-46, (Scenario – base case)
For Victoria as a whole, industries that will experience the strongest employment growth over the 30 years to 2045-46 include professional services, education and health care, while manufacturing, mining and agriculture are anticipated to lose workers by the end of the period. These developments are in line with national trends. These trends are also mirrored in the base case.

That said, there are some changes in employment by industry between the scenario and base case. This can be seen in Chart 5.3, which shows that health care, professional services, education, construction and retail trade gained the largest boosts to employment at the end of the forecast period compared to the base case.

The majority of the increase in professional services employment compared to the base case will be concentrated in Melbourne-Inner. Indeed, Melbourne Inner accounts for some 50 per cent of the total increase in professional services employment when considering place of usual residence. This is even starker when considering place of work, where professional services employment in Melbourne-Inner accounts for over 70 per cent of the total increase compared to the base case.

The majority of the increase in health employment is, for the most part, concentrated in Melbourne, predominantly in Melbourne Inner and Melbourne West, which together account for almost 56 per cent of the total increase (place of residence), or 50 per cent of the total increase (place of work). When considering place of usual residence, Melbourne South-East and Melbourne North-East actually lose health workers, as Melbourne’s East is expected to already have more health institutions in place compared to Melbourne’s less developed west.

The majority of the increase in education employment is also, for the most part, concentrated in Melbourne (with the exception of Melbourne South-East and Melbourne North-East when considering place of usual residence, as Melbourne’s East is expected to already have more educational institutions in place compared to Melbourne’s less developed West). This is similarly predominantly focused in Melbourne Inner and Melbourne West, which together account for almost 60 per cent of total increase (place of residence) or 47 per cent (place of work).

5.1.2 Summary of infrastructure implications
An injection of so many additional people in a short space of time will put significant pressure on existing infrastructure arrangements. Victoria will have an additional 1 million people in the State above current base projections. The shape of Melbourne will be further changed as the west side meets the east side in population levels, requiring the provision of infrastructure to support new and growing communities. The main infrastructure implications that should be considered are:

- The anticipated population in 2046 according to the base future case, will be reached 5 years earlier in 2040 bringing infrastructure needs forward.
- Approaches to risk management are a consideration for governments with respect to infrastructure planning and timing. The benefit of long-term planning is that it can afford the opportunity to set aside land for future infrastructure before land is rezoned or developed. With respect to the timing of investment there are both potential benefits and costs to decisions for infrastructure timing. The downside of delaying infrastructure investment can include increased congestion and lack of access to services for the new community, while building infrastructure too early means that infrastructure is underutilised for a period of time, tying up funding that could have been used more efficiently during that time. A potential benefit to delaying infrastructure investment is that the choices we make for investment could be different; for example, technological advances may present new options for infrastructure solutions.
- Inner Melbourne infrastructure will need to cope with the expansion on demand earlier to support amenity and lifestyle. Population growth occurs incrementally. Already constrained land supplies in the CBD will be heightened as density increases in the city areas. This will raise questions about how Melbourne can house more people while retaining current standards of liveability. Urban planning will play a key role in designing what living and working in metropolitan Melbourne looks like. High growth also eliminates the luxury of long lead times prior to new infrastructure provision. Government will need to be well-prepared from a planning perspective. While additional infrastructure may be needed to cope with demand, there is also need for different approaches to how we use existing spaces, such as encouraging flexible working hours to mitigate against increasing congestion levels.
• Ensure the provision of infrastructure in the growing west of Melbourne matches levels provided in already established areas. Infrastructure provision in the west will need to keep pace with population growth. As greenfield developments continue to fill out and density increases, the provision of housing should be one consideration against the many other factors that contribute to amenity, including public spaces and cultural infrastructure. When implementing infrastructure it will be critical to understand not only the current needs of the community, but what they will be into the future as the area continues to grow.

• Infrastructure provision will need to consider housing preferences and how this impacts on the transport network. A higher number of journeys to the CBD would test the current transport system in terms of both public and private transport. Excessive travel times waste labour and capital resources. It will be important that a population increase in the west is matched with the appropriate infrastructure to enable a safe, reliable, and timely journey to work and leisure activities, and prevent entrenched dependency on private travel.

• Linkages between Ballarat, Geelong, Bendigo and Melbourne are optimised. Linkages with external markets will support a move away from the reliance on manufacturing and other lower skills activities and allow for the efficient movement of goods to cater to a growing population and economy. In addition, enhanced mobility between these areas will also have flow on benefits for access to education and employment opportunities. Infrastructure will also support any movement towards a polycentric metropolis.

5.2 Scenario 2: Technological advances may drive a more productive society

5.2.1 Scenario basis

Productivity growth is the major driver of increased living standards over the long term. In the base case, labour productivity growth averages 1.6 per cent per annum and increasing productivity accounts for around half of the growth in Victoria’s economy over the next three decades.

Productivity growth can be driven by many things, including improved human capital (e.g. higher skill levels of the workforce), physical capital (e.g. more tools and equipment per worker), as well as the efficiency in which labour and capital are brought together through a society’s institutions and overall governance. Improved technology is an important driver of productivity growth. The last three decades has seen Victoria’s economy transformed by the revolution in computing and internet technologies.

The trajectory of digital technologies has tended to have the feature of being exponential in nature. This suggests that the revolution in digital technologies has much further to run. Technologies such as mobile internet, big data and data analytics, the IoT, and cloud technology are already seeing increased penetration with the potential for much more to come. There are also a number of “exponential” technologies on the medium to longer term horizon that have the potential to have far reaching, transformative impacts across geographies and industries. Some of these technologies include developments in artificial intelligence, robotics, next-generation DNA sequencing, additive manufacturing (i.e. 3D printing), and advanced computing technologies.

There is uncertainty around precisely how these technologies will evolve in the future and how they will be adopted by society. For technologies such as autonomous vehicles, regulatory approvals from government may be required. The base case projections in this report already assume a healthy rate of productivity growth, partly driven by improved technologies. This scenario will investigate a higher productivity growth scenario driven by a higher uptake of new and emerging digital technologies, such as the ones described above.

The scenario assumes that all industries will become more productive on average due to a higher penetration of digital technologies, such that labour productivity growth for Victoria’s economy as a whole averages 2.0 per cent per annum instead of 1.6 per cent per annum in the base case.4

Victoria in 2046 under this scenario sees higher than forecast productivity growth owing to an assumed higher uptake of new and emerging digital technologies – productivity in this scenario grows 2 per cent, compared to 1.6 per cent in the base case. This scenario sees automation of some jobs due to new labour saving digital technologies, with a shift in employment to jobs with a high share of knowledge workers, or distinctly human characteristics.

4Labour productivity growth on an hours worked basis.
Based on this research, the scenario assumes that this is where much of the future job growth occurs to replace the jobs lost due to automation. Productivity in some industries may also improve due to new digital technologies that improve output per worker independently of any impact on employment. Total employment in Victoria is assumed to be unchanged from the baseline projections.

There may be greater disruption and stronger productivity growth than the 2.0 per cent adopted in this scenario, with the magnitude of the impacts somewhat larger than shown. However, the productivity growth assumption of 2.0 per cent is considered to be a realistic scenario for considering the impact of higher productivity growth. There are some factors which may temper the uptake of new technology, including the need for new investments to be made, while society may resist the uptake of some new technologies. New digital technology also poses risks, including cyber security risks and the potential for technologies to be used in other criminal or military applications.

The historical experience of recent decades suggests a limit to the extent of productivity growth that is likely to be realised. For example, Australia’s labour productivity growth has averaged 1.6 per cent per annum over the past three decades, and Australia’s labour productivity growth has never exceeded 2.5 per cent for any extended period since the mid-1960s despite the improvement in digital technology that has occurred over that time.
5.2.2 Implications for Victoria

The stronger growth in labour productivity of 2.0 per cent per annum instead of 1.6 per cent per annum, compounds over time and results in Victorian real GSP reaching around $881 billion in 2046. That is a total increase of 13.7 per cent in the size of Victoria’s economy above the base case projection by 2046.

As shown in Chart 5.5 and Chart 5.6, the stronger growth in the size of the economy is a direct reflection of stronger labour productivity growth with the number of hours worked assumed to be unchanged from the base case.

Chart 5.7 shows the stronger projections for labour productivity by industry in this scenario compared to the base case projections. These projections have been informed by the potential of new labour saving technologies to raise labour productivity.

Since clerical and sales occupations are highly susceptible to future computerisation according to the research cited earlier, industries which have a high share of these workers would see stronger productivity growth in this scenario. This is why rental, hiring and real estate services, accommodation and food services, and retail trade see the strongest productivity growth in this scenario. This is also broadly true of the other industries shown in descending order in the chart.

At the bottom, professional, scientific and technical services has a relatively low share of occupations susceptible to computerisation, and therefore may benefit less from new labour saving technologies. Despite this, labour productivity would still increase significantly for this industry under this scenario.

As noted earlier, some industries would also benefit from new digital technologies complementing the work of existing workers in the industry. In the scenario, it has been assumed that productivity growth in health and social assistance is stronger as a range of technologies such as robot assisted surgery and robot assisted therapy, and improved diagnostics raise the quality of health services.
Chart 5.8 shows the projections of employment by industry in this scenario compared to base case projections. The ranking for employment by industry is close to a mirror image of the outlook for labour productivity by industry shown above. Industries such as education and training, health care, professional services, and information media and telecommunications which have a high share of knowledge workers less susceptible to computerisation, would see the strongest employment growth. Arts and recreation which requires many workers with distinctly human characteristics is another industry which would see stronger than average employment growth.

While there would be big shifts in employment across occupations due to computerisation and automation (see Chart 5.4 earlier) under this scenario, overall employment would not fall. This is because the productivity gains generated by labour saving technology both create wealth and free up resources which can be used elsewhere. Historical experience with technological advances also tells us that as some occupations decline (or even disappear), new occupations are created offsetting declining industries.

Moreover, the employment shift is more muted on an industry basis than on an occupational basis because industries contain a mix of occupations, and not all are necessarily in decline.
Chart 5.9 and Chart 5.10 show the employment projections by region for this scenario relative to the base case. Inner Melbourne, encompassing Melbourne Inner and Melbourne Inner-East, see stronger employment growth in this scenario due to their higher share of employment in knowledge-based industries. This is most apparent in terms of absolute numbers. Even so, the overall employment rise in Inner Melbourne is relatively muted. Job losses in industries such as finance and administrative services as well as retail and hospitality services partly offset some of the jobs created in other knowledge-based industries in inner Melbourne.

This reflects a general finding that the employment shift is more muted on a regional basis than on an industry or occupational basis. Most regions contain a mix of industries (those declining and those increasing), so people will naturally gravitate to where there are opportunities.

It is important to note that this scenario does not see any region wiped out. The two worst performing regions are Melbourne North-West and Melbourne-West, which both have a high share of employment in transport, postal and warehousing as well as manufacturing. Employment would fall in these two industries as more work is automated due to the impact of new digital technologies. Robots are already transforming the way warehouses work, with Amazon increasingly using robots to fulfil customer orders in its warehouses. This trend can be expected to continue, but jobs will be created in education and training, health care and social assistance and other industries to partly offset these job losses.

5See https://www.youtube.com/watch?v=gvQKGev56qU
Chart 5.9: Productivity scenario – difference in employment by SA4 region on a place of work basis, per cent change relative to base future case, 2045-46

Melbourne – Inner East
Melbourne – Inner
Ballarat
North West
Melbourne – North East
Shepparton
Bendigo
Melbourne – Inner South
Geelong
Hume
Victoria
Warrnambool and South West
Mornington Peninsula
Latrobe – Gippsland
Melbourne – South East
Melbourne – Outer East
Melbourne – West
Melbourne – North West

Source: Deloitte Access Economics

Chart 5.10: Productivity scenario – difference in employment by SA4 region on a place of work basis, relative to base future case, 2045-46

Melbourne – Inner
Melbourne – Inner
Ballarat
North West
Melbourne – North East
Shepparton
Bendigo
Melbourne – Inner South
Geelong
Hume
Victoria
Warrnambool and South West
Mornington Peninsula
Latrobe – Gippsland
Melbourne – South East
Melbourne – Outer East
Melbourne – West
Melbourne – North West

Source: Deloitte Access Economics
5.2.3 Summary of infrastructure implications
This scenario sees all industries become more productive on average (compared to the base future case) due to the higher penetration of digital technologies. Although this scenario has a significant impact on employment outcomes by industry, the future for individual regions of Victoria is not as strongly influenced by these digital productivity trends. This provides a degree of confidence in long term planning for infrastructure around locations.

- There would most likely be a greater need for economic infrastructure generally, given the increase in the size of Victoria’s economy as a result of higher productivity. However, digital technology driven innovations specifically in the infrastructure sector that allow infrastructure to be used more efficiently could help to offset this.
- Infrastructure (such as ICT infrastructure and transport) would also be needed to accommodate a higher number of knowledge workers in inner Melbourne.
- Without countervailing actions, the higher level of economic activity could also bring with it a range of environmental impacts, including higher levels of pollution and carbon emissions as well as the possible need to build new infrastructure in new locations which will have environmental implications.
- The expectation of a greater need for economic infrastructure and possible negative environmental impacts are seen as stemming from the higher levels of production, incomes and consumption in this scenario. However, it is also possible to see a scenario where the effects do not occur to a significant extent, particularly if productivity growth is largely driven by improvements in the quality of goods and services produced and consumed rather than in their number.

Given the significant changes in the occupational composition of the workforce under this scenario, there may be increased social stresses caused by job losses. On the other hand, stronger economic growth would provide a greater fiscal capacity to spend on social services, while improvements can be expected in the quality of health services due to improvements in technology.

Retraining would also become more important in smoothly facilitating such change in this scenario. This is partly reflected in the strength in education and training in this scenario, which underscores that there would be a need for adequate education infrastructure.

5.3 Scenario 3: Stronger climate change mitigation activities will affect Victoria's economy

This scenario focuses on a greater degree of climate change mitigation activities than the base case set out in chapter 4. This scenario sees a significant shift from coal energy to renewables in response to carbon price signals and with it, increased demand for energy infrastructure that facilitates this shift. Depending on the mitigation policy implemented, there may also be an impact on demand for transport, particularly private car use. This scenario sees relatively low and localised employment impacts and changing demand for energy infrastructure.

5.3.1 Scenario basis
The alternative environmental scenario assesses the impact of policies which address climate change by decarbonising the Victorian economy. It focusses on the impact of mitigation activities, rather than the possible impacts of climate change on Victoria, which were covered in Chapter 4.

Climate change is one of humanity’s greatest challenges. Globally, temperatures are rising and extreme weather events are becoming more frequent and severe. Sea levels are also rising, putting pressure on low-lying and coastal areas.

Projections indicate that these trends will continue down the same path in the absence of action. Supported by growing evidence, the need to address climate change is becoming increasingly recognised. Major developed and developing economies are introducing greater measures to lower carbon emissions. In 2015, an agreement (Paris Agreement) was reached by the 192 parties to the Kyoto Protocol to limit global warming to ‘well below’ two-degrees and pursue efforts to limit the increase to 1.5 degrees (UNFCCC, 2015).

The Paris agreement will have implications for Australia over the next 30 years. Following the meeting, Australia is targeting a 26 to 28 per cent reduction (from 2005 levels) in greenhouse gas emissions by 2030 (Australian Government, 2015a). However, this target may come under scrutiny in future, given that Australia’s emissions are amongst the highest in the OECD (OECD, 2013).
Government policies on carbon emissions would affect how Victoria reduces greenhouse gases and the speed in which it does. An economy-wide carbon price could speed up the cessation of conventional coal generation. A carbon price became effective in Australia in 2012 but was repealed in 2014, replaced by a policy with a preference for incentivising businesses to reduce or offset emissions and encouraging households to switch to renewable energy.

In Victoria, policies designed to reduce greenhouse gas emissions are likely to continue the shift in electricity generation away from brown coal and towards renewable sources and gas, which has lower emissions than brown coal (DEDITR, 2015a). Currently, around 84 per cent of Victoria’s electricity is generated from brown coal and a further 4 per cent is generated from gas.

While a reduction in Victoria’s carbon emissions over the next 30 years appears likely, there is uncertainty as to what the future sources of clean electricity might be. Although renewable energy generation is expected to continue growing, brown coal may still represent a significant share of a cleaner energy mix, if CCS becomes a viable option in the future. In 2015, AGL announced its greenhouse gas policy, including a pathway to decarbonising electricity generation by 2050. Central to this policy is the closure of all existing conventional coal fired plants – including Loy Yang in Victoria (AGL, 2015).

Alternatively, zero-carbon electricity could be generated from renewable sources alone. The penetration of intermittent energy sources such as wind and solar may be somewhat limited because, without storage, they do not provide continuous energy. The role of distributed energy storage technologies will therefore become more important as the penetration of renewables in Victoria, and Australia, grows (AECOM, 2015).

This scenario is based on a carbon price policy rather than the current Direct Action policy for two reasons. Firstly, a large number of countries across Europe and Asia have enacted market-based climate change policies which put a price on carbon emissions, either in the form of a tax or emissions trading scheme (OECD, 2015). Given this global trend, there is a strong possibility that Australia could enact a similar policy in the future. Secondly, there is a lack of Victorian economy-wide modelling available on the current Direct Action policies.

The scenario modelling has been informed by previous research on the impact of carbon policies on the Australian and Victorian economies. In particular, it draws on work undertaken by Deloitte Access Economics (2011) which assesses the impacts of introducing a carbon price on the Victorian economy. We have updated this modelling by applying the relative economy-wide impacts of introducing a carbon price, in percentage change terms, to the base-case forecasts to assess the expected impact of such a policy to Victoria’s economy.

5.3.2 Implications for Victoria
While the impacts of introducing a carbon price are significant in some industries, they represent a relatively small part of the overall Victorian economy. Electricity generation and coal mining operations in Victoria account for less than 1 per cent of Victorian employment. For other industries, the main impact of the policy comes through changes in electricity prices and changes to wage rates.

In Victoria, employment in mining and construction would be relatively lower under a carbon price. The mining industry would be the industry most affected by the carbon price, with the fall in employment reflecting a large decrease in brown coal mining, which is currently the primary source of Victoria’s electricity. Employment in the construction sector is also impacted, primarily through the impact on electricity prices. Employment in some sectors would rise, partly because of the nuances of the policy assumed in this scenario. In particular, employment in the agriculture, forestry and fishery industry would rise, which mainly reflects the exemption of agriculture from the carbon price. Agriculture was exempt from the previous Australian carbon price policy and is exempt from other policies worldwide, such as the ETS in the European Union. Although not considered in this analysis, the agriculture industry could be eligible to generate carbon credits by changing activity under such a policy, however uptake in incentivised abatement policies in agriculture to date has been limited.6

6The Carbon Farming Initiative (CFI) policy was introduced in 2011 to complement industries exempt from the carbon price, including agriculture, waste, forestry and land use. The policy issued carbon credits for abatement activities in those sectors, including revegetation, foregoing forestry and managing methane emissions from manure and landfill waste. The CFI was replaced by the Emissions Reduction Fund (ERF), which is available to all industries. A 2014 review of the policies noted that there had been only seven agriculture projects approved out of the 178 to that point. To date, the lack of financially viable abatement opportunities for agricultural land owners has restricted abatement action in that sector (Climate Change Authority, 2014).
Employment in the electricity, gas, water and waste industry would also increase. In electricity generation, there will be a significant shift between coal-based electricity generation and renewable industries or gas generation. The overall impact on employment in the energy generation sector depends largely on which energy generation industries grow the most, and their relative labour intensity. In manufacturing, higher employment in light (labour intensive) manufacturing is offset by lower employment in highly emissions-intensive manufacturing industries, such as the aluminium and non-ferrous metals industries.

Across the state, the regions where employment grows the most are those with relatively large agricultural industries. The spatial distribution of affected industries is rather concentrated.

The regions where employment impacts are likely most negative are those that specialise in coal mining, oil and gas or commercial services, Chart 5.12. In Inner and North West Melbourne, employment would fall slightly reflecting the relatively large share of employment in either construction or commercial services. However, this impact is largely offset by the presence of other industries.
Employment in Gippsland would fall by the most of all regions outside of Melbourne, reflecting the relative importance of the coal mining and conventional coal-based electricity generation. However, the fall in employment would likely be partially offset by other industries, such as agriculture. The introduction of clean energy industries in the region and a subsequent rise in employment in clean energy industries will also help to offset falls in coal mining and conventional coal-fired electricity generation. This is also supported by modelling by the Australian Treasury (2011), which projected total electricity generated in the region to increase out to 2030 through increased gas, renewables, and CCS.

In other regions, the extent to which employment would be affected depends on the relative size of the affected industries. Regions with strong agricultural and manufacturing industries would experience less negative employment impacts than others, notably the Warrnambool area, which has relatively large dairy farming and dairy processing industries. In all regions, our modelling suggests that there are likely to be a mix of positively and negatively impacted industries which offset one-another to a certain degree, meaning that regional employment impacts would be small overall but all negative by broad region.

In the near term, this shift may cause dislocations in terms of employment. Due to their concentrated nature, this may cause social stresses with the need for adequate social support services. Over the longer term, employment numbers and commuting patterns will only see relatively small impacts, so there are unlikely to be significant implications for infrastructure from employment shifts.
5.3.3 Summary of infrastructure implications

Overall, the impact of the introduction of a carbon price on the Victorian economy would not significantly alter employment projections relative to the base-case. However, as has been discussed elsewhere in the report, decarbonising the Victorian economy requires Victoria’s infrastructure networks to adapt.

There are a number of infrastructure implications that arise from the introduction of a carbon price, such as:

• Abatement policies can fast track adoption of clean energy generation, driving demand for new infrastructure such as wind turbines, solar panels or coal plants that capture and store carbon. New infrastructure will also be needed to connect these to the grid.

• Greater penetration of both large and small scale renewable sources will likely drive demand for batteries, in order to smooth the supply of intermittent sources (wind and solar) on the grid.

• Future policies could also have implications for transport infrastructure, particularly if emissions on transport are priced. While not a feature of the 2012 carbon tax in Australia and therefore not included in the scenario considered here, the implications of a possible taxation of households’ use of transport fuels in the future are also worth considering.

• The likely implications of transport emissions being priced include reduced demand for conventional cars and road infrastructure, and higher demand for public transport infrastructure, as well as walking and cycling infrastructure.

• Primary production of agriculture and forestry products could also be affected by future policies which could result in a change in their output. This will affect the demand for transport infrastructure required to move production along supply chains, such as grain storage.
Chapter 6: Conclusion
This report examines the current state and a selection of possible future states for Victoria’s society, economy and the environment (streams). It provides an information base outlining Victoria’s strategic context, with discussion of drivers of infrastructure demand for each stream. The streams are interdependent with a number of themes (or mega trends) of key importance across all streams, necessitating a systems thinking approach to infrastructure planning to be mindful of unintended consequences and benefits.

Of course, views on the future need to be couched in terms of uncertainty, particularly when projecting over an extended timeframe of 30 years. But infrastructure assets are also long term assets, so trying to make sense of those longer term uncertainties is important in understanding future infrastructure need. We used two frameworks to analyse the possible future states of Victoria:

- Current and major emerging trends affecting Victoria formed our ‘base’ future case;
- Scenario analysis tested three discrete possibilities for Victoria’s future state, and we considered how implications for infrastructure changed relative to the base case.

Sustainable development will become an increasingly prominent goal over the next 30 years given the headwinds we face in climate change, strong projected population growth, our finite supply of land, and technological disruption. Indeed, getting more out of existing infrastructure will also be increasingly necessary as government fiscal capacity is challenged by our ageing population and the influence of global events on our economy in an increasingly interconnected world. As infrastructure needs grow and change, strategies such as demand management and augmenting existing infrastructure will be considered, and in some cases delay the need for new infrastructure.

Projections of strong population growth in Victoria over the next 30 years, sees growth unevenly distributed across the State, centring in Melbourne and on its fringes. This pattern of growth brings a number of different challenges including the need for infrastructure to cater for the growing population, ensuring that our urban form provides housing diversity to facilitate optimal housing allocation for Victorians, and the growing distance between where people live and work leading to longer commute times and potential for social disadvantage.

Clearly congestion of our transport networks (public transport, roads, rail, air and ports), and the risk of disamenity (such as higher pollution) will also be challenges as the population grows, given that under the base future case, employment growth is projected to centre in Melbourne. This pattern of growth is in line with the increasing importance of the knowledge sector and agglomeration benefits to the economy.

Like other developed societies, Victoria’s population will continue to get older over coming decades, reinforced by longer life expectancies and relatively slow natural increase. This brings a number of challenges including increasing prevalence of chronic diseases, putting pressure on health infrastructure and a higher dependency ratio that would see slower growth in government revenues while demand for government services is expected to rise at a faster rate. Catering to the needs of older Victorians will become increasingly important. Urban development and renewal (for private and public buildings) will need to be planned with a focus on accessibility. We also need to ensure that there is sufficient housing diversity, and therefore appropriate dwelling options for older people to facilitate downsizing in the communities where they are needed.

In an increasingly interconnected world, Victoria’s economy will continue to be impacted by global and local trends including geopolitical developments, environmental pressures, the emergence of Asia as the centre of the global economy, migration (such as the globally mobile ‘knowledge worker’), information and capital flows and technological developments.

A key challenge for Victorian businesses and individuals will be to remain internationally competitive in order to participate and thrive. One way to achieve this is to boost productivity by being smarter in the way goods and services are produced and provided to consumers. Infrastructure of sufficient capacity is required to facilitate trade.

At the same time, Victoria, like the rest of the global community, is facing an increasingly uncertain future due to climate change. The Paris Agreement (2015) confirms a global recognition of the need for climate change mitigation. And while reductions in global greenhouse gas emissions may constrain global warming, some degree of warming (and associated changes) is now considered to be inevitable, meaning future adaptation is essential.
The need for sustainable economic development is therefore intensifying with major implications particularly for Victoria’s energy sector. Currently dominated by brown coal-fired energy, the sector is slowly transitioning to renewables. In line with international cities similar to ours, there is increasing uptake of distributed generation (like solar panels), which is likely to become more popular as battery storage technology improves and falls in price. With significantly reduced (or eliminated) reliance on brown coal, Victoria’s environment could benefit from another emerging global trend, electric driverless cars.

The implications of the mega-trends for both infrastructure demand and provision will also critically depend on how we utilise technology and how we design our cities.

• Future technological advances will help shape demand for infrastructure as well as assisting us in combating the challenges we face by helping us to both make better use of the infrastructure we already have, while also potentially opening up new possibilities for infrastructure choices. But, technology on its own is not a panacea – there is significant uncertainty around not only the development of new technologies, but also their potential effect on the economy, society and the environment.

• Where people live, work and play, and our choices around urban form play a big role in determining what kind of infrastructure we need and where, but infrastructure also influences urban form. Over the next 30 years, Victoria’s liveability may trade-off with productivity – as cities and economies grow so too can pollution and congestion while also potentially leading to a loss of private and public space. Maintaining Victoria’s liveability will be an ongoing challenge-long term planning around both urban form and infrastructure will be crucial in shaping Victoria over coming decades.

Next steps

The starting point for long term infrastructure planning should be asking the question what kind of Victoria do we collectively want? Society has multiple objectives for infrastructure – economic efficiency and growth on the one hand, and equity and sustainability objectives on the other. Given this, as well as competing demands between different individuals, businesses and governments, it is simply not possible to deliver everything that everyone wants from infrastructure.

There are a range of trade-offs that we need to openly talk about regarding Victoria’s future infrastructure planning. But it is not all negative; options to deal with some infrastructure implications can have potentially significant beneficial spill-overs that help to overcome other challenges at the same time.

Examples of trade-offs and spill-over effects include:

Productivity and liveability

While bigger is better for the economy it can deteriorate liveability through disamenity, congestion and pollution. Careful planning around multi-modal transport and urban renewal with open spaces for example can help to maintain or improve liveability as the economy grows and the urbanisation trend continues.

With a significant share of jobs growth projected to be in inner Melbourne, coupled with solid projected population growth over the next 30 years, there also trade-offs to be made regarding our choices around urban development:

• Peri-urban development and indeed any future decision to extend the urban growth boundary sees development in competition with other land uses (including wildlife preservation and agriculture).

• Densification is also characterised by trade-offs for land use, including development, public spaces and cultural infrastructure.

A move to a polycentric city can reduce some of the negatives associated with a larger economy (such as congestion, long commutes, pollution and disamenity), but are unlikely to eliminate them if Victoria’s population growth is accommodated through peri-urban development.
Urban form and housing

Decisions between peri-urban development and densification carry further trade-offs.

- Grattan Institute research (2011) suggests that Melburnians typically prefer detached or semi-detached homes in high amenity suburbs. When making a choice about where to live, we make trade-off decisions about budget, location, size and the quality of dwellings. Living in denser dwellings can be challenging to people’s sense of privacy and desire for space.

- Dense cities in some developed countries, particularly cities in Europe, have a smaller carbon footprint per person (partly due to car dependence) compared to peri-urban development. Living closer to employment allows for shorter commutes to work, and multi-modal transport options that encourage walking and cycling (which also has knock on health and environmental benefits).

- However, some people find the closeness of denser living challenging. Mindsets are likely to change over time, shifts in energy costs over the long run may make living far from employment unaffordable (Grattan, 2011). Well planned densification and urban renewal with a strong focus on liveability could make denser living more appealing, and may begin to alter people’s preferences for housing type.

- There is also a trade-off between health and well-being and car dependence. People who live in fringe areas are much more likely to be car dependent due to poor access to public services. Health and well-being impacts include increased prevalence of car accidents, stress and obesity. Car dependence also further entrenches social disadvantage and poverty because cars are expensive to maintain relative to Melbourne’s subsidised public transport network.

Decarbonising the Victorian economy

A popular assumption is that decarbonising the Victorian economy carries the trade-off of lower economic growth, but this is sensitive to underlying assumptions around national and international policy settings, technological development and the period of time under consideration.

- There are also actions that can reduce emissions that make sense to undertake in their own right, such as energy efficiency (which saves consumers money); developing a more efficient urban form for both urban renewal and new development (which carries knock-on health and societal benefits); and increasing options for multi-modal transport, particularly cycling and walking (with positive knock-on benefits for congestion, and health and wellbeing).

- Furthermore, doing nothing to reduce our carbon emissions will see worsening climate change for future generations, affecting almost every aspect of life including health, food production, water, and safety (greater frequency and intensity of extreme weather), all of which ultimately affect our ability to be productive in the economy.

Health and the environment

Currently, sedentary lifestyles and other risk factors are leading to a rise in chronic disease, which will put increasing pressure on health services infrastructure. Urban planning, such as the 20 minute neighbourhood, disability accessibility, and open public spaces can encourage walking, exercise and cycling.

Open spaces and green wedges support biodiversity, reduces urban heat and regulates air and water quality but they also spillover benefits, reminding us of our connection to the natural environment and providing a context for cultural heritage, artistic expression and diversity.

This report provides a future view of key drivers of infrastructure needs. Understanding the trends underlying demand drivers is a good starting point for conversations about infrastructure planning. We hope that this report serves as an information base that helps to inform the work of Infrastructure Victoria and other stakeholders over 2016 in developing Victoria’s 30 year infrastructure plan.
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