Infrastructure Report Card

SOUTH AUSTRALIA

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Contents

Communique i

Ratings Summary iii

1. Overview 1

1.1 Background 1
1.2 Process 1
1.3 Significant Issues 2
1.4 Future Directions 4

2. Roads 5

2.1 Background 5
2.2 Overview 5
2.3 Evaluation 9
2.4 Future Directions 13
2.5 Report Card Rating 13
2.6 Case Study 14

3. Rail 15

3.1 Background 15
3.2 Overview 15
3.3 Evaluation 18
3.4 Future Directions 22
3.5 Report Card Rating 23
3.6 Case Study 24

4. Water 25

4.1 Overview 25
4.2 Evaluation 30
4.3 Potable Water 31
4.4 Wastewater 36
4.5 Future Challenges 41
4.6 Report Card Rating 43
4.7 Case Study 44

5. Stormwater **45**

5.1 Background 45
5.2 Overview 45
5.3 Level of Service 50
5.4 Existing Infrastructure 51
5.5 Future Needs 52
5.6 Report Card Rating 53
5.7 Case Study 54

6. Electricity **55**

6.1 Background 55
6.2 Overview 55
6.3 Evaluation 60
6.4 Future Directions 63
6.5 Report Card Rating 63
6.6 Case Study 64

7. Gas **65**

7.1 Background 65
7.2 Overview 65
7.3 Evaluation 71
7.4 Future Directions 74
7.5 Report Card Rating 75
7.6 Case Study 76

Tables

Table 1 Population Served 2003–04 26
Table 2 Authority Interaction with SA Water 27
Table 3 Authority Interaction with Local Government 28
Table 4 Rating Criteria 31
Table 5 Annual Water Consumption 34
Table 6 Annual Wastewater Collection 39
Table 7 Wastewater Performance Indicators 39
Table 8 Future Scheduled Generating Capacity, Prospective 56
Table 9 Electricity Industry Governance Arrangements 57
Table 10 Performance of ElectraNet, 1996/97–2003 60
Table 11 Performance of ETSA Utilities, SAIDI and SAIFI, 2000/01–2003/04, High Voltage Only 61
Table 12 Projected Impacts of Wind Farm Development on the South Australian Electricity Sector 64
Table 13 LP Gas Distribution Networks in South Australia 68
Table 14 Annual Demand for Natural Gas in South Australia over the last 10 years 69
Table 15 Australia's Estimated Gas Reserves at June 2003 70

Figure

Figure 1	SA Annual Fatality rate per 1000 population vs national average	9
Figure 2	South Australian Generation by fuel source, including non-scheduled generation 2003–04	56
Figure 3	Status of the South Australian High Voltage Network: projected capacity	58
Figure 4	ETSA Utilities, Actual and Projected Capital Expenditure, 2000–01 to 2009–10	59
Figure 5	Peak Asset Utilisation Factor for Substations, MW/Capacity in MVA	61
Figure 6	Age Profile of ETSA Utilities Network Assets, by replacement cost	62
Figure 7	Australian Gas Reserves Estimates — June 2003	70

Appendices

Appendix A — Rating Methodology	77
Appendix B — Acronyms	79
Appendix C — References	81
Endnotes	84

Communique

The quality of South Australia's infrastructure is an indicator of its current and potential economic viability.

Inadequacies or failures of infrastructure add risk and hardship and can be an obstacle to economic growth and competitiveness.

While Engineers Australia welcomes the South Australia *Infrastructure Plan*, we note the long lead time from the announcement of the impending plan and the fact that priorities are only now being identified. Involvement of a broad range of stakeholders in the priority setting process is recognised. However, we await with interest the budgeting process, which will see the projects to completion. In particular, we are concerned that budgeting and spending take place to rectify the backlog of maintenance work, while also introducing new infrastructure projects. A long term vision is required.

Infrastructure in South Australia has been assessed and rated using the methodology developed for the Engineers Australia *2001 Australian Infrastructure Report Card, 2003 NSW Infrastructure Report Card, 2004 Queensland Infrastructure Report Card* and the *2005 Victorian Infrastructure Report Card.*

The Report examines key infrastructure sectors in South Australia, evaluates the status of assets and planning processes and assigns a rating which can range from **A** (very good) to **F** (inadequate). In South Australia all ratings are in the range **A-** (good) to **D** (poor).

The table below compares the 2005 ratings for the *South Australian Infrastructure Report Card* with the ratings from the *2001 Australian Infrastructure Report Card.*

Category	2005 South Australian Ratings	Category	2001 Australian Ratings
National Roads	**C**	National Roads	**C**
State Roads	**C-**	State Roads	**C-**
Local Roads	**D**	Local Roads	**D**
ARTC Rail Network	**C**	Rail	**D-**
Metropolitan Rail and Tram Network	**B-**		**Not rated**
Regional Rail Network	**D**		**Not rated**
Metropolitan Potable Water	**B-**	Potable Water	**C**
Non-metropolitan Potable Water	**C**		**Not rated**
Metropolitan Wastewater	**C+**	Waste Water	**C-**
Non-metropolitan Wastewater	**C-**		**Not rated**
Stormwater	**D**	Stormwater	**D**
Electricity	**B-**	Electricity	**B-**
Gas Overall	**B+**	Gas	**C**
Transmission	**B+**		**Not rated**
Distribution	**A-**		**Not rated**
LP Gas	**B+**		**Not rated**

The preponderance of C and D ratings is a warning that infrastructure in South Australia is not in good condition.

It is clear that the way in which infrastructure is planned, funded, managed and maintained in South Australia requires urgent improvement.

With the release of the South Australian Strategic Plan, the Strategic Infrastructure Plan for South Australia, and the associated Regional Overview and the Draft Planning Strategy, the South Australian Government has signalled a major change in the way infrastructure is to be planned. A whole of government approach to capital planning will result in project identification and appraisal occurring before funding decisions are made. We commend the South Australian Government on these steps. Further, Engineers Australia commends the South Australian Government and the Local Government Association on the development of an Urban Stormwater Management Policy for South Australia. We urge Government to vigorously pursue the two policy initiatives to improve infrastructure delivery in South Australia.

Recommendations

Engineers Australia recommends the following to ensure that South Australia's infrastructure will meet the needs of future generations.

- The South Australian Government must allocate sufficient resources to identify and seek Federal funds for the provision and maintenance of major infrastructure projects for the State.
- All levels of government must recognise that the amount of funding allocated to the maintenance of infrastructure is insufficient to maintain assets in their current condition, let alone address maintenance backlogs. Therefore, urgent steps need to be taken to budget accordingly.
- The South Australian Government must acknowledge that the State's road infrastructure is deteriorating as a result of inadequate maintenance and must allocate funds to address this backlog of maintenance work.
- Regional corporations should be established by local government to better use available resources, seek funding and prioritise projects.
- As a matter of urgency, local government must embrace asset management strategies to better manage infrastructure taking into account needs, funding, level of service and community expectations and in particular, collection of appropriate data.
- A single Urban Stormwater Authority should be established to control planning and expenditure in stormwater drainage.
- All infrastructure owners, particularly local government, must recognise that good data is essential to the proper management of infrastructure.
- All levels of government should work cooperatively with the private sector to mobilise broader investment sources in the development of infrastructure.

Ratings Summary

The following summarises the South Australian Infrastructure Report Card ratings.

Category	Grade	Comment
National Roads	**C**	The need for more funding under *AusLink* and the high fatality rate on the more heavily trafficked roads reduces the overall rating to **C**.
State Roads	**C-**	The need for increased funding, level of service and safety concerns, and sustainability issues reduce the overall rating on State roads to **C-**.
Local Roads	**D**	Inadequate aggregated data collection, the lack of availability/ reliability of asset management data, and the need for more government funding do not allow a rating of more than **D**.
ARTC Rail Network	**C**	Operational and speed restriction constraints on the Adelaide metropolitan network and Belair line reduce the overall freight efficiency of the network.
Metropolitan Rail and Tram Network	**B-**	Networks appear to be sustainably managed, although some shared sections of the network suffer alignment, speed restrictions, and operational constraints.
Regional Rail Network	**D**	The regional rail network is aged and has many different gauges, which leads to operational inefficiencies except where dual gauges are provided. The network is maintained to a standard to maintain movement of current freight tasks by line operators, however some lines operate at very low speeds due to the track condition and road network interfaces, and other poor linkages to other rail and road networks.
Metropolitan Potable Water	**B-**	South Australia has a relatively secure water source in the River Murray and all of its water supply is managed by one organisation. High volumes of water are required from the River Murray. Overall, the management of the existing assets is sound but the rating takes into account the low level of infrastructure renewal. As a risk minimisation measure, it is considered that South Australia should be looking for alternative sources of water to supplement its reliance on the River Murray as its principal source of water, especially during dry periods.
Non-metropolitan Potable Water	**C**	There are concerns with water supply in rural areas due to quantity and quality issues related to groundwater and changes in demand in a number of locations. These factors are reflected in the lower rating.
Metropolitan Wastewater	**C+**	The existing assets in the urban centres are generally good. Effluent reuse in major urban areas is extensive. The high salinity levels in the older areas of the Adelaide system indicate these assets are in an advanced state of deterioration and more needs to be done to address the problem.

Category	Grade	Comment
Non-metropolitan Wastewater	**C-**	Collection systems are generally in reasonable condition. The treatment systems in many cases, particularly in Septic Tank Effluent Disposal Schemes need significant refurbishment to meet current standards. Land application of treated effluent is commonly practised, but this is more of a disposal avenue rather than true beneficial reuse. The level of water recycling in the non-urban areas seems disappointing given the greater opportunities to recycle water in these regions.
Stormwater	**D**	A lack of planning control during the development of South Australia's major towns and cities has resulted in stormwater infrastructure that is under increasing pressure. Aging stormwater infrastructure and inadequate maintenance needs to be addressed in the short and medium term to budget for the replacement and upgrade of stormwater infrastructure. The focus of incomplete stormwater infrastructure works has been the major stormwater system. There is a need for additional data collection, funding and a coordinated approach to managing stormwater in South Australia. The minor stormwater infrastructure rating for South Australia is C- and the major stormwater infrastructure rating for South Australia is **D-**, resulting in an overall rating of stormwater infrastructure for South Australia of **D**.
Electricity	**B-**	The overall rating for the electricity sector reflects the concerns that the process of achieving and paying for desired local levels of performance in an increasingly national system is not well defined at present and may result in some deterioration in South Australia's future supply reliability.
Gas	**Overall B+**	
	Transmission B+	The need for increased funding of regional gas infrastructure development reduced the overall rating to **B+**
	Distribution A-	Management and the funding regime, including the mandated funding arrangements, are very positive.
	LP Gas B+	The absence of an unloading facility for LP Gas in South Australia is considered a significant negative.

1. Overview

1.1 Background

For some years Engineers Australia has been concerned with the management, funding, and provision of Australia's transport, water and energy infrastructure. In 2000, Engineers Australia published *A Report Card on the Nation's Infrastructure* and published an expanded review in the *2001 Australian Infrastructure Report Card*. Subsequently, Engineers Australia wished to undertake a more detailed, State–based review and commissioned GHD to carry out research and prepare Infrastructure Report Cards for New South Wales (2003), and Queensland (2004). In 2005, GHD was appointed to prepare Report Cards for the remaining Australian States and Territories.

The objectives of the *South Australian Infrastructure Report Card* include:

- Providing a Report Card that is seen as credible, substantiated, reliable and independent by media, government, business and the public;
- Raising awareness of the fact that infrastructure underpins the community's quality of life and that inadequate infrastructure impedes economic and social growth;
- Generating debate on the quality and level of infrastructure provision (which includes condition, distribution, funding and timing) required to meet society's needs;
- Encouraging the implementation of best practice infrastructure provision and management, including adopting total asset management principles, triple bottom line and demand management; and
- Identifying the state of the infrastructure sectors and the challenges facing infrastructure providers.

This report provides a strategic overview of South Australian Infrastructure. It also provides a benchmark, which the community can use to identify need and evaluate alternative infrastructure priorities over time.

1.2 Process

The general purpose of this Report Card is to rate the quality of roads, railways, potable water, wastewater, stormwater, electricity and gas infrastructure. Ratings are based on the consideration of asset condition, asset availability and reliability, asset management and sustainability (including economic, environmental and social issues) and security.

The ratings used are the same as those used for the *2001 Australian Infrastructure Report Card*:

A	**Very Good**	Infrastructure is fit for its current and anticipated purpose in terms of infrastructure condition, committed investment, regulatory appropriateness and compliance, and planning processes.
B	**Good**	Minor changes required in one or more of the above areas to enable infrastructure to be fit for its current and anticipated purpose.
C	**Adequate**	Major changes required in one or more of the above areas to enable infrastructure to be fit for its current and anticipated purpose.
D	**Poor**	Critical changes required in one or more of the above areas to be fit for its current and anticipated purpose.
F	**Inadequate**	Inadequate for current and future needs.

The assessment for the *South Australian Infrastructure Report Card* was carried out through research and consultation. Questionnaires were prepared and posted to asset owners, operators and regulators, followed by interviews where appropriate; documents were researched and analysed; and a summary report was written. Each sector was then assessed using the methodology contained in the Appendices.

In arriving at a rating the concepts of "level of service" and "fitness for purpose" were reviewed for each infrastructure sector. The process was to firstly consider whether "level of service" was defined and how it varied; identify changes or trends or future needs; identify any performance indicators; then assess whether the infrastructure was fit for its current and anticipated service based on these parameters; and finally determine a rating.

The assessment has relied on publicly available information and has, in line with its aims, focussed on strategic issues, supplemented by quantitative performance measures where these were readily available. The South Australia Office for Infrastructure Development provided access to a range of stakeholders involved in the State and Regional Infrastructure Plans and a briefing session was held with them to outline the process and seek their assistance. A number of industry associations were consulted and Engineers Australia provided assistance through its expert panels and groups.

This report, together with the previous Report Cards and associated information, is available electronically on the website http://www.InfrastructureReportCard.org.au

1.3 Significant Issues

In undertaking the investigation, a number of major issues were identified.

1.3.1 Strategic Planning, Co-ordination and Integration

The State Government has recently released the State Infrastructure Plan and Regional Overview, State Strategic Plan and is soon to release the State Transport Plan and Planning Strategy.

These provide some direction on how the South Australia Government could potentially coordinate and undertake long term planning and implementation of strategic infrastructure in a sustainable manner, and have partly been prepared in consultation with local government and other stakeholders. However, there appears to be no clear legislative or strategic framework requiring all levels of government to work together on developing South Australia's infrastructure, and more needs to be done to ensure a coordinated approach.

Similarly, local government either individually or through Regional Local Government Associations has been preparing transport, water and Septic Tank Effluent Disposal Scheme (STEDS) strategies aimed at identifying the infrastructure and associated fiscal needs of regional communities (Eyre Peninsula Central Local Government Region and Murray & Mid Malley Regional Transport Strategies 2003).

The South Australian Local Government Association (LGA) has been very active in promoting policy across the road transport, infrastructure, STEDS and stormwater portfolio areas. It has also been instrumental in introducing an Asset Management Advisory Committee and a parliamentary bill requiring Councils to prepare asset management plans.

While these individual initiatives provide vital information on the plight of various agencies, there does not appear to be any requirement for State, Federal or local governments to develop integrated strategies.

The benefits of a coordinated approach include:

- An increased awareness of the relative importance of the infrastructures;
- The ability to prioritise infrastructure expenditure across the entire State; and
- Improved capacity to work towards overarching goals such as sustainability and security.

The key influences of the current approach require review. The review could assess the available opportunities for coordination, and outline the path towards a coordinated and integrated approach, with a focus on successful implementation. A review should consider the roles of Government (in particular State and local), regulators, and private organisations in supporting decisions that are best suited for South Australia as a whole. A review could also consider the funding processes, ensuring that the funding is approved based upon the priority across all infrastructure within South Australia.

To be effective, such a review needs to incorporate changes in strategies and include long-term (at least 20-year) schedules of works, budgets and trends.

1.3.2 Funding

Funding has been identified as a major issue for South Australia, particularly across the freight transport and stormwater sectors. AusLink and Federal Government funding is inadequate, being based on using road length and population as an indicator of relative road use.

The South Australian Freight Council has said a total of $636 million in AusLink funding is required to put South Australia on an equitable footing with the rest of Australia in terms of freight infrastructure expenditure and maintenance[1].

The LGA's recent submission to the independent inquiry into the *Financial Sustainability of Local Government* indicated that Councils were hamstrung by serious under funding from the Federal and State Governments and an inability to address the shortfall in infrastructure funding requirements through their own revenue raising. South Australian Councils currently spend $55 million per annum on renewal and maintenance programs for roads compared to the $160 million that is required. This backlog is expected to grow to $240 million within ten years.

Under local government STEDS, funding is allocated on a year by year basis, typically limited to $3 million per annum, and is not geared to long term upgrading or replacement.

The current funding shortfall for stormwater replacement and upgrading has been estimated at $200 million.

The key issues are as follows.

Competing priorities and fiscal restrictions on local government

There are numerous competing priorities for limited funds. The difficulty faced by governments and regulators is the appropriate allocation of funds to deliver the required results. One factor that adds complexity to these decisions is the inability to reasonably compare options from different sectors. There are also restrictions on Councils' funding mechanisms through rate pegging and legislative loan borrowing capacity.

Financial provisions for roads, stormwater and STEDS are based on short-term programs

Funding for this infrastructure appears to be geared towards 1–5 year horizons and there is a need for increased funding for maintenance and renewals.

AusLink Funding Commitment Short-term

AusLink funding for transport improvements is only guaranteed for five years with no commitment for ongoing maintenance.

1.3.3 Sustainability

Many infrastructure organisations now incorporate sustainability objectives in their plans. Of the many definitions of sustainability, one of the simplest is from the original Brundtland reports that defined development as sustainable *'if it meets the needs of the present without compromising the ability of future generations to meet their own needs'*[2]. The South Australian Government has developed a sustainability policy that references this in the State Infrastructure Plan.

It is critical for limited resources (such as water and energy), to be managed through conservation, reuse, renewable strategies, and alternative solutions. Funding decisions are increasingly expected to consider the 'triple bottom line' when undertaking assessments of applications.

Federal, State and local governments have a responsibility to drive sustainable solutions. For example, a transfer of road use to public transport delivers some environmental benefits, however this also has substantial impacts upon infrastructure. Good quality strategic planning is critical, taking into account future trends in the prioritisation of works and the approval of funding.

Land use policies must be sustainable in their impact on resources, community and social well being, equity and accessibility. This is particularly important in reducing travel demand.

The absence of long term planning and inadequate funding of maintenance and renewals will create significant problems for future generations.

1.3.4 Security

In recent years, there has been an increase in terrorism in urban areas and addressing terrorist risks has become a priority for the State Government, infrastructure owners and operators. However, the approach through the different levels of government and infrastructure owners in South Australia varies.

For example, the State Government has established a security portfolio within the Department of Premier and Cabinet and has appointed directors in key infrastructure areas, which is a positive step.

Similarly, many State Government organisations and infrastructure owners and operators have undertaken risk assessments and developed strategies for improving security and addressing security incidents.

Local government has been slow to respond and is not well prepared.

The security issues facing infrastructure are comprehensively covered in the report by Engineers Australia titled *Engineering a Safer Australia: Securing Critical Infrastructure and the Built Environment*[3].

1.4 Future Directions

The *South Australian Infrastructure Report Card* has identified and acknowledged some significant successes and policy initiatives, as well as highlighting a number of areas that need to be improved.

Advances have been made in the commitment to sustainability, however the following suggested improvements should be considered:

- A coordinated approach to the provision of infrastructure across all levels of government which incorporates long term strategic planning and funding commitments;
- A concerted evaluation of the existing funding shortfall and the associated implications;
- The development of a pre-emptive recovery program to enable secured future performance of infrastructure;
- Reduced demand, increased reusing and recycling resources, and incorporation of a balanced social, environmental and economic assessment process to determine priorities;
- Enhanced collection, allocation, and analysis of data particularly in the roads and stormwater areas through better definition of level of service and consistent classification of critical infrastructure, and the commitment by all infrastructure owners to provide quality data;
- Long term planning of future works, their maintenance and management, linked to changing community expectations and standards and asset management strategies incorporating overall needs, funding, level of service and community involvement;
- Security issues being given a higher priority; and
- Amalgamation of local government services into regional corporations to better utilise available resources, funding, management and prioritisation of projects.

In addition some specific infrastructure requirements include:

- The provision of one stormwater authority to focus planning and expenditure;
- Increased funding of flood mitigation works and aging stormwater infrastructure replacement;
- Strengthening of gas supply infrastructure in regional areas; and
- Maintaining adequate electrical distribution network performance irrespective of the regulator and for the electrical transmission network to be responsive to the challenges arising from the National Electricity Market (NEM).

2. Roads

2.1 Background

South Australia has approximately 97,000 km of roads, the majority of which are managed by local government.

2.2 Overview

2.2.1 System Description

The road system is divided into National, State arterial (or regional) and local categories, comprising:

- 2,750 km of National highways funded by the Federal Government and managed by the Department of Transport and Urban Planning (DTUP);
- 9,470 km of State arterial roads managed by DTUP (910 km urban, 8,560 km rural);
- 100 km of local roads managed by DTUP;
- 75,000 km of local roads (80 percent unsealed) managed by local government, funded by both local ratepayers and Federal road assistance grants (10 percent urban, 90 percent rural);
- 10,200 km of unsealed roads outside of Council boundaries that are managed by the State to service outback destinations, National Parks and Aboriginal communities;
- 12 ferry crossings on the River Murray managed by DTUP to provide linkages to the rural arterial road network; and
- The Adelaide — Modbury O'Bahn also managed by DTUP

2.2.2 Governance

All roads in South Australia are vested in local government under the *Local Government Act*. However, under the *Highways Act*, the Commissioner for Highways has responsibility for certain roads. The *Motor Vehicles Act* and a raft of other Acts regulate the control and maintenance of roads.

Funding for overall management of roads, including planning, design, construction, maintenance, and operation is the responsibility of Federal, State, and local government authorities, and to a much lesser extent, the private sector.

The Federal Government has sole financial responsibility for the National Highway System. It also funds:

- Road safety improvements throughout the whole road network through the Black Spot program;
- 'Roads of National Importance' (RONI) program jointly with the States;
- Untied grants to State and local government authorities; and
- Local roads under the 'Roads to Recovery' Program;

DTUP is responsible for the funding and management of State highways and State arterial roads, and shares funding and management responsibility for urban arterial/regional roads. Local government is responsible for funding works within verge areas beyond the main carriageway.

Local Government is primarily responsible for the funding and management of local roads.

In the unincorporated regions of South Australia, DTUP, National Parks and Aboriginal communities are responsible for the management of regional and local roads[4].

Special cycleway projects have specific construction grants allocated towards them through a shared arrangement between DTUP and the Council, generally 50/50.

Private sector consortia are being asked to take responsibility for ongoing maintenance of some key assets under design and construct arrangements for up to 10 years in contracts such as the Port River Expressway and Mawson Connector.

The LGA has an overall policy framework for local government and an overarching policy framework for funding of local government infrastructure and setting of rates. The LGA has established an Asset Management Advisory Committee and the LGA is seeking legislation to require local government to develop asset management plans.

Regional Local Government Associations have been established to represent the interests of, and oversee infrastructure studies for groupings of rural councils in regional areas. They do not have a direct governance role in infrastructure or asset management.

Associations such as the Royal Automobile Association, the South Australian Freight Council, and the Committee for Adelaide Roads represent the interests of motorists and the freight industry and undertake studies to promote their members interests in road issues.

The Office for Infrastructure Development, reporting to the Economic Development Board, has released State and Regional Infrastructure Plans that prioritise road projects to be funded over the next five years and identify the agencies responsible for their delivery. The Office for Infrastructure Development will be responsible for driving the implementation of the plan and the Economic Development Board will monitor implementation progress. The Office for Infrastructure Development is currently developing the next 20 priority projects.

2.2.3 Sector Trends

Federal Funding

Additional funding has been announced from the Federal Department of Transport and Regional Services (DOTARS) under the Federal Government reform, *AusLink White paper: Building our National Transport Future (AusLink).*

Under *AusLink*, the Federal Government has allocated $239 million to South Australia over four years for strategic projects and a further $72.4 million for local government under the Roads to Recovery Program, with no commitment beyond that period[5].

In their response to *AusLink* in February 2003, the various South Australian transport agencies and local government note that current funding for roads, on a per km and population basis, has decreased substantially in real terms from 1995–96 due to Federal funding cutbacks.

State and Local Government Funding

State expenditure on road maintenance in 2003–04 was $74.3 million, with $63.2 million budgeted in 2004–05. This is similar to 2001–02 levels.

The current maintenance backlog for State roads is estimated at $160 million, with a similar amount for local government roads[6].

Change in Governance

The State government has recently restructured its transport and planning portfolios and has created a new Department of Transport, Energy and Infrastructure. This department will have carriage of road, transport and infrastructure issues from 1 July 2005.

Spending on local government road infrastructure

The 2001–2002 National Report on Local Government[7] recognises that local government capacity to fund infrastructure is constrained by its general revenue raising capacity. Most revenue comes from rates and loans, supplemented by Federal Government financial assistance grants.

The LGA's *Wealth of Opportunities — study into infrastructure asset conditions in South Australia*, estimates that a four fold increase in current renewal spending is required immediately and would need to be sustained beyond a 40 year period to meet projected renewal funding requirements[8].

The study highlighted that local government currently expends $55 million per annum on maintaining and renewing its assets, with roads comprising between 51–66 percent of expenditure in regional and Adelaide metropolitan areas and 70–80 percent in rural areas respectively, even though funding from grants represents less than 20 percent of total revenue.

In an attempt to address this, $26.25 million in supplementary funding will be released over the next three years under *AusLink*, however this is still inadequate.

The LGA has written to both the Federal Minister for Transport and the Prime Minister, stating that South Australia has 11 percent of the national local road length and 7.7 percent of population. This means that current grant funding of 5.5 percent should increase to 9.4 percent based on using road length and population as an indicator of relative road use.

Freight Task in South Australia

Up to 116 million tonnes of freight per annum is moved in South Australia.

It is estimated that South Australia roads are used in approximately 75 percent of all freight movements. Work undertaken by the Bureau of Transport and Regional Economics shows that since 1984, inter-State road freight flows have increased at a rate 1.5 times the growth rate of the Australian economy. Assuming that past trends continue, the freight task in South Australia is estimated to double by 2020 in terms of tonnes carried[9].

The South Australian Freight Council has developed a list of high and medium priority road infrastructure projects with an overall cost of $2.4 billion to address the State's freight demands based on triple bottom line and South Australian Freight Council 's core principles and policy issues. It has also suggested a total of $636 million in *AusLink* funding is required to put South Australia on an equitable footing with the rest of Australia in terms of freight infrastructure expenditure and maintenance[10]. These projects include: Port River Expressway Stages 2 and 3, Sturt Highway extension, Adelaide North-South corridor development; Riddoch Highway expansion and duplication; accelerated maintenance of the road freight network; Eyre Peninsula grain transport system; Adelaide inner and outer ring route completion; and Dukes Highway duplication.

The South Australian Government also identified a number of key projects in its submission to the Australian Government Infrastructure Taskforce in May 2005.

Community Expectations for Levels of Service

Improving the amenity and condition of existing local roads and accessibility between settlements is a significant issue for local communities. Community opposition in Adelaide metropolitan areas to road widening and provision of new roads is a constraint forcing a more sustainable transport solution.

This is being addressed in rural and regional areas through the preparation of regional transport plans that have focused on upgrading and maintaining identified strategic road corridors to achieve significant regional economic and social benefits.

Demand Reduction

The annual cost of congestion in Adelaide was estimated to be $0.8 billion in 1995 and is expected to be up to $1.5 billion in 2015 if measures are not taken to avert this result[11]. It is estimated that half of these congestion costs are related to recurrent delays arising from road network capacity issues, and the remainder due to incidents such as vehicle breakdowns and accidents.

Continuance of current private vehicle trips in Adelaide is unsustainable and a greater use of public transport through land use policies should be encouraged.

The Bureau of Transport Economics (now the Bureau of Transport and Regional Economics) notes that to be effective in addressing congestion and the environmental impacts from traffic, policies designed to affect city transport must target road travel directly.

DTUP promote a reduction in the number of vehicle trips by encouraging public transport usage and better land use strategies, which reduce the demand for trips.

Project Delivery Methods

In other States of Australia, a growing number of road projects are being delivered through alliancing and Public Private Partnership (PPP) contract methods as a means of changing the payment and risk profile, and have proved beneficial.

Alliancing and PPPs are not formally established in South Australia as a means of delivering road projects. However, in recent years, some regional councils have submitted joint funding submissions to the South Australian Local Government Grants Commission for roads located on municipal boundaries.

DTUP have introduced 'design, construct and maintain' delivery methods on selected strategic projects such as the Port River Expressway and Mawson Connector, and is considering possible alliance contracts for the South Road Tunnel project.

There are opportunities under the *AusLink* framework to establish private/public alliances for strategic projects.

Tourism

The South Australian road network is used by a large number of domestic tourists, particularly from Victoria and NSW, most of whom use the national highway and rural arterial road network as well as recommended tourist trail routes. A small number use the 4WD unsealed network within the Flinders Ranges/Gammon Ranges region and elsewhere in the outback.

Australian domestic tourism forecasts anticipate growth of 20 percent over the ten year period 2002–2012 or 1.8 percent per year[12].

The *South Australian Tourism Plan 2003–2008* aims to increase visitor expenditure by 47 percent by 2008 through increased visitor numbers and length of stay. This will necessitate safe and well-maintained road access to key tourist destinations.

Provision of Safe Cycleways

In addition to the provision of suitable road systems, the provision of safe cycleways is now a standard policy requirement for any new development and road upgrade works. Bicycle Plans are developed to connect major hubs of activity, tourist areas, community centres and transport nodes. The use of bicycles is seen as an alternative private transport mode to not only alleviate the reliance on private motor vehicles but also to achieve health and environmental benefits.

Intelligent Transport Systems

Technology such as variable speed signs, real time passenger information systems, pedestrian microwave sensors, and video detection systems at signals are already in place in some locations in Adelaide. Opportunities exist for increased application on key road infrastructure projects.

Future applications include possible tidal reversible lanes in peak periods, traveller information signage, and incident management systems as a means of reducing congestion and affording safer travel.

2.3 Evaluation

2.3.1 Level of Service

For a road network, level of service typically refers to safety performance, the degree of congestion (which directly impacts on travel times), and the condition of the network.

Depending upon various factors such as usage and strategic importance, higher levels of service will be required for some parts of the network compared to others, particularly along urban arterial commuter routes.

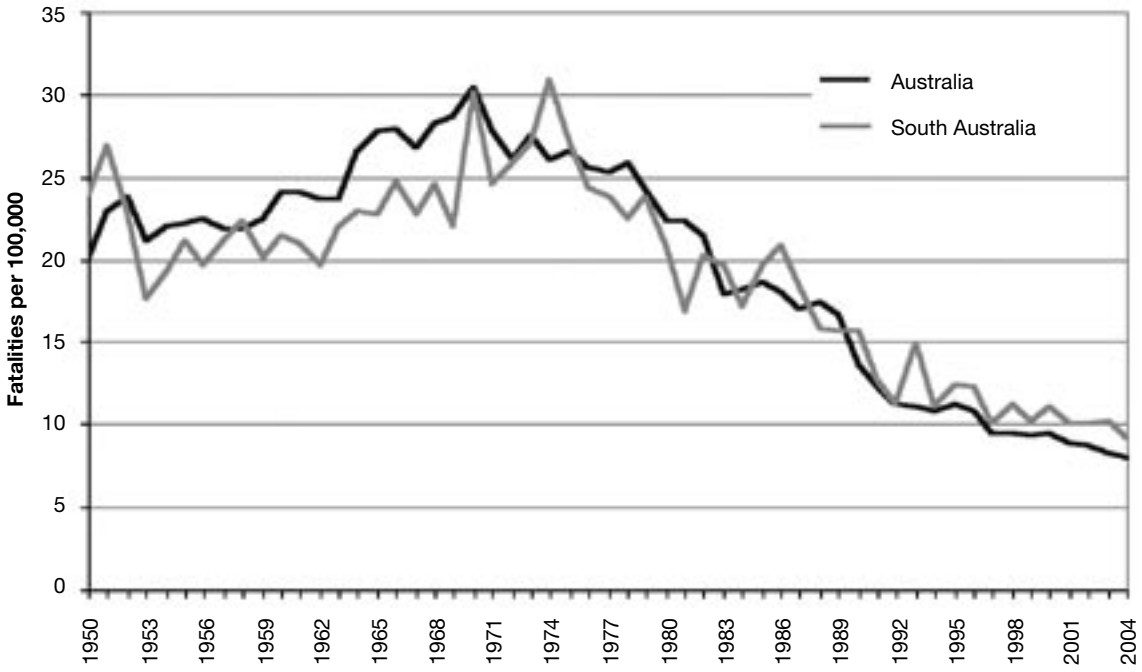
Safety Performance

DTUP regularly reports on and monitors accidents against a number of indicators including age, gender, fatalities per 100,000 population, accident type, and benchmarks these against other States and countries.

In 2002, the total cost of road crashes in South Australia was estimated at $1 billion, of which there were 154 fatalities (11 fatalities per 100,000 population). The fatality rate has again risen in 2005 with 52 fatalities to end of April compared to 41 for the same period in 2004, a 27 percent increase.

The fatality rate trend since 1950 for South Australia compared to Australia is shown in Figure 1.

Figure 1: SA Annual Fatality rate per 1000 population vs national average



Source: Department of Transport and Urban Planning

Of the 2004 fatalities, 52 percent were on regional roads and 41 percent involved collisions with fixed objects.

South Australia's current fatality rate on a per capita basis is 15 percent worse than the national average and is currently ranked 6th compared to all other Australian States and Territories. It has remained higher than the national average since 1992. It is 82 percent higher than the 2010 national target, and 35 percent worse than the UK average, but similar to the median of OECD countries.

The South Australian Government's strategy target is to halve the number of fatalities and serious injuries by 2018, based on 2002 figures, with a 44 percent reduction in fatalities by 2010. Such a reduction target is too low, particularly with an increasing fatality rate in 2005 and given there are current suggestions that there should be a zero tolerance level to road fatalities whereby one fatality is socially unacceptable.

Convenience of Travel

Transport SA, the project delivery unit of DTUP, has been measuring and monitoring travel times in morning and evening weekday peak and business peak periods (11 am–2 pm weekdays) on key Adelaide urban arterial corridors for the past five years. Average speeds during am and pm peaks on the main commuter corridors have continued to decline to below 30 km/h, which is approaching 'level of service' (at capacity), resulting in some diversion of traffic onto lower order roads.

Once the level of service has become sufficiently low, vehicle diversions ("rat runs") through residential streets become commonplace.

The Committee for Adelaide Roads, the Royal Automobile Association, the South Australian Freight Council and local government have extensively lobbied the State Government for measures to address this issue.

The population in metropolitan Adelaide exceeded 1,060,000 in 2004 and the State Government *Strategic Plan* has set a State population target of 2,000,000 by 2050. This is an increase of 400,000 people in the State over a 45 year period (80 percent within the Adelaide metropolitan area),, that will have a further impact on travel times.

The Committee for Adelaide Roads in particular has been pushing for an alternate north-south freight link involving grade separation of South Road at all key intersections to improve road freight efficiency. There is currently no dedicated north-south freight route between Cormack Road and the Southern Expressway that is uncongested.

The State Government *Infrastructure Plan* has made provision for grade separation of part of the route. Main North Road between Angle Vale turn off and Gepps Cross has similar problems and carries the majority of road freight movements from the Barrier and Sturt Highways. An alternative alignment known as the Sturt Highway Extension is currently being investigated for the purposes of defining a preferred alignment and associated land acquisition requirements.

The South Australian Government's aim is to look at more sustainable forms of transport such as increased public transport usage on the other corridors rather than capacity upgrades.

Increased application of intelligent transport systems, including a greater roll out of real time passenger information systems, may be required to encourage more confidence in, and usage of, the public transport system. The use of tidal illuminated lanes would also improve travel times and reduce congestion costs on urban roads.

Road Condition

Transport SA measures the roughness and skid resistance of National highways and other State roads and regularly reports these against roughness indicators provided in Austroads for Smooth Travel Exposure (STE), a National Performance Indicator.

Roughness is accepted around the world as an indication of ride comfort and of the general condition of the road surface.

Roughness level indicators vary according to the function of the road.

A perusal of Transport SA's 2004–2005 STE results indicates that the roughness levels according to classification and vehicle kilometres travelled are within acceptable limits, however the roughness on the State rural network has increased compared to previous years. The roughness on the National and State urban road network has remained consistent.

DTUP also collects traffic volume and vehicle axle data, and conducts drive-through condition assessment inspections annually on selected routes. It records this on its asset management system and registers, traffic information management system and pavement management system.

Registers covering traffic signals, road lighting, bridges/culverts and earthworks are also provided.

For State regional / arterial roads contractors engaged under five year term routine and periodic maintenance contracts, record defects against performance standards and intervention is effected in accordance with prescribed schedules.

For local roads, pavement defects are reported randomly by field staff and road gangs for placement on a maintenance program or for immediate intervention.

Very few rural councils have an asset management system or undertake routine inspections.

Community Expectations

The Royal Automobile Association undertakes regular surveys of road users and members and has itself undertaken audits of the road network.

Based on the survey, key community expectations include:

- Reducing rough road surfaces;
- Providing more rest stops on country highways;
- Providing more overtaking lanes and sealed shoulders; and
- Reducing peak period travel times on the key Adelaide arterial roads.

2.3.2 Asset Quality

Based on the findings of regional transport strategies and the LGA *Wealth of Opportunities Study*, the rural local road network is generally in poor condition. The majority of areas have unsealed pavements trafficked by increased heavy vehicle movements resulting in accelerated distress. This, coupled with the Royal Automobile Association user surveys, identifies that the local rural road network requires urgent attention through increased funding and improved asset management strategies.

The National network appears in reasonable condition, based on the Transport SA STE 2004–05 report to Austroads, which indicates that the National network is no longer in decline in terms of roughness. It is also being progressively upgraded through improved riding quality and safety measures.

The highly trafficked Dukes Highway east of Tailem Bend, the undivided sections of Sturt Highway and Highway 1 north of Port Wakefield and Riddoch Highway, all feature highly in regional fatalities. An overtaking lane and surface improvement strategy has been developed and is being implemented, but is constrained by Federal funding. The South Australian Freight Council has suggested the duplication of the Dukes Highway to the Victorian Border, Riddoch Highway and Highway one to Port Augusta.

The *State Infrastructure Plan Regional Overview* recommends the duplication of the Sturt Highway from Gawler to Nuriootpa, along with safety and alignment improvements further east. Transport SA is also developing a bypass solution for Truro.

The above National highway safety improvements need to be accelerated.

The State urban arterial network is generally in reasonable condition with selected level of service improvements and new linkages planned or completed along key freight routes (Port River Expressway Stage 2, South Road grade separation at Anzac Highway and Port Road). However, pavement condition, lack of kerbing, and capacity issues remain concerns.

The rural arterial network is in fair condition with some sections of the network (such as the Victor Harbor and Cape Jervis Roads, the Warnertown — Jamestown and Loxton-Murray Bridge roads and Main North Road to Clare and Barossa Valley Way in the Barossa Valley), suffering poor alignment, high fatality rates,

lack of overtaking opportunities, poor ride quality and high usage of heavy vehicles. The Transport SA 2004–05 report to Austroads indicates that the State rural network has declined in terms of roughness compared to previous years.

The ferries providing access across the River Murray are aged and a refurbishment program is under way to ensure continuous access is maintained.

Sections of the 10,000 km of unsealed outback road network can become un-trafficable in wet weather and strategies are proposed to ensure reasonable access is maintained.

2.3.3 Sustainability

An improved asset management system and availability of reliable traffic and condition data, would enable the local road network to be managed more sustainably. Proposed State Government Asset Management legislation will assist local government in better managing its road assets.

The Draft *Transport Plan* has several strategic policies guiding the State's adherence to sustainable asset management principles, including a focus on the State network towards safety improvements and more sustainable forms of transport, particularly in the Adelaide metropolitan area. The level of service on some Adelaide arterials continues to reduce, resulting in increased greenhouse gas emissions.

The National network will continue to facilitate local inter-State and intrastate freight movements. However, the predicted increase in freight will place more emphasis on more sustainable forms of freight transport, such as rail, in order to reduce the rate of wear on the road freight network. State Government strategies appear to be geared towards this.

The State Government proposes to develop an *Outback Road Access Plan* to focus investment in targeted areas on the outback road network it maintains.

The DTUP's sustainability framework is currently embraced in the *Environment Strategic Plan 1997*. The *Transport Environment Action Plan 2005–2010*, *Green Print SA 2003* and the *State Strategic Plan* will replace this.

There appears to be an increased use of recycled pavement materials on National, State and local roads as a means of reducing dependence on, and the environmental impacts of, extracting virgin materials.

2.3.4 Security

The State Government is well advanced in the identification of security risks to its assets and has appointed a Director of Transport within the Department of Premier and Cabinet to oversee the drafting and implementation of a security strategy.

Measures are already in place to protect Adelaide's traffic signal intelligent transport systems and the Heysen Tunnels.

The LGA is considering regional security plans for protection of regional local government assets.

2.3.5 Funding

The maintenance backlog and capital expenditure requirement in South Australia for State and local government roads exceeds the funding available from all government sources. Funding commitments from DOTARS appears to be insufficient. Local roads in particular require a four-fold increase in expenditure immediately to address the backlog and a 25 percent increase in maintenance spend for a period of ten years[13].

NSW and Victoria have developed privately funded toll roads to overcome lack of government funds. Similar options could be considered in South Australia to enable private sector investment in the future.

The State Government, LGA, the South Australian Freight Council and the private sector are assessing ways of increasing South Australia's funding share and have jointly submitted several high priority projects to DOTARS for consideration that are over and above those announced through the *AusLink White Paper* and *State Infrastructure Plan*.

2.4 Future Directions

The South Australian Government, in April 2003, released South Australia's Draft Transport Plan *Towards a Sustainable Transport Future*[14] and a draft *Planning Strategy*, and in 2004 released its State Strategic Plan.

The South Australian Government, on 8 April 2005, released a *State Infrastructure Plan* outlining key road infrastructure upgrade requirements and a list of priority projects for the next five years along with lead agencies responsible for implementation. A *Regional Review Plan* was released on 5 May 2005[15].

The *State Infrastructure Plan* and *Regional Overview Plan* are linked to the above documents. However, the final Transport Plan has not yet been released. The planning strategy is currently with stakeholders for comment.

The development of the above plans is encouraging, however long term commitment to projects over a 20 year period and a focus on strategic local roads needs to be included.

Initiatives to reduce private vehicle usage and congestion, and to reduce greenhouse gases (including demand management, mode shifts and more efficient road infrastructure) are necessary in the Adelaide metropolitan area. It is noted that public transport projects such as the Glenelg Tram upgrade and extension, and the improved provision of bus services is increasing patronage and reducing demand on private vehicle usage.

2.5 Report Card Rating

Based on recent improvements or no decrease in **condition**, a rating of **B-** can be justified for Urban National highways and **C+** for rural National highways. Based on declining roughness on State urban and rural roads, a rating of **C** can be justified for these roads. Based on the findings of the regional transport strategies, an overall condition rating of no more than **C** for urban and **D** for rural roads is appropriate.

In relation to community expectations in **level of service**, a rating of **C** for urban and rural National highways is appropriate based on the results of the Royal Automobile Association and DTUP surveys. However the high fatality rate warrants **C-**. A rating of no more than **C-** for Adelaide metropolitan arterial roads and local roads is considered appropriate, because of the saturation levels and increasing travel times during peak periods. A rating of **D** for rural local roads is considered appropriate.

The rating for **asset management** is rapidly improving for State roads and National highways and a rating of **B** is considered appropriate, but a rating of **D** for regional local roads because asset management and condition is poor. The proposed compulsory implementation of Local Government Asset Management Plans is positive.

Asset knowledge in relation to urban and regional local roads varies widely between Councils and a **C-** and **D-** rating respectively is warranted. The major action necessary is more consistent data collection, analysis and reporting, to support more effective strategic management.

For **sustainability**, a rating of **C-** may be warranted with environmental aspects improving. However, a number of significant issues remain, including greenhouse gases and traffic congestion. Social/ community aspects vary, with poor access to public and community transport particularly in regional areas still a problem. The major concern relates to the adequacy of funds to provide infrastructure to an appropriate level for the future.

Due to the need for more funding by both the State and Federal governments; the large maintenance backlog; the high car dependence; and high fatality rate; a rating of **D+** is appropriate for urban National highways, State roads and rural local roads, and **C-** for other roads.

Overall Rating for Road Infrastructure

The overall rating was developed by a consolidation of the above issues.

National Roads are rated **C**, based on the need for more funding under AusLink and the high fatality rate on the more heavily trafficked roads.

State Roads are rated **C-** . The rating is based on the need for increased funding, level of service and safety concerns, and sustainability issues reduces the overall rating.

Local Roads are rated **D**. Inadequate aggregated data collection, the lack of availability/reliability of asset management data, and the need for more government funding does not allow a rating of more than **D**.

2.6 Case Study

The Central Local Government Region Challenge

The Central Local Government Region of South Australia Inc, commissioned a regional transport strategy in June 2002 to investigate transport requirements and identify future infrastructure needed to meet those requirements. The region represents 15 Local Government Areas ranging from Barossa in the south, York Peninsula in the west, the Flinders Ranges in the north, and Peterborough in the east.

The Study, completed in March 2003, concluded the following:

- The estimated replacement cost of all local roads in the Central Local Government region involving 27 percent of the incorporated area of the State was $403 million;
- Current annual expenditure for road upgrading was $16 million, compared to a regional spend need of $48 million immediately to reduce the maintenance backlog;
- Government grants accounted for only 20 percent of the total road spend;
- The region has 26,630 km of local roads, of which 92 percent are unsealed;
- Traffic data was not available on 90 percent of the local road network and very few Councils have an asset management system or use a consistent road classification system;
- Many of those roads were used by heavy vehicles, and most Councils did not have the tools or finances to capture traffic data or to conduct pavement condition assessments; and
- Because of the large disparity between available and required funding and the difficulty in capturing asset data on 22,630 km of road so as to reduce the total network upgrading and maintenance burden, it was recommended that maintenance effort be focused on 30 percent of the local road network (identified as strategic in terms of function and classification). A regional asset management approach whereby a regional body was established to oversee the capture of critical data and assessment of maintenance and upgrade priorities was also adopted.

3. Rail

3.1 Background

There is 5,000 km of rail line in South Australia, including 240 km for the metropolitan train and tram network, comprising a range of gauges managed and maintained by government organisations and various private operators.

3.2 Overview

3.2.1 System Description

The Australian Rail Track Corporation (ARTC) manages and maintains 40 percent of the network comprising part of the national standard gauge rail network.

The State Government manages approximately 15–20 percent of the network, comprising the broad gauge Adelaide metropolitan, south-east and heritage lines.

The remaining 40-45 percent of the network is owned or leased by a variety of organisations operating on a range of standard, narrow and broad gauge lines.

The Tarcoola-Alice Springs line is maintained and operated by Freight Link Pty Ltd under a 99 year lease agreement.

3.2.2 Governance

The Commissioner for Highways is the railway regulator covering all railways in South Australia, including ARTC controlled assets.

The Minister for Transport owns most rail assets other than the ARTC and Freight Link networks and leases lines to private operators (typically on 15 year + 15 year terms) who assume all responsibility for maintenance and operation.

The Essential Services Commission regulates TransAdelaide's operations and sets pricing and access regimes under the *Rail Operations Act*.

ARTC sets access conditions for its network and maintains its asset through period maintenance sub-contracts. It also administers private rail siding agreements with private rail siding and rail terminal proponents. DTUP have a policy of advising on and facilitating private rail sidings. DTUP operates public transport under the *Passenger Transport Act* and has an obligation through the Office of Public Transport to assist in railway Park and Ride car park schemes.

TransAdelaide owns and maintains the metropolitan broad gauge rail network and standard gauge tram network. Some platforms and environs are maintained by community volunteers.

The Australian Railroad Group (ARG) operates on and maintains the majority of the regional railway networks. It also has a 50 year lease on closed lines, but under lease conditions, cannot upgrade those lines. NRG Flinders operates and maintains the Leigh Creek coal line.

OneSteel own and operate a narrow gauge line between Iron Duke and the Whyalla steel mill.

DTUP part lease the Wallaroo-Snowtown, Peterborough and Limestone heritage lines to private operators.

The Department of Environment and Heritage owns the Pichi-Richi and Steam Ranger Tourist Railway lines and leases the track to private operators.

3.2.3 Sector Trends

Public to Private Operators

There appears to be a trend towards increased competition for the provision of rail freight forwarding services and the provision of additional rail sidings to service major metropolitan and regional industries.

Planning

AusLink, the Draft *State Transport Plan*, *State Infrastructure Plan*, and *Planning Strategy* all highlight integrated land-use planning in terms of planning urban and regional communities and rail infrastructure.

Investment in Urban Rail

The State Government is committed to increasing usage of public transport as a means of encouraging more sustainable forms of transport and increasing the safety of users crossing or using its network and rail is included in this list.

Key projects and initiatives to support this include:

- Mawson Lakes rail bus interchange;
- Glenelg Tram corridor infrastructure and tram upgrade;
- Extension of Glenelg corridor from Victoria Square to Adelaide Railway station;
- Oaklands Rail bus interchange;
- Feasibility study into extension of the Noarlunga rail corridor to Seaford;
- Provision of additional rail cars during peak demand times;
- Increased security on trains and at stations;
- Increase provision of Park and Ride facilities at railway stations and tram platforms;
- Increased accessibility to persons with disabilities;
- Increased compliance with timetables;
- Improving rail safety at level crossings (Provision of painted markings and road corridor measures to discourage queuing across level crossings) and upgrading pedestrian crossings to increase pedestrian observance of oncoming trains;
- Investigation of electrification of the Adelaide metropolitan rail system to provide faster trains;
- Encouragement of future land development adjacent to public transport corridors;
- Operational upgrade of the Adelaide — Wye Junction — Goodwood section of track;
- Upgrading of bridges and structures; and
- Completion of replacement of the centralised Train Control Centre.

The Federal Government has historically provided little funding for planning, policy and funding of vital urban facilities and has viewed funding of urban rail infrastructure as a State responsibility.

The DOTARS *AusLink* initiative has not funded any urban passenger rail projects. However, it is contributing towards the Port Adelaide and Outer Harbor rail freight links. A direct benefit will be the removal of freight traffic from a portion of the TransAdelaide network at Port Adelaide.

Investment in Rail Freight Infrastructure

The rail network in South Australia carries an estimated 18.7 million tonnes of freight per annum or 17.6 percent of the total South Australian freight task. The composition of this annual freight share is as follows:

- Inter-State — 4.8 million tonnes;
- Regional and Adelaide — 1 million tonnes;
- Region to region — 12.9 million tonnes.

The South Australian Freight Council has prepared a list of high and medium priority rail infrastructure projects for consideration by Government to address the State's freight demands based on triple bottom line and the South Australian Freight Council 's core principles and policy issues[16].

These projects include: Port River Expressway Stage 3, Eyre Peninsula grain rail system; rail intermodal terminals in key areas, upgrade Adelaide-Melbourne line to double stacking and 1800m long train capacity, upgrade South East regional lines and Adelaide rail bypass between Murray Bridge and Pt Wakefield.

This freight task is expected to at least double within the next 20 years, assuming that the current modal share is maintained. However, based on *AusLink* strategies, the modal share to rail is expected to be greater.

Neither DOTARS nor ARTC have announced major funding towards upgrading of the South Australian rail freight network with the exception of $80 million in *AusLink* funding towards the Port Adelaide and Outer Harbor rail freight links, and a $10 million annual maintenance allocation generated from user charges and access fees. ARTC are developing their list of projects for consideration under the next five year round of *AusLink* funding.

The *Regional Transport Strategies* and *State Infrastructure Plan* have also identified the need for additional regional intermodal facilities to address the anticipated freight increases.

The Adelaide-Melbourne line is considered by ARTC to have the greatest potential for freight share growth and they are investigating the feasibility of double stacking. However, the cost of upgrading the Melbourne-Adelaide corridor to double stacking capability is considered a major constraint due to the number of bridges and tunnels requiring clearance improvements. An alternate alignment proposal west of Murray Bridge via Truro and Gawler mooted some years ago has received recent community support in view of recent derailments between Blackwood and Glenalta in the Adelaide Hills. ARTC is considering its merits.

There is a trend to more private sector and/or joint government private sector investment into railway infrastructure, particularly with private rail sidings.

ARTC have a general philosophy of not allowing new 'at grade' level crossings over its network, except when replacing existing level crossings. In most cases, new grade separated structures are provided, with no support provided in the section of corridor maintained by ARTC.

Regional Rail Network

Studies and workshops involving various stakeholders including DTUP, the South Australian Freight Council, local farmers, ARG and ABB Grain have identified impediments on the Eyre Peninsula relating to the efficient movement of grain to Port Lincoln for export. These impediments relate to safety and operational aspects on the rail network and the road interfaces.

The Angaston-Port Adelaide Penrice radial line via the Barossa Valley services a single commodity and has no linkages with other regional rail corridors. Standardisation of the track and linkage with the Roseworthy — Kapunda line is considered an important upgrade to improve the line's operational efficiency.

The *State Regional Infrastructure Plan* supports the development of an intermodal hub at Angaston and standardisation of the line would support this. There has been considerable debate on upgrading and re-opening the Mt Gambier-Wolseley line despite State Government and private attempts towards track standardisation and upgrade.

The South Australian *Infrastructure Plan Regional Overview* has identified a number of high priority regional rail initiatives including:

- Working with the Victorian Government to facilitate the use of rail to transport freight from the South East to Portland (VIC) and identify a preferred site for a regional intermodal facility;
- Upgrading the rail network and supporting road freight routes on Eyre Peninsula to support the entire supply chain as identified above;
- Evaluating options for accessing the main railway line to transport minerals for processing from the Gawler Craton;
- Evaluating options to augment transport services for expanded operations at Olympic Dam including rail;
- Consideration of a rail intermodal facility at Port Augusta; and
- Investigating the strategic need to upgrade transport infrastructure to support mineral sands mining in the Murray Mallee Region (particularly existing rail infrastructure).

3.3 Evaluation

3.3.1 Level of Service

Performance and Reliability

The performance of railways and light rail is mostly defined in terms of compliance with the *Rail Safety Act*, Codes of Practice, and compliance with key operational performance indicators as set by the operators or regulators.

The main key performance indicators for infrastructure typically include:

- On time running;
- Delays to transit times (speed restrictions, percentage of track under temporary speed restriction and service disruption due to asset failure);
- Percentage of healthy and unhealthy trains (ie trains running within 15 minutes of schedule over entire journey);
- Track and structures condition and capacity;
- Integrity of inspection systems, asset register and data management systems; and
- EPA compliance in terms of wheel noise.

ARTC

The focus and targets for ARTC are as follows:

- 98 percent of healthy trains exiting the network on time; and
- Time loss on network <2 percent based on 1 percent of track under speed restriction.

The performance achieved in 2003 was:

- 97.2 percent of trains exiting on time;
- On time exiting from terminals on to the ARTC network was 53.7 percent largely due to loading and unloading delays within terminals; and
- 80 minutes loss on the South Australian network as measured against the <2 percent KPI.

Line speeds through the Adelaide metropolitan area are typically 40–50 km/h. The Islington Freight Terminal and Dry Creek to Outer Harbour lines have restrictions of 10 km/h and 25–30 km/h respectively largely due to the large number of junctions with the metropolitan rail network, and freight terminals and large numbers of level crossings with poor sight distance.

Such line speeds are inconsistent with business demands and lines need upgrading to improve performance, however some projects such as the LeFevre Peninsula corridor upgrade are under way to address this.

The Adelaide-Melbourne line from Goodwood to Nairne has a line speed of 50–60 km/h and a 5,000 tonne train weight restriction largely due to the steep grade and low radius curves. This reduces performance of the freight system.

The Goodwood-Belair section of the Melbourne — Adelaide line also suffers the following performance and environmental problems:

- Signal delays at the Goodwood junction when waiting to cross the Noarlunga suburban line, which can cause trains to extend past the Cross Road rail level crossing delaying vehicular traffic;
- Recent non track related derailments in two concurrent years, causing significant network delays and disruptions of up to one week to Melbourne-Adelaide bound rail freight and passenger services; and
- Severe wheel noise, leading to community complaints.

The Crystal Brook-Broken Hill Line requires 25 tonne axle load capacity and 90 km/h operating speeds and uninterrupted service for 1800 metre long trains. Some structures are being upgraded to accommodate this and crossing loops are being extended to improve efficiency.

Measures to address the above issues are being progressively implemented as funds permit under ARTC's maintenance contract arrangements.

TransAdelaide

The Office of Public Transport measures performance against 12 Key Performance Indicators (KPIs) and TransAdelaide must meet 10 of these to retain its train operational contract[17]. Key KPIs include:

- Speed restrictions due to track condition;
- Faults;
- Late and early arrivals of trains, trams and buses;
- Number of signal faults per month;
- Greenhouse gas emissions;
- Customer satisfaction level; and
- Track and infrastructure condition index as measured against its own Code of Practice, which is linked to the National Code.

Heavy fines apply for late or early train arrivals and customer surveys are undertaken to determine demand for additional rail cars and improved timetabling.

Relevant performance results as reported in the Office of Public Transport 2003–04 Annual Report were as follows:

- Growth in tram and train patronage — 4.8 percent on the previous year;
- Customer satisfaction — 93 percent satisfied, 7 percent dissatisfied;
- Signal faults — 50/100 per month; and
- Greenhouse gas emissions — 35,606 tonnes pa.

It is noted that some railway lines such as the Belair line have a high incidence of late running trains or inadequate rail car capacity at peak times. The line also suffers from being a single track with several crossing loops and steep grades, which affect the speed performance of trains particularly in wet weather. The rolling stock comprises diesel rail cars, which are reported to be slower than electrified trains.

Delays to trams on Jetty Road, Glenelg remain a concern.

ARG

Performance is measured in relation to tonnage of freight moved on each line against weekly targets, on time arrival and departure, and total temporary speed restrictions on the network resulting in actual speeds being > 85 percent of the agreed operating speed.

Demand for increased service is determined through regular operational meetings with existing customers and business development initiatives to attract new customers.

ARG aim to maintain current levels of business.

NRG Flinders

NRG Flinders operates a daily single coal train service between the Leigh Creek mine and the Port Augusta Power Station.

The network has suffered from numerous derailments in the past and associated delays. Trains also operate at a low speed.

Operational inefficiencies occur at the coal pit due to the requirement for a 7 km road haulage from the active coal face to the rail loading area.

Track Condition

TransAdelaide Network

TransAdelaide undertakes manual inspections on a monthly basis, track recording quarterly, ultrasound assessment annually, rail wear sampling on a 300–400 m track sample annually and defective sleeper counts annually as a means of measuring the condition of its infrastructure.. Railway structures are subject to annual general inspections and detailed inspections at three to six yearly intervals by contracted inspectors. The network comprises one third steel, one third concrete and one third timber sleepers.

TransAdelaide has a formal asset management plan, a ten-year capital and recurrent maintenance program, and a three year forward estimates program.

ARTC Network

Up to 98 percent of the ARTC network contains concrete sleepers and a program is in place to replace the remainder, with the exception of timber sleepers used at turnouts. The rail is re-profiled every 25–30 million tonnes of freight on straight track sections and 10-15 million tonnes of freight on curved track. Special investigations are undertaken in areas of high rail wear.

ARTC have a formal asset management system and a network maintenance program developed from the following approach:

- A 25 year capital and maintenance program is developed based on the assumption that the asset age is at mid-life and certain elements will require replacement;
- A 5 year rolling program is then developed comprising those elements that may require more urgent replacement or maintenance as derived from a risk based assessment of the consequences of delaying the work;
- An annual plan is then derived from the five year program by ARTC's external maintenance provider; and
- A program of regular and detailed drainage structure and bridge inspections is developed and undertaken by consultants and any cleaning, replacement or upgrade recommendations are included in the relevant plans.

ARG Network

ARG contract out annual visual inspections of their rail, sleepers, level crossings crossing loops, and ballast within their network from which an annual maintenance and capital program is determined.

The Eyre Peninsula rail network maintained by ARG is understood to be the most problematic in terms of its age condition and performance and currently compromises the efficient delivery of grain to the Port Lincoln Port and may not be fit for future supply chain requirements. Despite this, DTUP have indicated that rail operations on Eyre Peninsula have been described as 'fit for purpose' in terms of the network's capacity to move additional grain tonnages of up to 0.6M tpa with little or no investment required, despite an acknowledgment of slow train speeds[18].

NRG Network

A major program of sleeper replacement was undertaken two years ago.

The track will require relocation at the coal pit end to improve operational efficiencies.

3.3.2 Asset Quality

The rail network managed by ARTC appears to be in generally good condition with the exception of localised sections of the Adelaide-Melbourne track between Goodwood and Belair where track geometry, operational constraints, and recent derailments have adversely impacted on track performance and amenity.

Some sections of the Crystal Brook-Broken Hill line have crossing loops with insufficient length to hold 1800 metre long trains and structures requiring upgrading due to capacity and axle load constraints, however programs are in place to address this.

The Adelaide metropolitan train and tram network managed by TransAdelaide appears to be in good condition and provides reasonable ride comfort and low rail wear. It is subject to a regular maintenance program. The service suffers reliability problems on some routes and timber sleepers require regular replacement. The track and rail infrastructure on the Glenelg line is currently being upgraded to service new trams, and plans have been announced to extend the line from Victoria Square to Adelaide Railway Station in order to extend network coverage and provide improved public transport linkages.

The rural freight routes are functional but some sections of the network require upgrading due to age, the number of crew changes required on longer distance routes, and to provide improved and more efficient linkages to ports particularly on the Eyre Peninsula and the South East. These networks are considered to be in poor condition in terms of overall asset quality.

3.3.3 Sustainability

ARTC's asset management plan is geared to a life cycle sustainability approach, long term management strategies, defined service levels and performance monitoring, and management of network failures (including derailments and allocation of liability and costs with other corridor users e.g. TransAdelaide).

ARTC have assumed a 3 percent compound growth in demand and regularly meet with their customers and operators to confirm future service and maintenance network requirements over a 25 year period. Current funding levels are considered sustainable and all KPIs are based on sustainability principles.

ARTC are investing in wheel noise research with the South Australian Environment Protection Authority (EPA) and have installed permanent wagon tag identification recorders on the Belair line to detect bogies with excessive noise and to regularly monitor environmental performance. ARTC are also developing a program to revegetate the entire corridor network with low maintenance plant species so as to maintain constant soil moisture profiles and reduce the overall maintenance requirement. They are also selecting timber sleeper species from renewable forest sources.

The TransAdelaide and Freight Link networks are adequately managed with well developed asset management plans and medium to long term maintenance programs in place. The condition of the network and performance standards is regularly monitored.

The regional freight lines are managed to a lesser extent and although DTUP highlight that some lines (eg Eyre Peninsula) are financially sustainable for the grain industry, other lines may soon become unsustainable unless they are upgraded or have improved intermodal linkages. If not, a reversion to road freight will occur.

Infrastructure managers are looking at sustainable uses for used sleepers and TransAdelaide undertakes ballast cleaning programs.

TransAdelaide have set greenhouse gas emission targets of 29,376 tonnes pa by 2010, a reduction of 18 percent on current levels.

All infrastructure managers have issues relating to toxic materials within the railway rights of way resulting from decades of traditional vegetation control procedures. Whilst practices have now been modified, earthworks within rights of way face strict conditions on soil disposal and are a significant factor in planning construction and maintenance activities.

3.3.4 Security

TransAdelaide is well advanced in upgrading security on its train platforms and network and has undertaken a full risk assessment as well as developed a security strategy.

ARTC have also developed a security strategy in conjunction with the Federal Government.

3.3.5 Funding

Federal funding provision for rail infrastructure under the *AusLink* current five year program is limited.

ARTC spend on average $10 million per annum on maintenance and upgrade work on the South Australian network. Some key projects can be down scoped or deferred (eg Murray Bridge Rail upgrade, Jamestown Crossing loop extension) due to rescheduling of priorities.

TransAdelaide expended around $11.2 million on capital improvement in 2003–04.

Funding for rural freight lines is governed by individual operators' maintenance programs and is focused on retaining track to a serviceable standard so as to retain freight targets.

3.4 Future Directions

The freight task in South Australia is expected to at least double within the next 20 years with the modal share to rail expected to increase. ARTC currently report an 81 percent market share on the east-west (Perth — Parkes) corridor. Although it already has double stack capacity, a move to additional intermodal facilities en-route to attract road trailers, and additional freight will become important.

Mass distance pricing based on the differential cost of network maintenance for road and rail freight could also become important as a means of creating equality between the modes.

ARTC are also considering the implementation of corridor based asset management plans by November 2005, rather than the current Australia wide based plans.

The number of freight train movements on LeFevre Peninsula is expected to increase from 7 to 21 per day upon the completion of the ABB 60,000 tonne capacity grain terminal at Outer Harbor. The proposed mineral sands extraction in the Murray Mallee area may attract additional train movements on the Loxton-Tailem Bend line. These factors will result in increased freight train movements through metropolitan Adelaide.

Investment strategies appear to be geared towards more private sector or joint funding involvement or special funding submissions to DOTARS under the regional programs AusLink initiative.

3.5 Report Card Rating

The continued uncertainty over the lack of Federal Government investment in the network following *AusLink*'s initial five year provision, remains a concern.

The State Infrastructure Plan's framework for a whole of Government and private sector partnership project development and delivery approach will place greater reliance on other funding sources, but these may be required to adequately maintain the rail network to sustainable levels and cater for future freight tasks.

There have been some recent investment announcements in upgrading maintenance and renewal of the urban passenger and freight infrastructure. System expansion is occurring through construction of the Port River Bridge/LeFevre Peninsula Transport Corridor track duplication and extension of the Glenelg Tram line.

The *State Infrastructure Plan Regional Overview* provides a positive step forward in recognising the strategic need for upgrading the rail network. Some high priority regional projects have been announced, with the next round of projects being formulated, but a joint approach will be required to ensure effective delivery and investment.

The ARTC and TransAdelaide networks appear to be sustainably managed although some shared sections of the network suffer alignment, speed restrictions, and operational and environmental constraints.

Crossing loop extensions and additional intermodal facilities are also required on the east west (Broken Hill-Port Augusta) corridor.

The limited line speeds on the Adelaide Metropolitan and Adelaide Hills section of the national freight network and the high cost of providing double stacking capability on the Adelaide-Melbourne line reduces the performance of the ARTC network overall.

A Report Card rating of **C** is given to the ARTC network and a rating of **B-** has been given to metropolitan rail and tram network.

The regional rail network is aged and has many different gauges, which leads to operational inefficiencies, except where dual gauges are provided. The network is maintained to a standard to maintain movement of current freight tasks by line operators. However, some lines operate at very low speeds due to the track condition and road network interfaces, and other poor linkages to other rail and road networks.

A Report Card rating of **D** has been given to regional networks. This rating could be improved upon with implementation of the key projects outlined in the *State Infrastructure Plan*.

3.6 Case Study

Grain Industry Rail upgrades for LeFevre Peninsula and Eyre Peninsula

The future needs of the South Australian grain industry and its export value to the State has given rise to two major rail infrastructure upgrade projects in South Australia.

LeFevre Peninsula Project

The first project involves the construction of a new opening rail bridge over the Port River known as Port River Expressway Stage 3; the duplication of the existing dual gauge rail track and rationalisation of level crossings on LeFevre Peninsula; and the extension of the track to a new 60,000 tonne grain terminal operated by ABB Grain.

Trains currently operating on the existing line have to travel along a winding route involving several rail level crossings (some with large vehicle traffic volumes) and 25 km/h speed restrictions. With an expected trebling of daily rail movements, operational speeds had to increase in order to facilitate the additional daily train movements. This is being achieved by the provision of a dedicated shorter route and new river crossing, additional crossing loops, track duplication and rationalisation of 18 level crossings to 7.

The project has been successful in attracting $80 million AusLink funding.

Eyre Peninsula Project

The second project evolved from a joint approach by stakeholders on the Eyre Peninsula involving the Eyre Peninsula grain growers, ARG, ABB grain, local government and the State Government.

An Eyre Peninsula grain summit was convened in Cummins in October 2003. Grain is the biggest regional economic driver generating $1 billion per annum in exports and employing a third of the Eyre Peninsula workforce. The outcome of the summit was that a safe, efficient and competitive transport system is of critical importance to the region and retention of the viable rail network was an essential element[19].

The result is that the stakeholders have developed a business case and, together with the State Government, have pledged $20 million towards rail upgrade improvements. A submission has also been lodged with the Federal Government for an additional $20 million in order to meet the $40 million upgrade requirement[20]. A decision on funding has just been announced by DOTARS.

4. Water

4.1 Overview

The water report evaluates potable water and wastewater.

South Australia is often referred to as the driest State in the driest inhabited continent in the world. As such, water is a precious resource. The River Murray is the key water source for the State, supplying about 40 percent of Adelaide's potable water on average. However, in drought years this can be as high as 90 percent. It also supplies numerous towns along its length, and water is distributed via an extensive pipeline network to many inland areas. The balance of the water supply comes from surface water collection and storage, with ground water supplying about 7 percent of the State's needs.

In recent years, the worst drought in recorded history in the Murray Darling Basin has been the dominant influence in the water sector, with water restrictions being introduced in South Australia in June 2003 and continuing as permanent water conservation measures from October 2003. South Australia was the first State to introduce such measures.

In major urban areas (particularly south of Adelaide around Aldinga, Victor Harbor, Murray Bridge and Mount Barker), there is increasing pressure to release land on the urban fringe for housing. The development of these areas will increase the demand for water, increase the volume of wastewater to be treated, and potentially increase the runoff of stormwater.

4.1.1 System Description

General

Unlike most of the other States, South Australia has virtually all water supply as well as the majority of wastewater collection and treatment services under the control of a single authority, the South Australian Water Corporation (SA Water).

A brief summary of the extent of the State's potable water and wastewater assets is as follows:

- 25,355 km total length of water mains and distribution pipelines;
- Five major pipelines from the River Murray totalling some 1,061 km in length and with a combined pumping capacity of 1200 ML/d;
- 17 major dams;
- 20 water treatment plants;
- 8,224 km of sewer network;
- 23 wastewater treatment plants; and
- Approximately 160 townships served by Council owned and operated STEDS.

Water & Wastewater Service Provision

With few exceptions, SA Water provides all areas in South Australia with water services, and SA Water also provides 88 percent of those customers with wastewater collection and treatment.

SA Water also serves major rural centres for sewerage and sewage treatment, including Mount Gambier, Port Pirie, Victor Harbor, Riverland towns, Murray Bridge, Port Augusta, Port Lincoln and Whyalla. Smaller town sewerage is typically treated by Councils with STEDS which use facultative, non-mechanical lagoons or proprietary package type systems for wastewater treatment. There are some 42 Councils operating the 160 STED Schemes throughout the State.

Notable exceptions to the above are Woomera, (serviced by the Defence Department via the Port Augusta — Woomera Pipeline) and Roxby Downs, (serviced by Olympic Dam as an adjunct to mining operations).

Estimated populations served by the various schemes (excluding Woomera and Roxby Downs) are shown in Table 1.

Table 1: Population Served 2003–04

	Population Served 2003–04		
Utility	**Water**	**Sewerage**	**STEDS**
SA Water Corporation — Metropolitan	1,090,000	1,057,000	0
SA Water Corporation — Country	416,000	144,500	0
Councils	0	0	160,000

SA Water supplies wholesale and retail water to customers.

A water service is available to virtually all potential customers in the major urban areas.

Ownership and Management of Water and Wastewater Infrastructure

Apart from Council owned STED Schemes, SA Water owns nearly all the water and wastewater infrastructure in the State. It also operates the bulk water supply systems and the assets in country areas. In what is still the largest water outsourcing contract in Australia, the management, maintenance and operation of the metropolitan water and wastewater assets has been contracted to United Water to mid 2011. United Water is a private water company.

Riverland Water operates 10 water treatment plants along the River Murray, on behalf of SA Water. These supply water to the Riverland area as well as the Barossa Valley and areas to Port Wakefield, Murray Bridge, Tailem Bend and East to Keith, Mannum and Balhannah/Eastern Hills areas. These will be operated and maintained until 2025 under Build Own Operate Transfer (BOOT) Schemes.

Other outsourced contracts include:

- The construction of the Victor Harbor wastewater treatment plant under a BOOT arrangement due for completion in mid 2005;
- Construction (in 1996) and operation of the Aldinga wastewater treatment plant;
- Council STEDS for the most part are owned and operated by Councils. The City of Onkaparinga (south of Adelaide) has contracted the management and operation of all its schemes to United Utilities Australia including the reuse components. A similar approach is being considered by some individual Councils and some Council Regions.

4.1.2 Governance

State Government

SA Water is a Government business enterprise established under the South Australian *Water Corporation Act 1994*, which also makes it subject to the *Public Corporations Act, 1993*. The primary functions of SA Water are to provide services for:

- The supply of water by means of reticulated systems;
- The storage, treatment and supply of bulk water; and
- The removal and treatment of wastewater by means of sewerage systems.

It is also empowered to undertake other functions including research, consultancy, and commercial development, as well as encourage and facilitate private and public investment and participation.

Other legislation directly relevant to SA Water includes:

1. *Waterworks Act 1932*, which empowers SA Water to construct and operate water supply systems;
2. *Sewerage Act 1929*, which empowers SA Water to construct and operate sewerage systems;
3. *Metropolitan Drainage Act 1935*, which SA Water administers on behalf of the Minister for Administrative Services, and which provides for flood mitigation works on the River Torrens, Sturt River, Brownhill Creek and Keswick Creek;
4. *Rates and Land Tax Remission Act 1986*, which allows rate concessions for various parties; and
5. *Water Resources Act 1997*, which provides for management of the State's water resources.

Being a Government commercialised business unit, SA Water is required to provide a commercial return to Government. In 2003–04, SA Water returned $261.6 million in dividend and tax income to the Government.

Like most commercial water businesses, the services provided by SA Water are also subject to regulation by clearly separated bodies, specifically in the areas of price, environment, health and water resource allocation. The relevant bodies and some of the areas where interaction occurs with SA Water are shown in Table 2.

Table 2: Authority Interaction with SA Water

Regulation	Body	Area of interaction
Water Resource Management	Dept of Water, Land & Biodiversity Conservation	◗ Environmental flow releases ◗ Ground water allocation ◗ Surface water allocation ◗ River Murray licences ◗ Restoration of health of River Murray ◗ Enhancement of natural resources
Health	Dept of Health	◗ Approval of small/on-site waste water ◗ disposal systems ◗ Water reuse ◗ Water quality
Environment	Environment Protection Authority (EPA)	◗ Environment Improvement Programmes (EIP's) relating to wastewater discharge ◗ Wastewater discharge to environment ◗ Potable water discharges ◗ General environmental issues (eg odour, noise) ◗ Disposal of residuals from water and wastewater treatment ◗ Licensing (for waste water treatment plant's > 1,000 people)
Economic and Customer Services	Minister for Administrative Services and the Treasurer	◗ Service level agreement with Minister and Treasurer and updated annually ◗ Essential Services Commission reviews price setting process ◗ State Government publishes pricing transparency statement

As noted previously, SA Water only provides wastewater service to metropolitan Adelaide and main regional centres. Wastewater collection and treatment for other rural areas and towns is managed by local government.

Local Government

Councils have the power for collection and treatment of wastewater under the *Local Government Act, 1934.*

The first STED Scheme was installed in Pinnaroo in 1962. The State Government essentially provides funding for schemes, with the allocation and delivery of systems being the responsibility of the LGA. The LGA works with Councils to identify needs, and ensure that current systems are meeting criteria appropriate for the re-use of the effluent, and match standards designated by the Department of Health and Environment Protection Authority (EPA).

Annual funding subsidy by State Government for STED Schemes has been some $3 million annually for the past two years.

Councils operate and maintain the systems, with the LGA providing advice on good management practices, effluent reuse schemes, pricing and other issues. The LGA is also encouraging Councils to undertake STEDS audits to confirm the sustainability or otherwise of their schemes. It has been identified that Councils are not recovering the full costs of STEDS, and therefore schemes cannot be adequately maintained, upgraded and replaced in perpetuity.

In general, most Councils lack institutional strength and appropriate skills and finances to provide a complete service, particularly in relation to upgrades and quality compliance issues.

Consequently, there are a number of authorities and stakeholders, which are involved in helping Councils in delivering funding, advice and regulation of collection and treatment of wastewater. These are summarised in Table 3.

Table 3: Authority Interaction with Local Government

Regulation	Body	Area of interaction
Funding allocation advisory role	Local Government Association (LGA)	◗ Provision of advice to Council (Operations and maintenance, pricing) ◗ Provides representation to State Government and other key stakeholders to seek funds ◗ Commissioning of audits
Facilitate working relationships between State and local government	Office of Local Government	◗ Intermediary between Councils and other agencies ◗ Negotiation of funding for new schemes ◗ Management of operational matters and interface with Minister and local government stakeholders

Interaction also occurs with the EPA, the Department of Water, Land and Biodiversity Conservation and the Department Of Health, and their roles are described in the State Government Governance section.

4.1.3 Sector Trends

The water and sewerage services sector in South Australia is currently driven by the following factors:

- Prolonged drought and increased competition for water allocations from the River Murray (primary source of water for South Australia);
- Increased salinity in River Murray;
- Increased demand for more water to accommodate population growth and new industries;
- Limited capacity of existing waterways to accept more waste loads from urban areas;

- Increased community awareness and desire for sustainable water solutions; and
- Introduction of the capping and trading regime under the National Water Initiative.

The above drivers have resulted in the following trends in the South Australian water sector:

More Focus on Demand Management Initiatives

Like most other States, South Australia has increased its focus on water demand management in recent years. By encouraging consumers to use water wisely, reducing leakage and promoting use of water saving devices (such as low flow shower roses, front loading washing machines, drought tolerant planting, etc), it is possible to reduce total water demand and thereby defer the need for new infrastructure.

SA Water has been reasonably successful with its demand management initiatives. Over 2003–04 in Adelaide, water consumption decreased some 13 percent on the previous year despite a small increase in population.

More Water Recycling and Implementation of Integrated Water Management Schemes

Limited new water sources combined with more stringent effluent discharge standards have led to more wastewater recycling schemes being developed in both urban and rural areas. Wastewater effluent is now recognised as a source of water rather than a waste.

South Australia currently recycles just over 20 percent of the wastewater generated in the State and there are plans to double this[21], which is the highest proportion amongst all Australian States. However, given that South Australia is the driest State, it is appropriate to be aiming for even higher recycling targets.

A number of new schemes recently developed have demonstrated that it is possible to achieve much higher recycling targets by implementing integrated water management concepts. Mawson Lakes is an example of such a development in South Australia.

Investigations have shown that, considered on a holistic basis, integrated water management can significantly reduce water consumption at minimal additional cost. The economics of individual schemes depend upon the particular configuration of trunk infrastructure.

Integrated water management can be most effectively implemented “from the ground up” in green field developments. This means that decisions need to be made now to address water supply issues in 20 years’ time.

Greater Emphasis on Sustainable Solutions

The fragile South Australian environment, combined with limited sources of water, has led to a greater emphasis being placed on more sustainable solutions from environmental, economic and social perspectives.

For example, with respect to Council STEDS, the Government is placing more emphasis on the existing schemes being financially and technically sustainable as a pre-requisite to the provision of continued funding for new schemes.

A greater emphasis is also being placed on the sustainability of rivers and watercourses, with prescribed streams having identified environmental flows that need to be sustained. On a larger scale, the State Government is pursuing nominated environmental flows for the River Murray.

There is also a strong desire to minimise discharge to the sea via ocean outfalls, which is one of the drivers for wastewater reuse.

New urban development areas, such as Mawson Lakes, are able to accommodate more people with reduced demand for potable water, as well as reduced wastewater discharge to the environment than traditional urban development schemes.

Water Trading

The separation of titles for land and water is providing new opportunities for owners of water titles to trade them for higher value uses. For example, the wine industry in South Australia has been able to acquire more water to meet its growing demand through water trading. This trend is likely to increase in future as the trading regime matures and will result in more water transferred from low to higher value users.

4.2 Evaluation

4.2.1 Level of Service

The intent of the Report Card Rating is to provide an informed assessment of fitness for purpose of water and wastewater infrastructure in South Australia.

Factors used to assist in the assessment are outlined below. For many factors, the level of service has a direct bearing on the fitness for purpose of the infrastructure. For example, the level of treatment at a sewage treatment plant has a direct bearing on the impact of effluent discharges on downstream waterways.

The key factors where the level of service is important include:

Potable Water

- Protection of catchments;
- Provision of environmental flows in rivers;
- Security of supply;
- Water treatment;
- Water quality management in the delivery system;
- Water pressure;
- Frequency of interruptions;
- Cost to customers, and the actual cost;
- Demand management, and
- Infrastructure maintenance and renewal.

Wastewater

- Elimination of dry weather overflows;
- Management of wet weather overflows;
- Sewage treatment;
- Effluent reuse;
- Odour complaints;
- Frequency of sewer collapses and blockages;
- Cost to customers;
- Biosolids management;
- Demand management, and
- Infrastructure maintenance and renewal.

The above parameters were used for ranking of existing assets and performance of the operating authorities. The key criteria and factors related to rating are summarised in Table 4.

Table 4: Rating Criteria

Factor	Potable Water	Wastewater
Asset Condition	Structural soundness of head works and reticulation	Structural soundness of sewage collection systems and treatment plants
Asset Availability and Reliability	Reliability and security of supply in both quantity and quality.	Conveyancing and treatment of average dry weather flow, and system performance in peak wet weather; the frequency and number of overflows and the treatment of overflows.
Asset Management	The availability of data on the system, and the existence of forward planning programs of maintenance and renewal.	The availability of data on the system, and the existence of forward planning programs of maintenance and renewal.
Sustainability	Environmental: the impact of head works on downstream waters; the impacts of treatment by-products. Economic: the level of investment for maintenance and renewal; the cost to customers; concerns that pricing is not reflecting actual costs, and demand management. Social: impact of lack of supply; health impacts of deficiencies in quality, meeting of community expectations on appropriate treatment and use of water.	Environmental: the impact of discharges on downstream waters; the impacts of treatment by-products. Economic: the level of investment for maintenance and renewal; the cost to customers. Social: impact of lack of service; health impacts of deficiencies in quality of treated effluent; meeting of community expectations on appropriate treatment and use of sewage.

4.3 Potable Water

4.3.1 Overview

Water Sources

Water supply in South Australia comes from three main sources:

- The River Murray (providing anywhere between 35–90 percent, but recent average has been approximately 48 percent);
- Surface water, which comes mainly from the Mount Lofty Ranges (average of 45 percent);
- Groundwater (some 7 percent).

One of SA Water's key objectives is to safeguard public health and the community drinking water supply. Metropolitan Adelaide is supplied by a combination of surface water storage, supplemented with water from the River Murray. In a dry year, up to 90 percent of the required supply is obtained from the River.

The heavy reliance on River Murray water during prolonged dry periods presents a risk to Adelaide. There is a need to diversify the sources of water so that this level of reliance is reduced in future. Obtaining water supply security through diversity of sources is now being pursued by several of the major water utilities in Australia and is appropriate for South Australia.

The five major pipeline systems from the River Murray are:

- Murray Bridge Onkaparinga Pipeline;
- Mannum Adelaide Pipeline;
- Morgan Whyalla Pipeline;
- Swan Reach Paskeville Pipeline; and
- Tailem Bend Keith Pipeline.

The first two pipelines service the metropolitan area and all service large portions of the State.

Average electricity costs associated with the operation of these five major pipeline systems are in excess of $5 million per annum. Consequently, SA Water has developed and implemented two sophisticated multi-million dollar software systems (HOMA^{XD} and IDMS) to assist in the planning and real-time operation of the integrated major pipeline and reservoir system.

In the west, Eyre Peninsula from Port Lincoln in the south to Cowell in the north east and Ceduna in the north west is serviced by four major underground basin water supplies as well as the Tod Reservoir, interconnected by a series of trunk pipelines. Issues associated with the supply include sustainability of the basins and salinity of water from the Tod Reservoir.

The Morgan Whyalla and Swan Reach Paskeville pipelines service Yorke Peninsula, with the recently constructed Clare Valley Water Supply Scheme augmenting supply in the northern areas. Distribution extends as far south as Edithburgh. Areas at the foot of the peninsula are supplied from groundwater basins. The major issue with supply is that the trunk mains are down the centre of the Peninsula servicing the inland towns, whereas the trend is now towards population growth along the coast.

The south east of the State is largely supplied by water from extensive underground aquifers that underlie the region. Large centres such as Bordertown, Robe, Kingston, Mt Gambier (Blue Lake), Millicent, Naracoorte and Pinnaroo are supplied by independent schemes.

Issues associated with the South East groundwater supplies generally relate to potential pollution rather than quantity of water available.

Townships along the River Murray generally source their supply direct from the river, with nine of the larger townships receiving treated water.

Coober Pedy and Roxby Downs source their water supplies from the Great Artesian Basin and utilise reverse osmosis desalination treatment.

Kangaroo Island obtains its water supply from a combination of surface water storage, private schemes and a desalination plant at American River.

An issue facing large dam owners is the sizing of spillways to accommodate estimated flood flows. Flood estimates have tended to increase with changed methods of hydrological analysis, and this has led to an apparent need to upgrade the spillways of many dams across Australia to continue to comply with Australian National Committee on Large Dams (ANCOLD) Guidelines.

SA Water is undertaking a program to upgrade its reservoirs to comply where required, and it has recently completed works at Happy Valley Reservoir.

Groundwater supply, although generally reliable, can be a contentious subject, and recently problems with access by irrigators without due regard to the rights of others in the southern Mallee have arisen. Farmers are calling for Government action due to concerns about the sustainability of the resource in the face of new developments and a lack of prior government study of available supply[22].

Water Treatment

The majority of the population in South Australia is supplied with treated water.

Most surface water and groundwater sources in South Australia tend to be of poor quality, as the catchment areas are populated and the groundwater salinity is variable. This requires considerable treatment in order to bring it to acceptable standards. In general, conventional treatment processes are required for potable use, incorporating clarification, coagulation, filtration and chlorine disinfection. Additional processes are used in some locations, most notably with water from the River Murray, which tends to have a highly variable quality depending on the time of the year, both from a turbidity and a microbiological point of view. The ten treatment plants along the Murray incorporate alum dosing, clarification, filtration and chlorination, and six of the plants have recently had UV disinfection installed to provide a greater level of protection (dual barrier disinfection — UV irradiation and chlorination).

In addition, SA Water is trialling the MIEX process on a full scale at the Mount Pleasant water treatment plant to assess its effectiveness in reducing dissolved organic carbon in the water supply. It is anticipated that there will be increased application of this technology (and more advanced processing) over the next five to ten years for major urban supplies, particularly with expected on-going deterioration in source water quality.

Water service providers routinely monitor product water quality against the Australian Drinking Water Guidelines. SA Water has also implemented HACCP (Hazard Analysis and Critical Control Point) systems that are derived from the food industry.

Water in South Australia is generally fluoridated, to assist in the prevention of dental caries.

Treated water is stored in covered reservoirs to prevent recontamination of the water. Where necessary, further addition of chlorine is used to maintain a residual in the distributed water to prevent the regrowth of pathogenic organisms.

SA Water has recently commenced its Country Water Quality Improvement Programme, which aims to increase the quality of water delivered to country areas over a five year period.

Distribution Systems

Treated water is generally supplied by gravity from storage reservoirs throughout the service areas. The storages are used to buffer peak demand and to provide emergency supply in the event that supplies from the treatment plant are disrupted. Distribution mains are sized to accommodate peak flows arising from routine use, and for fire-fighting purposes. Water mains are generally laid in the streets and are fitted with in-ground spring hydrants for fire-fighting purposes.

The main issues with distribution systems are:

- Water quality;
- Leakage (non-revenue water);
- Main breaks; and
- Water pressure.

The frequency of main breaks and the amount of leakage are primarily a function of the age and state of repair of the system.

Within Australia, SA Water is one of the better performers in relation to burst rates and last year had only 24 breaks per 100 kilometre of main. It has a corporate aim to maintain its ranking and accordingly its five year forward plan provides an increasing budget allowance to compensate for the aging of the mains network and the consequent expected increase in burst rate.

4.3.2 Operational Data

Water Consumed

The volume of water consumed per property over the five year period 1999/00–2003/04 is provided in Table 5.

Table 5: Annual Water Consumption

Type	1999–00	2000–01	2001–02	2002–03	2003–04
kL/ Residential property	263	271	252	273	245
kL/ Property	399	413	365	371	341

Source: WSAA Facts 2004

It is difficult to compare this figure with other States given the climatic variations between the States, but there is a slight downward trend.

SA Water has undertaken a meter replacement program completing Stage 1 (440,000 meters in late 2004). Stage 2, which covers the remaining older style meters, is due for completion by the end of 2006.

The meter replacement program has been an economic success (in terms of more accurate recovery of usage costs) as well as playing a part in encouraging water conservation.

Distribution System Performance

Performance and reliability of the system is measured in terms of infrastructure leakage index and main breaks per 100 km of main. In both instances, with values of 1.2 and 23.4 respectively for 2003–04, SA Water is consistently in the top three of all Water Services Association of Australia (WSAA) companies.

Overall, leakage in Australia is in the lower 25 percent worldwide and from benchmarking through WSAA, the Adelaide water supply network compares favourably with other organisations in Australia.

Compliance with Drinking Water Quality Guidelines

SA Water monitors drinking water quality on a regular basis at locations throughout the treatment and distribution system. Water quality is measured against the Australian Drinking Water Guidelines 1996. As previously mentioned, this is a risk based approach which requires assessment of processes and hazards, and testing at critical points. Over the last three years, SA Water has achieved full compliance with the Australian Drinking Water Guidelines.

In terms of WSAA benchmark data, SA Water is one of the best performers with a figure of 1.1 water quality complaints per 1000 properties, with the WSAA average being 4.9.

Service Delivery

Based on its corporate powers and its agreed level of performance with the Minister and Treasurer, SA Water prepares a strategic framework from which its forward planning is derived. Its infrastructure planning in particular, is a risk based process in which all system components are rated against, for example, capacity, condition, sustainability and are able to be ranked in terms of priority. The social impacts on users can be built into this process. The methods of dealing with the risk including procedural changes, renewals and capital investment, are also able to be considered in the process.

Pricing

Variability of Australian rainfall and run-off is a key driver of wholesale water supply costs. In response to the COAG led reforms, water service providers are progressively introducing full-cost pricing. This means that end users are paying the full cost of service provision, including allowances for asset renewal and replacement. In most cases a two-part tariff has been implemented, involving a fixed connection fee and

a variable consumption cost. Current 2004–05 charges per property in South Australia are $35.25 per quarter plus 44 c/kL up to 125 kL and $1.03 for every kL above 125 kL consumed. For a 250 kL annual consumption, the charge equates to $324.75.

The first transparency statement, dealing with 2004-05 urban water prices, was published in June 2004. It included a summary of the price setting process and an independent review of that process by the Essential Services Commission of South Australia. The Commission concluded the water prices comply with the COAG principles and also made several recommendations for improving the price setting process in the future[23].

In 2003–04, SA Water launched a social impact study to assess and suggest strategies for enhancing the social sustainability of its pricing and billing systems processes. It is intended that over time, these will be implemented in consultation with the Government and the community.

Renewal Expenditure

Figures for renewal expenditure in South Australia do not appear to be publicly available as they are no longer recorded in WSAA Facts. It is likely to be relatively low (<1 percent) based on information from earlier Report Cards for the whole of Australia, and general industry knowledge of recent programs. It would be desirable for this information to be available for use as a benchmark in the future.

The performance indicators which are used to measure the condition of assets, such as burst rates/100 km of main and infrastructure leakage index, indicate that South Australia's water supply system is currently performing well. SA Water's asset management plans recognise the increased maintenance and renewal associated with the aging of assets and provision for increased renewal funding is being made in long term plans. SA Water's goal is to at least maintain its good position relative to other States in terms of the measured performance indicators.

Demand Management

One of the key mechanisms for demand management will be the Water Proofing Adelaide project, which was established to set a blueprint for the management, conservation and development of Adelaide's water resources to the year 2025. The draft strategy was issued in late 2004 and release of the final strategy is imminent.

Key elements of the strategy include:

- Better management of existing resources including the River Murray, the Adelaide Hills catchments and groundwater.
- Implementation of programs to reduce water demand including permanent water conservation measures, promoting sustainable gardens and implementation of the Water Wise program.
- Seeking alternative water supplies including promotion of rain water tanks as well as the use of reclaimed water. A reuse target of 30 GL per annum by 2025 is considered achievable.

4.3.3 Sustainability

SA Water has recently issued drafts of its *Sustainability Policy, Environmental Policy* and *Social Policy* for public comment. They link in with SA Water's asset management policy. SA Water also publishes an annual 'Sustainability Report' on its website.

Some key sustainability practices that SA Water has implemented include:

- Measuring their performance against the Dow Jones Sustainability Index for the first time in 2003–04 where they achieved a median rating compared to other Australian Authorities;
- Substantially reduced chlorinated water discharge to streams, e.g. the Mannum Adelaide pipeline has been recently made non potable with alternative arrangements made for consumers along its length;
- Increasing environmental flows to streams in the Adelaide Hills;

- Installation of a mini hydro scheme at Hope Valley which returns power to the electricity grid; and
- Investigation into alternative water supply sources.

The approach taken by SA Water in relation to sustainability of its water and wastewater assets appears to be in accord with current accepted principles with assets being valued at "written-down" replacement costs and depreciation reflecting asset consumption.

4.3.4 Security

Bulk water supply systems have a relatively high vulnerability to terrorist attack because of their extensive water catchment areas, isolated impoundments and long delivery pipelines. Most systems would have limited redundancy in these areas, and therefore impacts could be significant. SA Water deals with this issue by maintaining bulk supplies above a minimum level to allow time to isolate and deal with problems.

SA Water has contingency plans in place for all its treatment plants and pumping stations.

Some water supply systems are vulnerable to bushfires due to their remoteness and location in bushland areas. The recent fire on Eyre Peninsula highlighted the issue as two above ground water supply pipelines were severely damaged. They were, however, back on line within 2–3 days given the relative ease with which an above ground pipeline can be repaired.

4.4 Wastewater

4.4.1 Overview

Treatment Plants

Sewage is water borne waste generated primarily by residential households in the kitchen, laundry and bathroom. The non-residential component comprises industrial, commercial and municipal wastewaters that represent less than 10 percent of the total sewage flows. In STEDS, sewage is first passed through an on-site septic tank, with the effluent passing to a network for collection and transfer to treatment.

Treatment of wastewater involves removal of harmful contaminants and provides a product, which is acceptable for disposal to the environment. Wastewater treatment plants comprise a selected combination of physical and biological processes to degrade contaminants and stabilise residuals. In urban situations, typically the wastewater treatment plants will have concrete tanks to mechanically achieve biological oxidation (incorporating aeration) and sludge stabilisation. However, in regional areas, the biological process units may consist of lagoon-based systems, which involve a larger footprint.

Treatment levels are referred to as primary, secondary or tertiary levels of treatment. Primary treatment removes screenings, grit and dense solids (and is roughly equivalent to septic tank treatment). Secondary treatment (downstream of primary stage) incorporates a biological process that reduces the organic content of the sewage to produce a clear effluent. Tertiary treatment further treats the effluent to reduce the nutrient content (nitrogen and phosphorus), where discharge to sensitive waters is occurring. Tertiary treatment and advanced tertiary treatment are generally provided prior to reuse, or discharge to sensitive waterways.

The five major wastewater treatment plants in metropolitan Adelaide are:

- Bolivar wastewater treatment plant
  One of the largest wastewater treatment plants in the country (serving the equivalent of almost one million people). The plant was totally refurbished in 2001. The Bolivar High Salinity Plant was recently commissioned at the site, and treats screened sewage from the decommissioned Port Adelaide wastewater treatment plant. United Water undertook construction and commissioning. High quality effluent is produced, having undergone nutrient reduction and disinfection, and is discharged to the Gulf of St Vincent.

Up to 90 GL /annum of Class A water is produced from the plant. Of this, an average of 29 percent is reclaimed and is used to irrigate market gardens in the north of Adelaide. (During peak summer months up to 55 percent of flow is reused).

A proportion of the effluent is treated via the high salinity plant (part of the old Port Adelaide catchment) and has high total dissolved solids concentrations, making this unsuitable for reuse.

Biogas is generated from the anaerobic digestion of sludge at Bolivar and is used to generate electricity for the plant.

- Glenelg wastewater treatment plant
  Serves some 200,000 people, and is operated by United Water. On average 11 percent of the treated effluent is reused (peaking at 17 percent in summer) for irrigation on local golf courses, recreational parks and Adelaide Airport with the excess effluent disposed to sea via an ocean outfall. Electricity generation from biogas for use at the plant is also undertaken at Glenelg.
- Christies Beach wastewater treatment plant
  Serves some 180,000 people, and is operated by United Water, with effluent provided for reuse to Willunga Basin Water Company during warm months and excess effluent disposed via ocean outfall, during the wetter months. 10 GL of effluent is reclaimed each year, representing 23 percent of the flow, and used for irrigating the grapevines of McLaren Vale. In peak months up to 70 percent of effluent is reused.
- Heathfield wastewater treatment plant
  Serves some 10,000 people, and operated by SA Water, with effluent reuse to local golf course and ovals. Treated effluent is discharged to a tributary of the Sturt River.
- Aldinga wastewater treatment plant
  Serves some 3,500 people and operated by United Water. 100 percent of the treated effluent from the Aldinga wastewater treatment plant is reused and there is no discharge to waterways.

Other major SA Water owned wastewater treatment plants include:

- Finger Point (Mount Gambier)
- Nangwarry
- Mount Burr
- Victor Harbor
- Angaston
- Hahndorf
- Port Pirie
- Murray Bridge
- Whyalla
- Millicent
- Naracoorte
- Mannum
- Myponga
- Gumeracha
- Port Augusta (East and West)
- Bird in Hand
- Port Lincoln

Many of the above produce effluent for land re-use applications of silviculture, park and agricultural irrigation. However, salinity in some areas (associated with infiltration) makes effluent unsuitable for land irrigation reuse. An average of 13 percent of treated wastewater is reused from the rural wastewater treatment plants.

Victor Harbor wastewater treatment plant is currently being replaced (to a new site and configuration). Other wastewater treatment plants currently under consideration for upgrading include Aldinga, Murray Bridge and Christies Beach.

Other regional and rural centres are typically served by STEDS, operated and maintained by Councils, which involves collection of individual septic effluent from households via gravity mains, and transfer to treatment plants. These typically comprise lagoon-based systems or proprietary modular mechanical systems. The larger of these include:

- Mount Barker
- Port Wakefield
- Penola
- Meadows
- Barossa Valley (6 plants)
- Bordertown
- Port Broughton
- Waikerie
- Moonta
- Robe
- Pinnaroo
- Kingston
- Keith
- Kimba

These schemes are relatively unique to South Australia in terms of the number constructed compared to other States. About half of the treated wastewater from STEDS is reused, with the majority of this on woodlots. Some is used for irrigation of pasture land or recreational grounds, while the remaining treated wastewater is evaporated. Recent changes to environmental legislation will force a tightening up of some existing disposal practices.

In the Minister's Local Government Forum of 2004, funding for STEDS programs was endorsed, with eligibility based on demonstration of functioning at a sustainable level (operational and financial terms). Annual State funding involves some $3 million, and contributions need to be factored in (SA Water charges are used as the benchmark). The LGA is currently actively encouraging Councils to audit their schemes for sustainability and to adjust their charges and operations accordingly.

Other Wastewater Management

In addition to the above, there are waste disposal stations operated by the Department of Water, Land and Biodiversity Conservation at marinas along the River Murray, which receive black water from houseboats. The wastewater is typically transferred to SA Water wastewater treatment plants, however, the Department has the responsibility for operations and maintenance of these disposal stations. The Department is looking to establish an asset management framework to ensure assets are appropriately maintained, but this is not yet complete.

Collection Systems/Sewer Networks

Residential properties are served by plumbing fixtures and house service lines. The house service lines are connected to the sewer collection lines (in some case via septic tanks) owned by the utility.
Raw sewage (or septic tank effluent) is collected via gravity lines, which feed to pump stations, which in turn feed to sub mains, and thence to main trunk sewers. The collected sewage and domestic/industrial wastewater is conveyed to a treatment plant for processing and disposal or reuse.

The main issues with collection systems are:

- Pipe breakages;
- Infiltration during wet weather; and subsequent overflows, when the capacities of the collection system and treatment facilities are exceeded;
- Corrosion of pipes and concrete structures, associated with sulphide generation; and
- Odour nuisance control.

The frequency of overflow from a system is a measure of the performance of that system.
Odour complaints are a further measure of the performance of a system.

4.4.2 Operational Data

Wastewater Generated

The volume of wastewater collected per property over the five year period 1999/00–2003/04 is provided in Table 6.

Table 6: Annual Wastewater Collection

Type	1999–00	2000–01	2001–02	2002–03	2003–04
kL/ Property	216	211	223	214	211

Source: WSAA Facts 2004

The level of collection has been consistent over the years despite a decreasing trend in overall water usage. This indicates that the reduction in water usage is occurring in areas external to the house.

The volume of wastewater collected per property in comparison to other States is generally low. However, it should be noted that with the climatic variations between the States, the extent of infiltration experienced in South Australia is comparatively lower. Peak wet weather flows for South Australia are around 3 times the average, whereas in eastern States, the peak to average ratio is often higher than 6.

Compliance with EPA Criteria

United Water, on behalf of SA Water, monitors effluent quality on a regular basis at each of the wastewater treatment plants in accordance with the EPA Licence conditions (which are specific to individual plants).

In the past five years each of the five major metropolitan wastewater treatment plants, have achieved 100 percent compliance.

SA Water has just completed a five year environment improvement program.

Service Delivery

Indicators used to measure the performance of SA Water are as follows:

Table 7: Wastewater Performance Indicators

Type	1999–00	2000–01	2001–02	2002–03	2003–04	Performance relative to other Australian Authorities
No. of sewer breaks & chokes/ 1000 properties	6.5	5.9	5.8	7.1	7.0	Poor
No. of sewer overflows per 100 km of sewer main	12.3	11.5	12.2	14.2	13.7	Above median
No. of wastewater odour complaints/ 1000 properties	0.3	0.8	0.7	0.8	0.7	Average
Percent of wastewater treated to tertiary level	0	17.4	54.6	81.6	91.0	Very Good
Percent of water recycled	11.4	15.9	15.1	19.2	21.4	The best

It is also noted that the number of sewer chokes/100 km of main is lower in Adelaide than in the major South Australian regional centres. The number of chokes in South Australian regional centres is significantly lower than other States' regional centres.

STEDS Audit (2005) involved a review of 36 schemes throughout the State, and represented 23 percent of all STEDS. Some of the findings in relation to operations and maintenance were:

- Most schemes are operated in a reasonable manner, with maintenance undertaken on an as needs basis (rather than programmed maintenance plans);
- Average age was found to be 23 years old (regarded as 45 percent of useful life), with the oldest 45 years old (Pinnaroo), and the most recent Scotts Creek (Morgan) and Port Broughton (< 2 years old); and
- Lagoon maintenance is not carried out well, with most systems requiring desludging and having suspect liner integrity.

Pricing

In response to the COAG led reforms, water service providers are progressively introducing full-cost pricing. This means that end users are paying the full cost of service provision, including allowances for asset renewal and replacement. Revenue per property for wastewater services in metropolitan South Australia is based on property value and the average charge per property in 2003–04 was $379.53[24].

The Minister's Local Government Forum of 2004, endorsed funding of STEDS programs, and stated that STEDS contributions from ratepayers needed to be no greater than the SA Water benchmark.

In STEDS Advisory Committee Report 2005, the average sustainable price for STEDS was found to be $360 (compared to SA Water's average country rate of $390). Of the 36 Councils audited, only three were charging at their sustainable rate.

Renewal Expenditure

As for water supply, figures for renewal expenditure in South Australia do not appear to be publicly available, as they are no longer recorded in WSAA Facts. It is likely to be relatively low (<1 percent) based on past information from earlier Report Cards for the whole of Australia and general industry knowledge of recent programs. It would be desirable for this information to be available for use as a benchmark in the future.

Overall, for assets owned by SA Water, there is considered to be significant expenditure required on wastewater, which is largely a reflection on environment improvement programs placed in the licence conditions by the EPA. Population growth and major developments in wastewater treatment plant catchment areas will lead to master planning reviews associated with the need to upgrade infrastructure for collection and treatment of increased loads.

The current annual regional STEDS budget administered by the LGA for funding assistance to new schemes is $3 million. This is allocated on a year to year basis. Funding is currently not guaranteed past June 2005.

4.4.3 Sustainability

As previously discussed, SA Water currently has a draft of its *Sustainability Policy, Environmental Policy* and *Social Policy* released for public comment. SA Water has been involved in a number of related initiatives, including alternative water supplies (reuse, stormwater harvesting, promotion of sustainable gardens through water sensitive urban design, mitigation of greenhouse gas generation through strategies ranging from reduced pumping to renewable energy to increasing sequestration of carbon dioxide through revegetation).

For SA Water, any upgrades to systems necessarily include a risk assessment, incorporating financial evaluation, OH&S and cleaner production principles.

In relation to reuse, 21 percent of metropolitan wastewater and 13 percent of country wastewater is reused for agricultural purposes.

There is potential to use biogas at some wastewater treatment plants for electricity generation purposes.

SA Water has re-use targets and provides financial incentives for reclamation or recycling. Recently, there have been applications of dual reticulation for developments, eg Mawson Lakes, but the size of the reuse application is relatively small. The reclaimed water provides toilet flushing and garden irrigation (with an aim to reduce mains potable water consumption by 50 percent). SA Water is also participating in two major reuse schemes, both of which are privately owned. They are probably unique in Australia, in that they generate economic development, as well as provide an avenue for disposal of effluent. They are:

- Christies Beach Effluent supply to the Willunga Basin Water Company, which provides reclaimed water to agricultural users in McLaren Vale; and
- Virginia pipeline scheme, where treated effluent from Bolivar wastewater treatment plant is used for irrigation of market gardens.

The volume of effluent recycled has been steadily increasing from 15 percent (2002), to 19 percent (2003) then to 21 percent (2004).

It is also noted that 100 percent reuse of annual biosolids (residuals) has been achieved for the metropolitan wastewater treatment plants.

LGA and Department of Health note their requirements for sustainability on an operational, financial and environmental base and effluent re-use is the general goal.

In the paper prepared for the Minister's Local Government Forum (2004), the Forum endorsed funding for STEDS programs, with eligibility based on demonstration of functioning at a sustainable level (operational and financial terms). In terms of sustainable environmental operation, STEDS lagoons are generally regarded as providing a suitable treatment option, where large land areas are available, and facultative operation negates the need for power requirements (so limiting generation of greenhouse gases associated with electricity requirements). However, at present a number of lagoon systems are not regarded as operationally ideal, producing sub-standard effluent (not meeting Department of Health or EPA requirements), and disposing to land . While there are treatment abilities associated with soil microflora, in many cases no studies of the capacity of the soil to cater for organic or nutrient loading has been undertaken. Some of the more recent mechanical treatment plant installations (eg Port Broughton) produce a high quality effluent suitable for multiple re-use applications.

4.4.4 Security

Wastewater infrastructure is less vulnerable to terrorist attack than water supply systems. Wastewater collection systems are generally buried deeply and sewage pumping stations are currently designed to resist vandalism.

Sewage treatment plants are usually remote from developed areas, and if access were to be gained by terrorists, decommissioning of the plant could be achieved relatively easily. Recovery from such an attack would depend on the extent of the damage. SA Water has contingency plans in place for all its treatment plants and pumping stations.

4.5 Future Challenges

Potable Water

There are a number of significant challenges in relation to water supply and management facing Adelaide in the new millennium, as outlined in the Water Proofing Adelaide document. These challenges are also reflected in the rural areas to a greater or lesser extent.

South Australia's key resource, the River Murray, is under stress with rising water salinity, increasing pollution, reduced runoff in the Murray Darling Basin and increasingly evident dieback of ecosystems.

SA Water has already started purchasing water allocations with the long-term aim to:

- Support economic development;
- Support population growth targets;
- Enable increased environmental flows;
- Compensate for the effect of climate change in diminishing supply; and
- Assist in dealing with possible future water restrictions imposed on SA Water licences[25].

This trend will continue.

As a risk minimisation measure, South Australia needs to be considering alternative sources of water in addition to greater allocations from the River Murray. These could be in the form of more water recycling in urban areas, groundwater harvesting and desalination.

There will be a greater emphasis on providing suitable environmental flows in areas such as the Adelaide Hills. However, a first step will be to study and define what the environmental flows should be.

Community expectations in relation to water supply are beginning to change and there is an awareness of the need to maintain aquatic ecosystems as well as manage the competing demands from development, industry and users.

Groundwater resources surrounding Adelaide in both the Willunga Basin and the Northern Adelaide Plains are close to full allocation and this has been one of the drivers for increased use of the potable supply (eg McLaren Vale) as well as the significant reuse schemes both north and south of Adelaide.

Shortage of groundwater supply in Eyre Peninsula is an issue and alternate sources of supply will need to be found. Management of potential pollution is an issue with groundwater in some areas of the South East.

Another issue is the change in demographics in some areas (such as Yorke Peninsula) with the decline in the inland towns around which water supply has been based and the trend towards coastal development. This has put stresses on the available infrastructure at times of peak demand.

A similar problem has occurred in the viticulture areas of the State (McLaren Vale, Barossa, Clare) where the water supply systems have originally been designed to service domestic customers. However, the high economic return related to the grape industry has made it economic to use mains water, putting extreme stress on existing supplies and distribution infrastructure. This has led to major augmentation for Clare and for the Barossa, and has assisted with the reuse scheme in the McLaren Vale area.

Wastewater

There are a number of challenges ahead for wastewater operation authorities, including:

- Expansion of population in coastal areas and implementation of infrastructure to meet demand;
- Water conservation and providing effluent for sustainable re-use applications;
- Greater sophistication in managing impacts of reuse, particularly salinity, and maintaining low levels to enable application of reclaimed water;
- Replacement programs for aging assets especially in areas with high groundwater table and increasing levels of salinity entering the sewer system, as this limits the usefulness of the treated water for further recycling opportunities;
- On-going upgrade of wastewater treatment plants and funding of required programs;
- Raising sufficient revenue for rural STEDS to make them sustainable;
- The need to upgrade some effluent disposal practices in country STEDS resulting from recent legislative changes;

- Integrated water cycle management and general sustainability in operations and maintenance of wastewater systems;
- Management of odours from systems;
- Viability of advanced technologies for wastewater treatment to provide greater effluent quality; and
- Alternate power supplies to avoid mechanical failures of systems.

4.6 Report Card Rating

The Report Card rating for **metropolitan potable water** is **B-**.
South Australia has a relatively secure water source in the River Murray and all of its water supply is managed by one organisation. High volumes of water are required from the River Murray. Overall the management of the existing assets is sound but the rating takes into account the relatively low level of infrastructure renewal. As a risk minimisation measure, South Australia should be looking at alternative sources of water to supplement its reliance on the River Murray as its principle source of water, especially during dry periods.

The Report Card rating for **non-metropolitan potable water** is **C**.
There are greater concerns with the supply in rural areas due to quantity and quality issues related to groundwater and changes in demand in a number of locations. These factors are reflected in the lower rating.

The Report Card rating for **metropolitan wastewater** is **C+**.
The existing assets in the metropolitan centres are generally good. Effluent reuse in major urban areas is relatively extensive. The high salinity levels in the older areas of the Adelaide system indicate these assets are in an advanced state of deterioration and more should be done to address the source of the problem.

The Report Card rating for **non-metropolitan wastewater** is **C-**.
Collection systems are generally in reasonable condition. However, the treatment systems in many cases, particularly in STEDS systems, need significant refurbishment to meet current standards. Land application of treated effluent is commonly practised, but this is more of a disposal avenue rather than true beneficial reuse. The level of water recycling in the non-urban areas seems disappointing given the greater opportunities to recycle water in these regions.

4.7 Case Study

This case study looks at a water supply system and some of the inherent difficulties faced in predicting and catering for water supply needs.

McLaren Vale — McLaren Flat Water Supply Area

The McLaren Vale — McLaren Flat water distribution network is a discrete system on the southern edge of metropolitan Adelaide supplied directly from the Myponga Trunk Main from two pressure reducing valve installations. The distribution network was essentially designed to service the two townships and provide domestic supplies to some of the surrounding rural areas.

Two key factors led to requirement for expansion of water supply to the region:

- The expansion of viticulture in the area for which it is economic to use mains water for irrigation (because of the high value of the crop); and
- Willunga Basin being declared a Proclaimed Wells Area (i.e. extraction is licensed) due to stresses on the groundwater supply.

The above has meant that demands were placed on the network well in excess of that originally envisaged.

Between 2000–2003, SA Water undertook a number of actions to maintain acceptable supply to domestic consumers. In times of peak demand, flows and pressures at the McLaren Flat end of the system and at some extremities, as well as in some locations in McLaren Vale were unacceptably low. The actions included:

- Construction of a second pressure reducing valve and feeder main;
- Construction of a booster pump station on a branch main between McLaren Vale and McLaren Flat;
- Provision of flow restriction at the meters on all rural supplies to encourage installation of storage tanks and off peak filling; and
- Selected duplication and network interconnections to improve flows.

The situation has improved with the above measures, but ironically the rate of increase in demand has reduced significantly due to the decline in value of grapes and because the Willunga Basin Water Company (which uses reclaimed water from SA Water's Christies Beach wastewater treatment plant) has expanded its network and become the source of supply in some locations in place of SA Water. It has proved difficult to predict the extent of replacement of mains water with reclaimed water. The current main driver for mains water usage is in the changes to groundwater allocations. Issues are therefore addressed as they arise. This indicates the need for significant planning in order to predict future requirements for a number of different contingencies.

5. Stormwater

5.1 Background

The current level of knowledge (including condition and level of service) of the state of stormwater drainage infrastructure within South Australia is variable. Responsibility and/or ownership of the stormwater assets is fragmented and widely distributed between local government, Transport SA, SA Water, the Department of Water Land and Biodiversity Conservation, Catchment Water Management Boards and Drainage Boards. This fragmentation is making a whole of catchment approach to issues more difficult to address. Local government is by far the major stormwater asset owner, due to their responsibility under the Local Government Act(s) as the drainage authority.

Flooding and quality issues are of major concern. Increased development through both in-fill and upper catchment development has placed a considerable strain on aging and under performing stormwater infrastructure that is in need of significant funding to upgrade and maintain at an acceptable level of service.

Historically, all spheres of government have taken a reactive approach to stormwater flooding and the current prolonged drought has taken some of the impetus away from flooding as an issue.

5.2 Overview

5.2.1 System Description

The stormwater system is an integral part of the water cycle, which collects and transports stormwater runoff from urban areas to rivers, lakes and the ocean. The stormwater system consists of:

- Man-made channels, both concrete and earth, typically defined as the trunk drainage system or major stormwater system;
- Stormwater pits, pipes and culverts, typically defined as the local stormwater drainage system or minor stormwater system;
- Overland flow paths including roadways also forming part of the major stormwater system;
- Detention and retention basins;
- Stormwater quality management infrastructure; and
- Water reuse infrastructure.

Traditionally, stormwater has been treated as a waste stream where it has been conveyed to the nearest point of relief by the most efficient technology available at the time of development. The stormwater system has traditionally comprised a minor (piped) and major (overland flow) system. Development within South Australia catchments has often been at the expense of providing adequate overland flow paths for major storm events. Councils and Catchment Boards throughout South Australia have undertaken numerous flood and drainage studies to collect the necessary data to determine the extent of the existing flooding problem, damages associated with flooding and the infrastructure requirements to provide acceptable levels of service for minor and major stormwater systems.

Local government is the major stormwater asset owner in South Australia. Typically, Transport SA stormwater assets include culvert crossings, bridges, side entry pits and cross pipes to the main trunk drainage line, which is generally owned by local government. The Department of Water, Land and Biodiversity Conservation has only minor stormwater asset ownership, including Patawalonga Lakes, and monitoring systems. Major stormwater infrastructure and flood management improvement works in the upper south-east part of the dry land salinity is handed over to local drainage boards upon completion.

The South Australian EPA has developed a stormwater Geographic Information System (GIS) for Adelaide, which includes information collection of stormwater infrastructure data from relevant authorities. The existing GIS includes data of various degrees of completeness. Some authorities have undertaken comprehensive data gathering projects to formulate detailed GIS, which include all the necessary data for undertaking a stormwater drainage study. Typically, authorities have collected sufficient information to show the location of the majority of pits and pipes. There are some authorities who have not undertaken any data collection projects and utilise hard copy plans to locate existing stormwater assets. Amalgamations of Councils throughout South Australia have resulted in some difficulty in collating data, particularly in the Adelaide metropolitan area. Without a complete picture of all the stormwater assets, it is difficult to put a value on South Australia's stormwater assets.

There have been a number of significant changes in recent years regarding the way in which stormwater runoff is viewed in the urban water cycle. A number of significant stormwater treatment and reuse projects have been implemented throughout South Australia. Traditionally there has been a focus on flood protection rather than the capture and reuse of stormwater. Councils with sufficient open space are now investing in stormwater capture and reuse schemes resulting in both environmental and economic benefits.

5.5.2 Governance

The responsibility (provision and maintenance) of the stormwater assets in South Australia lies largely with local government. Elsewhere, major trunk drainage lines and flood control infrastructure such as the Sturt flood control dam, Sturt River, River Torrens and downstream sections of Brownhill and Keswick Creeks are maintained by SA Water under the *Metropolitan Drainage Act 1935*.

Ownership, maintenance and operation of trunk drainage lines in metropolitan Adelaide are complex. Trunk drainage lines are owned, maintained and operated by the State Government, local government and private landholders. A lack of development control and long term stormwater planning during periods of development in Adelaide has resulted in sections of trunk drainage line with no drainage easements and no means of gaining access to maintain the system or undertake works to increase the capacity of the system without acquiring properties. The case study shown in Section 6.7 further demonstrates the issues associated with trunk stormwater drainage line ownership.

The key legislative documents that govern stormwater in South Australia include:

- *Water Resources Act 1997*
- *Metropolitan Drainage Act 1935*
- *Development Act 1993*
- *Environment Protection Act 1993*
- *Local Government Act 1999*
- *Natural Resources Management Act 2004*

There are also specific Acts such as the *South Western Suburbs Drainage Act 1959*, which sets out the roles and responsibilities of stormwater management in the South Western Suburbs of Adelaide and the *South Eastern Water Conservation and Drainage Act 1992*, which provides for the conservation and management of water and the prevention of flooding of rural land in the South East of the State.

Local government plays the key governance role relating to stormwater infrastructure as part of its natural hazard management function and flood protection responsibility under the *Local Government Act 1999*.

The role of Catchment Boards and their interaction with local government is summarised below.

Catchment Boards are State Government statutory authorities that report directly to the Minister for Environment and Conservation. The *Water Resources Act 1997* states that the Board's primary functions are:

- To prepare and implement catchment water management plans;
- To provide advice to the Minister and the constituent Councils for the Board's area in relation to the management of water resources;
- To act as the relevant authority for the control of activities affecting water, where appropriate these will be devolved or contracted out to operational units in agencies or Councils; and
- To promote public awareness of the importance of the proper management of the water resources in the Board's area, and of the sustainable use of those resources[26].

The Government's natural resource management reform in South Australia means that Catchment Boards will now be integrated into a larger natural resource management program.

The *Water Resources Act 1997* provides the Boards with statutory powers, which are set out in the Catchment Plan. The Boards' role is to integrate the efforts of Federal, State and local government agencies in a comprehensive water resources program. The Act does not establish clear boundaries for the responsibility of floodplain management. However, the Act clearly makes the Boards responsible for developing and implementing the Catchment Plan.

On a smaller scale, private developments operate and maintain stormwater systems that usually comprise pit and pipe systems, generally with some form of on-site detention or retention and proprietary water quality treatment devices.

The *Environment Protection Act 1993* promotes the minimisation of environmental harm through the principles of ecologically sustainable development and the use of the precautionary principle. Enforceable under the Act are a number of Environment Protection Policies (EPPs), including the recently developed Water Quality EPP, which aims to improve or protect the quality of water in creeks, rivers, lakes, wetlands, estuaries, seas and underground waters by defining levels of protection for each.

The role of the Department of Water, Land and Biodiversity Conservation is to provide integrated management of the State's natural resources. This includes providing advice and regulatory support to Government and the community regarding the management of surface and groundwater within South Australia.

There are many guidelines, policies and codes of practice to assist with stormwater management in South Australia. Some of these guidelines and policies include:

- *Australian Rainfall and Runoff;*
- Local council stormwater guidelines;
- Transport SA stormwater guidelines;
- Ministerial Plan Amendment Report on Stormwater in Urban Areas;
- Guidelines produced by local Catchment Authority for urban stormwater management produced by local Catchment Water Management Boards;
- Various EPA Codes of Practice;
- Local catchment water management plans;
- National and inter-State guidelines and policies;
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000);
- Local urban stormwater management plans; and
- Council development control plans.

5.2.3 Sector Trends

Urban development within cities and towns has often had little regard for maintaining the structure and health of natural waterways. Many natural waterways have been concrete lined, reduced in size or developed over the top with little provision for the major stormwater system.

In recent times, there has been a push to convert existing waterways into more natural waterways with the vision to replicate pre-European settlement. Restoration of waterways often includes constructed wetlands to improve stormwater quality and an aquifer storage recovery component for stormwater reuse and to maintain the long-term viability of groundwater resources.

The ultimate aim for cities and towns throughout South Australia is to reduce reliance on the River Murray for water supply. The *Water Proofing Adelaide* strategy is aimed at securing the long term supply of water for the Adelaide and nearby semi-rural areas. The draft strategy for securing the long term supply of water for Adelaide includes a combination of:

1. Reducing water use;
2. Better management of our existing water systems; and
3. Development of new or alternative supplies (eg stormwater or wastewater reuse).

Outside of metropolitan Adelaide, many local communities have undertaken or are in the process of undertaking studies to capture, treat and reuse stormwater for irrigating local sporting grounds, schools, bowling greens and parklands. There is increasing community awareness that stormwater and wastewater are valuable resources that can be treated to a sufficient quality for reuse within the local community.

State and Federal Programs

There are a number of State and Federal programs that assist Councils, Catchment Water Management Boards and the Community to improve the existing stormwater system within South Australia.

Catchment Subsidy Scheme

State Government assists Local Government to the extent of 50 percent of the estimated or actual cost to Councils of approved drainage works, whichever is the lesser under the Catchment Subsidy Scheme. The Scheme is administered by the Department of Water, Land and Biodiversity Conservation. Transport SA provides technical expertise, and the conditions and procedures governing this assistance are explained in full in Local Government Circular No. 21. To qualify for a subsidy, the drainage works being considered must have an upstream catchment area in excess of 40 hectares and must satisfy accepted engineering principles and standards. The annual Scheme budget is $4 million. Large projects are generally staged over a number of years so that they do not drain the annual funding, thereby preventing smaller projects from being undertaken.

Urban Stormwater Initiative

Under the Living Cities program, the Federal Government has allocated $6.8 million to the Urban Stormwater Initiative. The Urban Stormwater Initiative is aimed at enhancing water quality in the waterways of major coastal cities by improving stormwater management. The Parafield Partnerships Urban Stormwater Initiative — Salisbury, was undertaken using funds from the Urban Stormwater Initiative.

Australian Water Fund

In September 2004 the Prime Minister announced a $2 billion commitment over 5 years to the Australian Water Fund. The Australian Water Fund is divided into three parts, Water Smart Australia ($1.6 billion), National Water Standards ($200 million) and Water Wise Communities ($200 million). The Prime Minister has undertaken to provide $200 million over 5 years to support the following South Australia projects:

- Waterproofing Adelaide;
- Mt Lofty Ranges sustainable management project;
- Groundwater management;
- Managing the impacts of urban development on surface and groundwater resources;
- Whyalla Solar Oasis; and
- Implementation of the National Water Initiative.

Catchment Levy

The Catchment Boards' Catchment Plans are funded primarily through a catchment levy contribution from catchment Councils and their ratepayers. In the year 2003–2004, the levies for the Patawalonga, Torrens, Onkaparinga and South East Catchment Water Management Boards, amounted to $2.4 million, $4.09 million, $2.18 million and $0.41 million respectively.

Additional Funding Sources

Additional funding sources include the National Action Plan for Salinity and Water Quality, Natural Heritage Trust, and the Regional Natural Disaster (flood) Risk Assessment program.

Water Sensitive Urban Design

Water sensitive urban design is a general name for a suite of measures now being used by stormwater managers and planners to intercept and treat urban water. Water sensitive urban design can be applied at a range of scales, from at-source (measures that intercept water at the house block or roadside scale) to end-of-pipe.

The aim of water sensitive urban design is to replicate natural water cycles, in terms of water quantity and quality management, and manage stormwater at or near the source. This involves, amongst others, retention of natural waterways, retrofitting existing systems, provision of structural (eg. sediment ponds, wetlands, aquifer storage and recovery schemes, litter devices, bioretention) and non-structural (eg education, building level controls) strategies, integration of stormwater management within open space systems, implementing re-use and provision of swales and buffer zones. These initiatives are being pursued, particularly in new-release areas such as Aldinga Arts Eco Village, New Brompton Estate, Parifitt Square and Mawson Lakes.

As with any stormwater infrastructure, ongoing maintenance is required to ensure that the infrastructure operates as per the original design intent.

Water Cycle Management

In the interest of ecologically sustainable development, the entire water cycle is being considered during master planning of green field sites. This includes consideration of potable water supply, wastewater collection and transportation, wastewater treatment, water recycling and stormwater. Opportunities for stormwater include, amongst others, collection of roof-runoff in rainwater tanks for non-potable re-use and bio-retention of runoff from impervious areas, with recycling for irrigation. At present, approximately 5,000 ML of stormwater and wastewater is reused in the Adelaide region with a further 17,000 ML being reused in rural areas. Stormwater reuse schemes are being planned or undertaken for Grange Golf Course and Royal Adelaide Golf Course, with expected average annual yields of between 200 to 300 ML/annum at each Course.

Large scale stormwater harvesting schemes such as those undertaken by the City of Salisbury can provide a reliable water supply at competitive rates (below $1.00/kL). However, they generally require a significant land uptake, which is a barrier for many metropolitan Councils that do not have sufficient open space for such schemes.

On 5 March 2004, the Premier announced that rainwater tanks would be plumbed into all new homes from July 2006. The Rainwater Tank Policy calls for a 1 kL rainwater storage to be plumbed into at least one flush toilet or all laundry cold water outlets or hot water supply, where the average annual rainfall is greater than or equal to 300 mm. Rainwater tank rebate schemes have been implemented by a number of Councils including Adelaide City Council, City of Mitcham and City of Playford to encourage the uptake of rainwater tanks.

Non-Structural Stormwater Management

Non-structural stormwater quality management, comprising institutional and pollution-prevention practices to prevent or minimise pollutants from entering stormwater runoff and/or reducing the volume of stormwater requiring management, are being increasingly used. Strategies include town-planning controls; strategic citywide stormwater management plans, and maintenance practices by local authorities; enforcement and education programs; illicit discharge elimination; training; and licensing/auditing from commercial and industrial sites.

The Patawalonga, Torrens, Onkaparinga and Northern Adelaide and Barossa Catchment Water Management Boards have developed a 20-minute video outlining why polluted stormwater is damaging to the environment and gives small and medium-sized business owners step-by-step information on how to prevent stormwater pollution occurring as a result of their operations.

5.3 Level of Service

The level of service provided by stormwater systems throughout the State is variable. In many areas, the current level of service provided by many stormwater systems is less than the original design level due to increased development and urban consolidation in the upstream catchment. In-fill development will continue to reduce the level of service provided by existing stormwater infrastructure if no mitigation measures are implemented, which will need to be addressed through the stormwater master plan process. Regular maintenance of stormwater drainage systems is essential to maintain the design intent and an acceptable level of service. Parameters used to measure the level of service have been identified as follows:

Parameter	Level of Service
Flooding	Frequency of flooding
	Impact and extent of flooding
	Size and capacity of system relative to catchment
	Reliability of asset
	Sustainability of asset
	Public safety
	Property damage
	Maintenance frequency
	Maintainability
Water Quality	Type of structure
	Pollutant removal efficiency and effectiveness
	Pollutant build-up rates
	Pollutant storage capacity
	Reliability of asset
	Sustainability of asset
	Position in treatment train
	Blockage frequency
	Maintenance Frequency
	Maintainability
Structural	Infrastructure age
	Structural integrity
	Maintenance Frequency

Surveys of the Adelaide Metropolitan Councils, undertaken during the *Metropolitan Adelaide Stormwater Management Study*[27], generally indicated that the minor stormwater drainage system (for nuisance events up to a 5-year Average Recurrence Interval (ARI) event) was of an acceptable level of service in the upper and mid catchment Councils. However it was poor in some of the low lying Councils adjacent to the coast. The level of service provided by the major stormwater drainage system (for events larger than a 20-year ARI event) was generally adequate in the metropolitan fringe Councils, but poor in the well established Councils. The City of Unley rated the local major overland flow paths as being acceptable, while the creek system major overland flow path was rated as very poor. The City of Onkaparinga itself rated the local major overland flow paths as being very poor in the Willunga/Happy Valley areas and above average in the Noarlunga area.

Flood mapping studies have been undertaken for Brown Hill Creek, Keswick Creek and the River Torrens catchment. The First to Fifth Creeks catchments, the Clare township and the Dry Creek catchment flood maps are also in the process of being mapped or updated. Creeks in other areas have been mapped to a greater or lesser extent. The Brown Hill and Keswick Creek flood mapping study highlighted the extent of flooding and damages within this catchment, particularly through the Mile End South, Keswick and Airport areas. Increased data collection including flood mapping studies is required to ascertain the level of service provided by trunk drainage systems within metropolitan Adelaide.

From a regional perspective, the level of service provided by the minor stormwater drainage system in the City of Port Lincoln is generally acceptable. However, there are concerns over the level of service provided by the major stormwater drainage system. In 1980, a storm in excess of a 100-year ARI event struck Port Lincoln, resulting in estimated damages of between $2 million and $5 million. As with many regional towns, the cental business district of Port Lincoln lies in flood prone land. Flood water levels in the Port Lincoln central business district were reported to be waist high in some areas as a result of the 1980 storm event, causing significant damage and disruption to the town.

5.4 Existing Infrastructure

The extent, age and level of service provided by stormwater infrastructure in South Australia is variable. The knowledge base of existing stormwater infrastructure is also variable, with some Councils having up-to-date GIS showing key attributes of individual elements defining their stormwater system while others have no records to limited information on hard copy plans. Many of the knowledge gaps are due to information being lost when Councils amalgamated and when long serving Council officers left or retired.

Existing stormwater infrastructure in Adelaide is valued at over $5 billion. The age, condition and remaining life of stormwater infrastructure in the older areas of South Australia are issues that need to be addressed. Failure of stormwater infrastructure in the Cities of Port Adelaide, Enfield, West Torrens and Charles Sturt has been experienced. The rehabilitation of these failures is often very expensive and disruptive to the community. Condition assessments of existing stormwater infrastructure, particularly in the older areas, is required to fill information gaps relating to the condition of existing stormwater infrastructure and to prevent further failures from occurring.

Knowledge gaps in the form of outstanding drainage studies and flood mapping studies make it difficult to assess the level of service provided by existing stormwater infrastructure, flood damage estimates, and funding requirements for future works. Often problem areas are not identified until flood damage occurs. The City of Burnside has recently undertaken a *Stormwater Infrastructure Study*, which highlighted a number of problem areas requiring approximately $12 million to rectify. The City of Charles Sturt has undertaken urban stormwater master plans in three catchments (Port Road, Trimmer Parade and Meakin Terrace) and estimates that $30 million is required to upgrade the existing stormwater system, with an additional $10 million required for local drainage works. These studies are continuing and will provide a clearer picture of the capital investment required to upgrade existing stormwater drainage systems. The estimated cost of outstanding significant flood mitigation projects in metropolitan Adelaide is approximately $160 million, which excludes any land acquisition and minor stormwater works for catchments less than 40 hectares.

Fringe suburbs and less densely populated suburbs tend to have a stormwater system that provides a higher level of service. Newer developments often incorporate flow control and water quality measures and more recently in some developments, volume control measures have been implemented to reduce the impact of development.

Maintenance of stormwater infrastructure also varies, with some infrastructure owners taking a proactive approach, through having a maintenance system in place, while others take a reactive approach by only carrying out maintenance when a problem arises.

5.5 Future Needs

Future needs required to improve the level of service provided by stormwater infrastructure are discussed below.

Additional Data Collection

Additional data collection in the form of drainage studies, flood mapping studies, urban stormwater master plans and condition assessments is required to gain a better understanding of the existing stormwater infrastructure assets and the flooding problems within urban areas. Without knowing the full extent of the problem, it is difficult to determine the large capital investment required to provide flood mitigation measures. At present there is no known estimate of the cost of a 100-year ARI flood event in metropolitan Adelaide.

Single Stormwater Authority

One stormwater authority that brings both State and local government together to focus the efforts of both entities is required for the effective management of stormwater. A single authority with a clear aim and appropriate mechanisms in place would also assist in attracting much needed Federal Government funding.

Funding

An increase in funding for flood mitigation works and replacement of aging infrastructure is required. Cost apportionment models have been developed so that Councils within a catchment contribute funds based on the extent to which an area causes the cost. However, local government generally does not have sufficient funds to undertake the projects identified. The Catchment Subsidy Scheme annual funding of $4 million is insufficient to clear the backlog of projects (currently valued at $160 million) and to fund new projects that will arise as further data is collected in the form of urban stormwater master plans.

The relatively low cost of potable water has resulted in very little private funding for stormwater infrastructure, for example most viable aquifer storage and recovery schemes are heavily funded by the Government to construct the necessary infrastructure. Opportunities for private funding need to be explored.

Planning Controls

Planning controls from a State and local government perspective relating to development along trunk stormwater drainage lines and infill development need to be addressed and/or enforced to prevent the current situation from worsening and also to address potential problems in existing developed areas.

Asset Ownership

The ownership of trunk stormwater drainage lines within metropolitan Adelaide is complex, with State Government, local government and private ownership being a major obstacle to the effective management of the system. Asset ownership and maintenance issues need to be addressed if an effective plan for the management of trunk stormwater drainage lines is to be implemented.

Urban Stormwater Master Planning

The ongoing preparation of urban stormwater master plans is an important step in gathering the data necessary to make informative decisions and plan for future stormwater infrastructure.

Further studies are required to assess the impact that on-site detention and on-site retention systems have in mitigating major flood events. Preliminary work undertaken to date shows that on-site detention and on-site retention is very catchment specific and may be detrimental in some areas. Issues with respect to maintaining these systems also need to be addressed.

5.6 Report Card Rating

The formal endorsement of the *Urban Stormwater Management Policy* for South Australia by local and State Government is encouraging for the long term management of stormwater infrastructure in South Australia. The policy includes key goals and strategies in risk, governance, planning, sustainability and funding, recognising that significant work is required in each of these areas.

Existing stormwater infrastructure is under increasing pressure from upstream and infill development. A lack of planning control during the development of our major towns and cities and even today has resulted in stormwater infrastructure that is under increasing pressure. Aging infrastructure and inadequate maintenance also needs to be addressed in the short and medium term to budget for the replacement and upgrade of stormwater infrastructure.

Although there are significant information gaps in the minor and major stormwater systems, the view of most Councils is that the minor stormwater drainage system has a higher performance rating than the major stormwater drainage system. The focus of outstanding stormwater infrastructure works has been the major stormwater system and there is no known assessment of the outstanding infrastructure works for the minor stormwater system.

In summary, there is a need for additional data collection, funding and a coordinated approach to managing stormwater in South Australia.

The minor stormwater infrastructure rating for South Australia is **C-** and the major stormwater infrastructure rating is **D-**, resulting in an overall rating of stormwater infrastructure for South Australia of **D**.

5.7 Case Study

This case study looks at the issues associated with watercourse ownership, which result in access and maintenance constraints in watercourses within the Patawalonga Catchment.

In 2000, the Patawalonga Catchment Water Management Board undertook a watercourse audit of the urban streams in the Patawalonga Catchment. The total length of audited open watercourses was 27.3 km. The study showed that approximately 7.8 km of watercourse was privately owned, which was the largest land ownership, and approximately 18 km of the adjoining land use was residential. Generally there was limited access to watercourses through private properties. However, provision for access was better through public open space and public utilities, such as the Adelaide Airport. Examples of development encroaching onto the floodplain and even watercourses are shown in Photos 1 and 2 below.

Photo 1

Photo 2

Approximately 8.4 km of the Patawalonga watercourse linings were found to be in poor condition. A number of significant erosion points were identified, including three bridges and 11 culverts that had significant cracking and defects. Sections of the watercourses are subject to erosion and weed infestation, as shown in Photo 2 above. Photo 2 also demonstrates the difficulties in gaining access to carry out routine maintenance and undertake rehabilitation works within the existing watercourse.

6. Electricity

6.1 Background

The South Australian electricity industry consists of generation, transmission, distribution and end-use. Former State owned assets in the transmission and distribution sectors are subject to 200 year leases to the private sector from the public sector, which continues to maintain nominal ownership. The leasing program was completed in 2000.

As with other States in eastern Australia, growing summer demand for electricity presents challenges to the adequacy of the existing infrastructure. South Australia also has unique issues. Generation from inter-State represents a significant share of its overall generation mix, resulting in an exposure for both purchasers of wholesale energy and the State's consumers to the reliability of the electricity system in other States. Interruptions to inter-State supply can result in significant spikes in the price availability of power in South Australia, particularly under peak demand conditions. As a result of its fuel supply outlook, South Australia is likely to continue to be highly interconnected with other Australian States' networks. This reliance on other networks represents a challenge for South Australia in prioritising the necessary network enhancements in a national planning process.

South Australia has also been a key site for prospective wind farm developments. These developments, if they were to proceed in the numbers announced publicly, would represent a significant challenge to the State's existing transmission network in maintaining network stability.

6.2 Overview

6.2.1 System Description

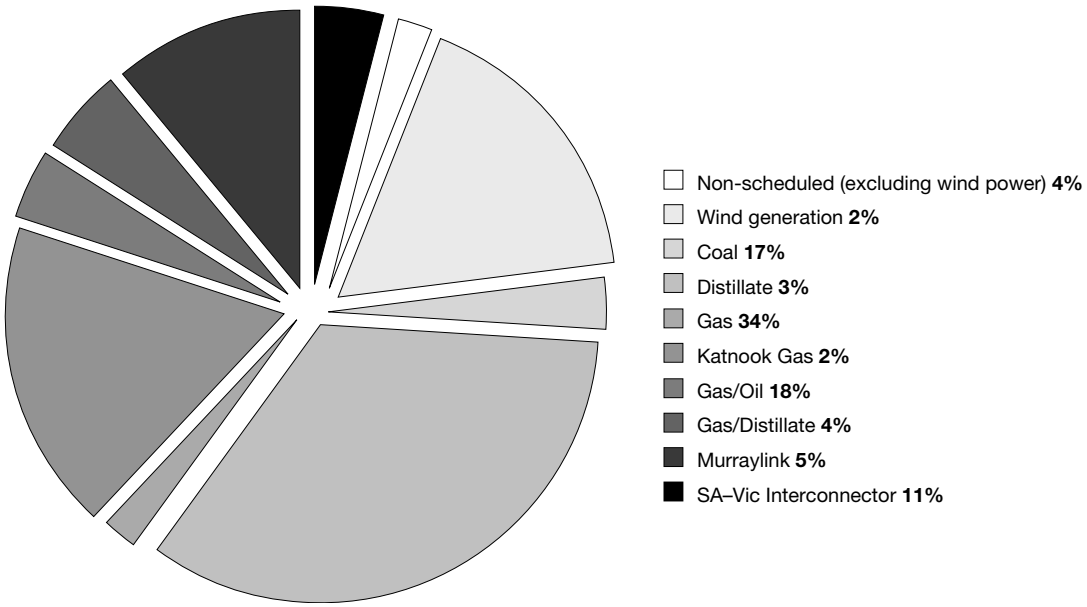
Generation

South Australian generation system currently consists of two sub–bituminous coal, two distillate, six natural gas and three stations with dual–fuel firing capability. The total installed name–plate capacity of the scheduled generating units in South Australia was 3,454 MW in 2003, depending on the weather conditions. South Australia is uniquely dependent on inter-State generation to provide base load power, not only during hotter than normal weather but at all times. In 2003–04, generation from inter-State contributed 16 percent of the State's required generation.

South Australia's total installed generation capacity of 3,454 MW (2003) compares with a projected maximum demand in the 2005–06 summer of 3378 MW[28]. With the delay of Basslink's commissioning into 2006, and without a further revision to projected demand in the combined region for summer 2005–06, the Victorian/South Australian region will again fall below the acceptable level of reserve capacity defined by the National Electricity Market Management Company (NEMMCo) in summer 2005–06. NEMMCo's reserve trader powers are likely to be called on as they were in 2004–05.

South Australia's identified future requirement for additional generation is mid and peak load. No significant augmentations of South Australian generation have currently been identified. Table 8, below, lists the augmentations to generating capacity identified by the Electricity Supply Industry Planning Council in its 2004 annual planning review[29]. Since the publication of the 2004 annual planning review, none of the developments identified as prospective has proceeded to commissioning.

Figure 2: South Australian Generation by fuel source, including non-scheduled generation 2003–04



Source: ESIPC 2004

Table 8: Future Scheduled Generating Capacity, Prospective

Power Station	Name-plate capacity (MW)	Plant Type	Fuel Type	Developer	Target Completion
Dry Creek	40	Gas Turbine	Natural gas	International Power	N/A
Hallett	250	Gas Turbines	Natural gas	AGL	N/A
Lock	500	Conventional	Coal-fired	Centrex	N/A
Millicent	30	N/A	Wood waste	Babcock and Brown	N/A
Mintaro	40	Gas Turbine	Natural Gas	International Power	N/A
Osborne 2	180	Combined cycle	Natural gas	ATCO Power	N/A
Pelican Point 2	240	Combined cycle	Natural gas	International Power	N/A
Quarantine	75	Combined cycle	Natural gas	Origin Energy	N/A
Snuggery	25	Gas Turbine	Distillate	International Power	N/A

Source: ESIPC 2005 Draft Annual Planning Report

Transmission

ElectraNet is owned by a group of four companies, the largest of which is a subsidiary of the Queensland Transmission Network Service Provider, Powerlink[30]. ElectraNet is the principal transmission Network Service Provider in South Australia, operating and maintaining the high voltage network throughout the State. The network comprises around 6,000 kms of transmission lines and 73 substations or switchyards, complemented by a monitoring and control centre and associated communications facilities.

The South Australian network is characterised by long distances, a low energy density and a small customer base compared to other States. Demand is significantly increased by high summer temperatures due to air-conditioning load.

The Australian Competition and Consumer Commission (ACCC) is currently the economic regulator for transmission in South Australia. The Ministerial Council on Energy agreed on new governance and regulatory arrangements for the energy market in December 2003. Under these arrangements, the National Electricity Code Administrator (NECA) will be abolished and its rule-making and enforcement functions for the National Electricity Market will transfer to the new Australian Energy Market Commission (AEMC) and the Australian Energy Regulator respectively, while the ACCC's responsibilities will also move to the Australian Energy Regulator.

Distribution

ETSA Utilities (ETSA) leases, owns* and operates networks comprising more than 77,600 circuit kilometres of distribution lines and 374 substations reticulating an area of 178,200 km^2 of the State. ETSA's high voltage networks typically operate at 66 kV for sub–transmission within the metropolitan area, as well as Eastern Hills, Fleurieu, Eyre Peninsula and Riverland regions. Lower voltages operate for country long distance sub-transmission, general distribution in built-up areas, and sparse rural distribution[31].

The Essential Services Commission of South Australia is the economic regulator for electricity and gas distribution in South Australia, although in time these functions are also expected to transfer to the Australian Energy Regulator.

6.2.2 Governance

The electricity market has complex governance and regulatory issues. The generation, transmission, distribution and retailing entities each have separate arrangements, shown below. Following the agreement of the Ministerial Council on Energy to changes as a result of the Parer Committee report, the governance arrangements are in transition to a single national energy regulator, the Australian Energy Regulator.

Table 9: Electricity Industry Governance Arrangements

	Generation	Transmission	Distribution
Market	Competitive market	Natural monopoly	Natural monopoly
Operator	NEMMCo operates National Electricity Market.	NEMMCo is responsible for power system security in line with its role as operator of the NEM	
Oversight	Overseen by NECA and ACCC Transition to the AER	Planning of grid by Electricity Supply Industry Planning Council in conjunction with ElectraNet ACCC governs pricing arrangements Transition to the AER	Regulated by ESCOSA Transition to the AER

* The terms of the lease from the South Australian government requires ETSA to maintain the existing network. Capital items of more than an agreed value remain the property of ETSA Utilities at the end of the lease. To manage this arrangement, ETSA maintains two asset registers.

6.2.3 Sector Trends

South Australian electricity demand is expected to grow by around 2.1 percent per annum over the next 10 years, with peak or maximum demand projected to grow by around 2.8 percent per annum over the same period.

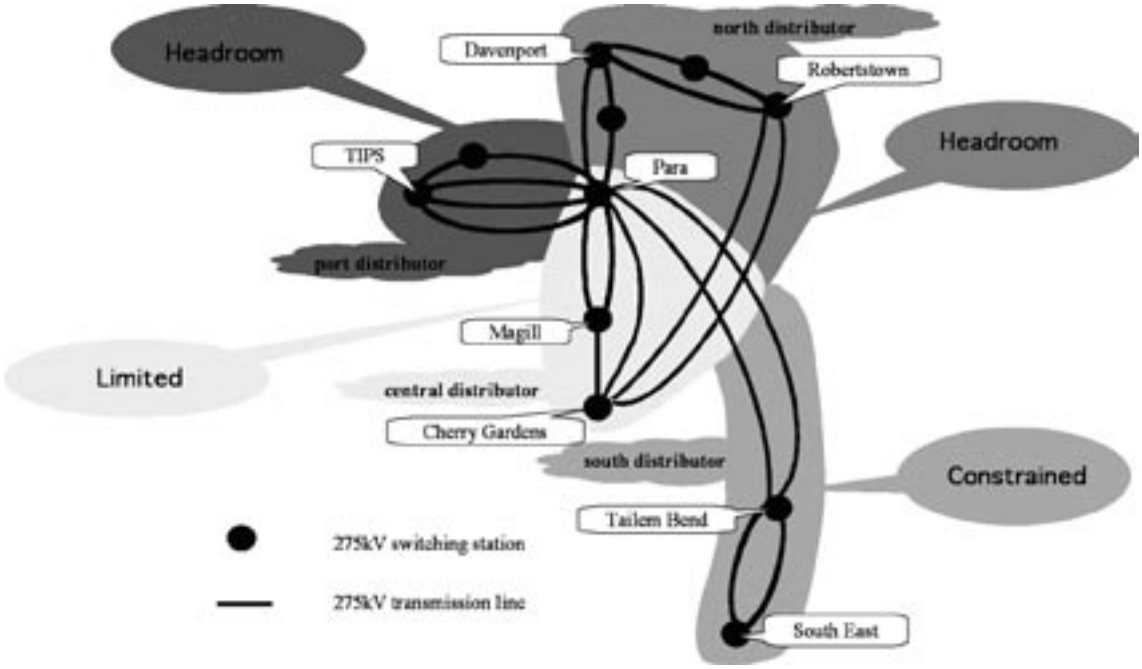
In common with electricity networks in other States in Australia, future investment will be required to remove emerging constraints from the network, provide for growth, particularly at peak periods and respond to changes in the location of generation and potential future interconnection. In South Australia, the Electricity Supply Industry Planning Council (ESIPC) currently has the role of identifying and planning for network augmentations. ElectraNet has developed a 20-year outlook for South Australia (*Network 2025*) as the basis for optimising longer-term network planning and asset replacement and augmentation decisions over the life of the plan.

ETSA identifies its future capital and operating expenditures in the process of the five yearly regulatory rate setting process as well as providing its forecasts for use in ESIPC's activities. ETSA also publishes an annual *Electricity System Development Plan*. There is a significant level of interdependency between ElectraNet's and ETSA's investment programs, with ElectraNet obliged to provide capacity in line with ETSA's forecasts at connection points within a mandated period.

Transmission

The South Australian *Planning Council 2004 Annual Planning Report* has identified a requirement for three large network augmentations in the South–East, Lower Flinders and southern metropolitan areas of South Australia. Going forward, ESIPC's analysis indicates that the bulk transfer capability across the greater Adelaide area is approaching its full capability and, based on the current planning output, will need augmentation in the next decade. (see Figure 3, below).

Figure 3: Status of the South Australian High Voltage Network: projected capacity



Source: ESIPC 2004

Future investment requirements for the transmission network are highly dependent on the configuration of South Australian generation, the location of future demand and other operational and investment decisions, in particular, developments in inter-State transmission augmentations. Network 2025 is part of a coordinated longer term planning process designed to assist in augmenting the transmission and distribution networks in an optimal manner going forward.

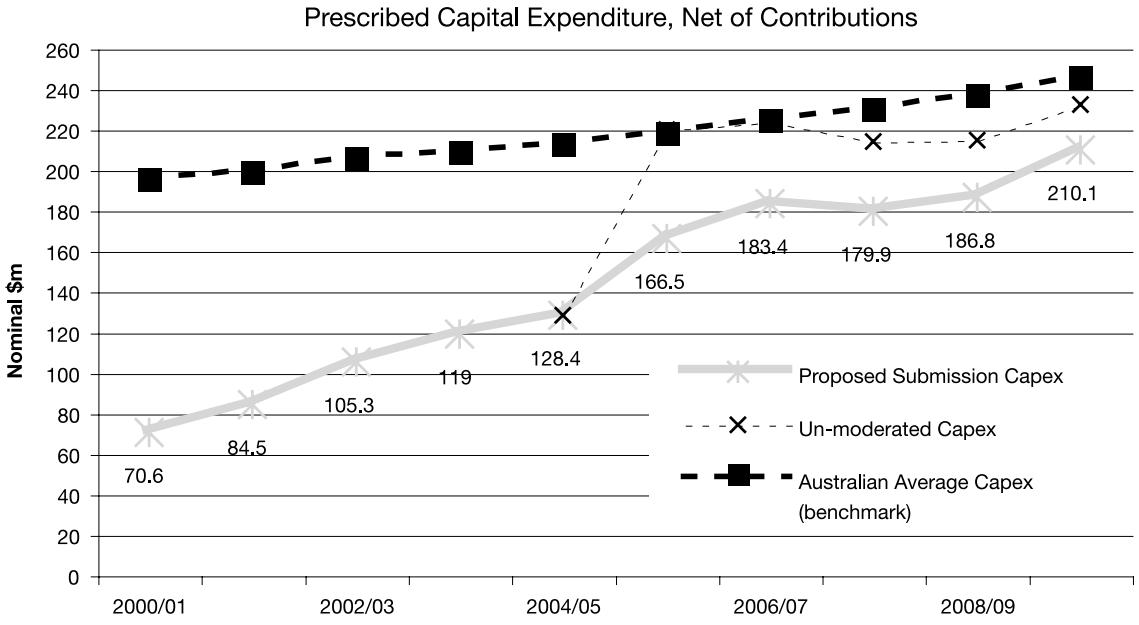
ESIPC's planning activities will, in future, feed into the new national process for transmission planning. This presents the challenge of achieving priority for projects affecting the capacity of the network to support transfers of power into and out of South Australia with a high level of reliability given the range of potentially competing national priorities. South Australia's challenge can be illustrated by looking at the first Australian National Transmission Statement, published by NEMMCo in 2004. That statement lists four projects as preliminary priority targets for investigation, only the last two of which (Victoria towards South Australia and Snowy towards Victoria) would relax potential constraints on South Australian power transfers.

Distribution

ETSA has experienced a steady increase in capital expenditure during the five years to 2004–05, as shown in Figure 4. Measured on an annual basis during the period 2000–01 to 2004–05 over the last regulatory period, ETSA's actual capital expenditures were very marginally greater than forecast in its revenue application for the period.

Going forward, the regulator (the Essential Services Commission), has allowed a further real increase in forecast capital expenditure to $743 million over the period 2005–2010, an increase of nearly 50 percent. The Essential Services Commission also allowed for real increases in forecast operating expenditure. The effect on customers was offset by the reduction in the allowed pre-tax Weighted Average Cost of Capital and a one-off reduction in customers' tariffs**.

Figure 4: ETSA Utilities, Actual and Projected Capital Expenditure, 2000–01 to 2009–10



Source: ESCOSA, April 2005

** ESCOSA applied a one off reduction of 4 percent to regulated income in the first year of the current regulatory period (X equivalent to 4), followed by an X factor of zero for the second and subsequent years. See ESCOSA, *2005–2010 Electricity Distribution Price Determination: Part A Statement of Reasons*, April 2005

6.3 Evaluation

6.3.1 Level of Service

Transmission

Table 10, taken from the ACCC's comparative review of the transmission businesses' performance suggests ElectraNet's performance has been stable and of a high level over the period covered. The data suggests that there has been an improvement in average outage duration over the period***.

Table 10: Performance of ElectraNet, 1996/97–2003

Indicator	Historical Performance						Current Performance
	96–97	97–98	98–99	99–00	00–01	01–02	2003
Total circuit availability (percent)	99.23	99.25	98.82	99.29	99.32	99.3	99.59
Loss of Supply Event Frequency Index							
>0.2 minutes per annum	5	5	3	9	5	5	2
>1.0 minutes per annum	3	2	0	2	1	1	1
Average outage duration (mins)	239.1	205.7	82.7	70.9	141.3	108.6	70.13

Distribution

Each regulatory jurisdiction in Australia reports on reliability of electricity supply using performance measures based on the average duration and frequency of interruptions to customers. Among other indicators, ETSA currently reports on:

- SAIFI — System Average Interruption Frequency Index, the number of times on which, on average, a customer could expect to experience an interruption to supply of one or more minutes, measured on the *high voltage network* only.
- SAIDI — System Average Interruption Duration Index, the total number of minutes, on average, a customer can expect to be without supply as a result of interruptions of one or more minutes, measured on the *high voltage network* only.

SAIDI and SAIFI are also used in Victoria, Queensland and NSW.

The data in Table 11 on ETSA's performance shows, as expected, significant differences in performance between the Adelaide Business District, major metropolitan areas and more remote and rural communities. Notwithstanding this, the South Australian distribution network performs well when compared to other distribution networks****.

*** The extent of the improvement in average outage duration may be a reflection of improved timeliness in responding to outages and may not reflect underlying performance. Communication from ElectraNet, 7 June 2005.

**** DNRME, Qld, *Detailed Report of Electricity Distribution and Service Delivery for 21st Century*, 2004 contains a comparison of the performance of the Australian distribution businesses, recalculated to ensure comparability of the reported measures. ETSA's performance ranks just behind that of United Energy and AGL, both of which have concentrated urban customer bases and do not face the difficulties of providing service to remote rural communities. Although some element of ETSA's relative performance is likely to be explained by the exclusion of outages on the low voltage network from its data, estimates of the effect of the exclusion of the low voltage network on these figures do not suggest a significant deterioration. From mid 2005, it is anticipated that ETSA will be able to monitor interruptions to service in the low voltage network, with some adjustment to the required levels of service to take account of the effects of this extension of the current monitoring scheme.

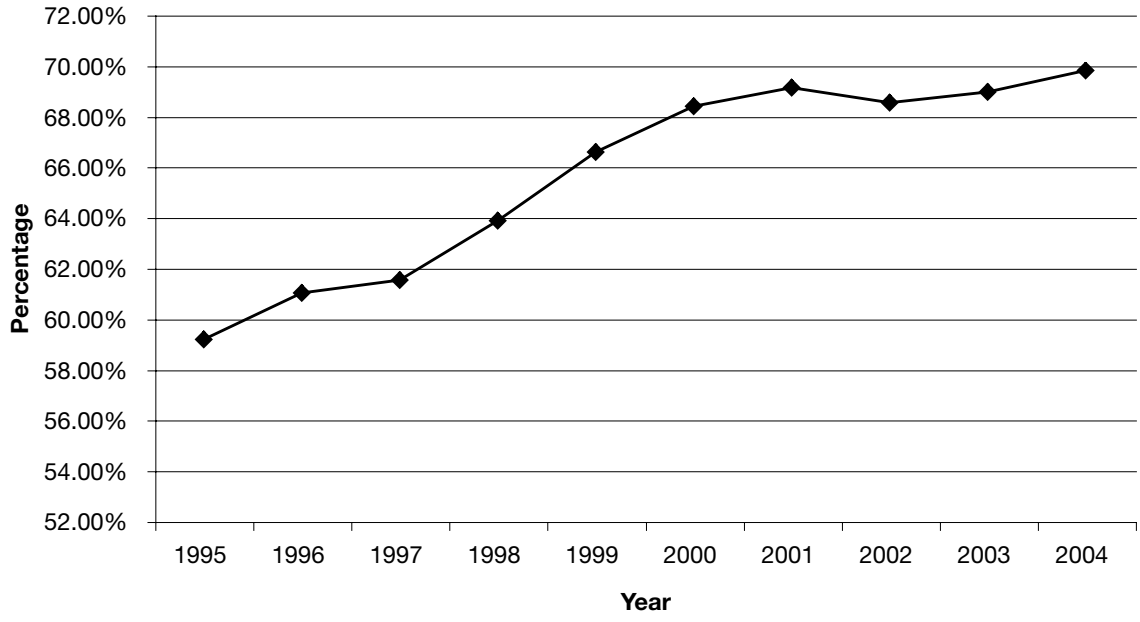
Table 11: Performance of ETSA Utilities, SAIDI and SAIFI, 2000/01–2003/04, High Voltage Only

Region	SAIDI (Minutes)	SAIFI (Interruptions)
Adelaide Business Area	24	0.29
Barossa/Mid-Nth & Yorke Peninsula/Riverland/ Murrayland	237	2.00
Eastern Hills/Fleurieu Peninsula	340	3.16
Major Metropolitan Areas	109	1.36
South East	324	2.57
Upper North & Eyre Peninsula	362	2.38
Kangaroo Island	1,185	8.82
Statewide	159	1.65

Source: ESCOSA, April 2005

In managing the performance of its network, ETSA has sought to stabilise the performance of its assets by investing in additional capacity in order to maintain performance at around current levels. As Figure 5 shows, the peak utilisation factor for substations, measured in aggregate, has stabilised in recent years after having increased systematically over the previous five years, reflecting substation investments since 1999. ETSA's asset utilisation planning aims to maintain the current level of network asset utilisation with no deterioration in customers' experience by planning its response in the event of an outage affecting a network asset, rather than maintaining an N-1 redundancy in the network. In the case of substations, for example, ETSA's options in the event of a substation outage include reconfiguring network flows to prevent customer disruptions and using a mobile substation to replace the out-of-service substation. Continual practice of the network's response to emergency situations allows ETSA to rapidly respond in the event of an outage.

Figure 5: Peak Asset Utilisation Factor for Substations, MW/Capacity in MVA



Source: ETSA Utilities

6.3.2 Asset Quality

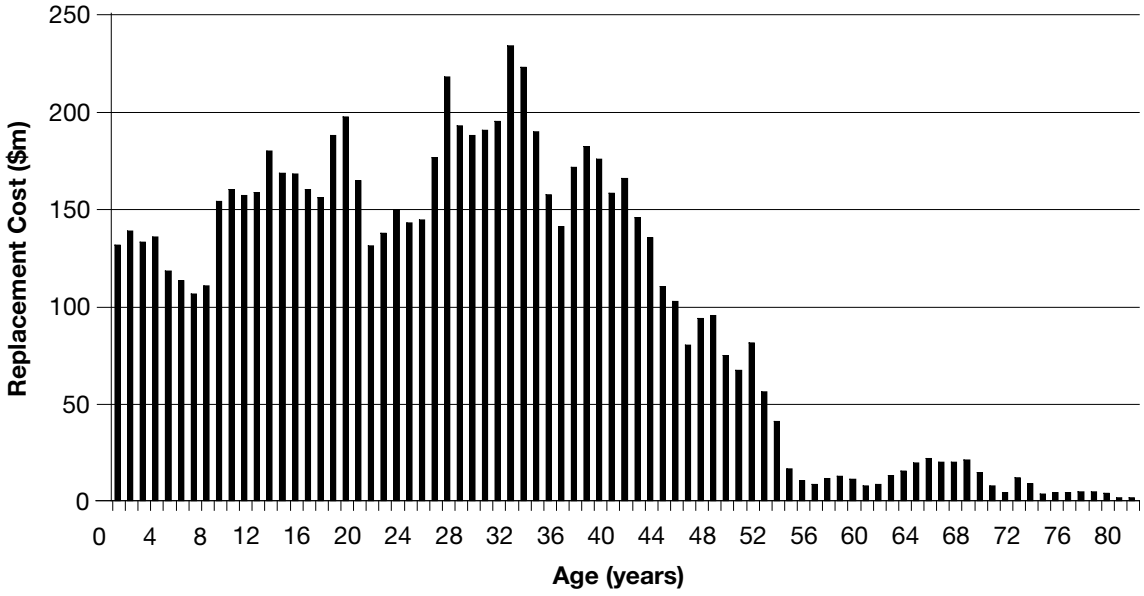
Transmission

ElectraNet's performance in recent years has been high and over the period to 2003 showed no overall trend, with potentially some improvement in the duration of the average outage.

Distribution

The South Australian distribution network, in common with most other Australian States, was constructed substantially in the 1950s and 1960s and significant components of the network are now nearing the end of the lifetimes for which they were originally designed to remain in service. The age profile of the network assets is as shown in Figure 6 below.

Figure 6: Age Profile of ETSA Utilities Network Assets, by replacement cost



Source: ETSA Utilities

The South Australian distribution network performs well when compared to other distribution networks and meets its current regulatory targets with no sign of deteriorating performance.

6.3.3 Security

In the near term, additional mid and peak load generation is required in the Victorian/South Australian region, despite the introduction of Basslink in 2006. Over the next decade, a combination of new base and new peak load generation will be required to service South Australia's power requirements. There are a number of ways in which South Australia's growing electricity demands could be met in the future, including:

- augmenting transmission interconnections between New South Wales, Victoria and South Australia;
- facilitating new investment in power stations in South Australia; and
- increasing the uptake of energy efficiency and the use of demand side management techniques in the National Electricity Market.

The location and type of generation brought on, the actions of other jurisdictions and the outcome of current discussions about carbon-trading schemes in Australia, with their implications for the relative costs of generation in Victoria compared with South Australia and New South Wales, will affect the future requirement for transmission network capability. The South Australian electricity system is interdependent with other elements in the national electricity industry and developments in other jurisdictions have the capacity to either increase the security of the South Australian system or increase its vulnerability.

The nature of the interconnected transmission network is that South Australia's supply reliability depends on developments in the transmission network in other States. For example, developments in the regions surrounding the Snowy interconnector, with increasing power off take in that region as growth occurs, affect the capacity of the interconnectors servicing South Australia. Given the critical nature of the performance of the interconnected transmission network to South Australia's wholesale electricity price, power availability and reliability, South Australia will need to manage the national process of agreeing future developments in the transmission system so as to achieve its local objectives.

6.3.4 Funding

The transmission and distribution assets, including augmentations, are funded by network charges to end users. The appropriate funding level is established by a determination of the relevant regulatory authority, currently in the case of ElectraNet, the ACCC and for ETSA, the Essential Services Commission. Performance indicators for the transmission and distribution businesses suggest that performance is currently meeting and in some areas exceeding the required levels, with no deterioration in performance evident despite aging assets.

South Australia's capital contribution scheme for new large electricity users connecting to the distribution system is designed to give appropriate price signals to users associated with their location and energy use pattern. As a result, despite the growth in connections in recent years, ETSA has maintained its capital and maintenance expenditures, with total expenditure slightly in excess of that forecast in the previous Electricity Distribution Price Determination.

In recent years, South Australian electricity users have experienced significant increases in electricity prices, reflecting developments in the wholesale cost of energy as well as changes to the contribution of transmission and distribution charges to overall costs. The 2005–2010 Electricity Distribution Price Determination will see a reduction in average customers' bills as a result of tariff rebalancing, a reduction in the allowed pre-tax Weighted Average Cost of Capital and a trade-off between costs in the first year of the Determination and future increases, which will reflect the CPI[32].

6.4 Future Directions

For the transmission network, the next decade is likely to present significant new challenges in response to the development of the NEM. A potential result of developments in the NEM is that the national transmission grid is significantly augmented, particularly with interconnection. There could also be further development of generation in States with the most cost-effective fuel supply and greater inter-reliance in the NEM on developments in other jurisdictions.

For the distribution networks, maintaining network performance and managing the transition to a different regulator, with that regulator's focus likely to reflect national rather than local concerns, will provide continuing challenges. With that transition, concerns arising from developments in other businesses are likely to give rise to regulatory action not related to the specific needs of the local jurisdiction. This challenge is not restricted to South Australia.

6.5 Report Card Rating

Ratings have been based on the consideration of asset condition, asset availability and reliability, asset management, sustainability (including economic, environmental and social issues) and security.

The **asset condition** of South Australia's electricity is such that a rating **B** is appropriate. Available material on asset performance shows no negative trends, despite increasing age.

Subsequently, **asset availability and reliability** is also awarded a **B**. General performance is very strong in this area.

Overall, **asset management** in the sector is assigned **B+**. Both ElectraNet and ETSA Utilities publish, as required, detailed annual planning statements, as well as being involved in the process of forecasting the States' overall requirements with ESIPC.

Security has been allocated **C**. South Australia is already the most dependent of all the NEM States on day-to-day developments in other States in the NEM. In the future, the shift towards a greater national focus on planning and regulation presents South Australia with a challenge in achieving the level of security and reliability required by its circumstances.

The **overall rating** for the electricity sector is **B-**, reflecting the concerns that the process of achieving and paying for desired local levels of performance in an increasingly national system is not well defined at present and may result in some deterioration in South Australia's future supply reliability.

6.6 Case Study

South Australia has been a key site for prospective wind farm developments. Proposed developments in South Australia have been significantly in excess of demand for Renewable Energy Certificates under the Federal Government's Mandatory Renewable Energy Target Scheme. The cost of augmenting the transmission grid to provide connection to remote wind farm locations, is likely to discourage a number of the proposed developments. As a result, wind farm developers are concentrating their research on establishing wind farms in the mid north and south east of the State in close proximity to the existing transmission system.

Table 12 suggests, the development of wind power is mixed in its impact on the performance of the overall system. Wind power is non-scheduled generation, requiring adjustment to scheduled generation in line with its actual generation at any point in time. The absence of any predictable relationship between the contribution of wind power and temperature, used in the table below as a proxy for demand, means that the contribution of wind power to projected generation requirements is significantly less than its maximum or even average output*****. Wind generation does not improve and may even reduce the State's load factor, increasing the utilisation of relatively higher priced mid and peak load generators from base load generation, with an upward effect on the wholesale electricity price. Furthermore, there is the potential for overall transmission charges to increase.

If significant additional wind generation were to come to market, it would require developers to meet the costs of augmenting the transmission network.

Table 12 notes the practical limits to wind generation, which include the implications for overall system stability, have not been determined and require further investigation.

Table 12: Projected Impacts of Wind Farm Development on the South Australian Electricity Sector

Market Aspect Investigated	Result
Firm Capacity	~8 percent of installed capacity
Correlation between Wind and Temperature	No specific correlation although some diurnal patterns detected
Interconnector: Net imports	Reduced
Interconnector: Hours of constrained operation	Reduced [(a)]
Generation levels of SA incumbents	Reduced
Changes in fuel usage	More unpredictable, higher volatility [(b)]
State Load Factor	Not improved
CO_2 emissions	Reduced
Practical limit to wind penetration	Not determined [(c)]

(a) Further research required on "gatekeeper arrangements; (b) Could potentially result in higher transport charges
(c) Further research intended

Source: ESIPC, March 2003

***** Generally, the expected output of wind generation is based on a utilisation factor of 30–40 percent, although there is some suggestion that even this number may be too high.

7. Gas

7.1 Background

Both natural gas and LPG (liquefied petroleum gas) are delivered to generation, industrial, commercial and residential customers in South Australia. Natural gas accounts for around 90 percent of the gas energy consumption per year, (around 100–110 PJ) with about 60 percent of natural gas going to electricity generation. Two main pipelines transport natural gas to Adelaide and a number of lateral pipelines transport natural gas to a small number of towns and industries reasonably close to the pipeline routes. By June 2004, natural gas was supplied to about 357,000 customers, including more than half the households in South Australia, with growth at 1.8 percent in 2003–04 and anticipation of future growth of around 6,000–8,000 customers per year.

South Australia's annual consumption of LPG, excluding Autogas, is in the order of 100–130,000 tonnes (~6PJ per year), representing about 10 percent of gas energy consumption (excluding natural gas generation). In addition, Autogas in the order of 180,000 tonnes per year, is used for transport fuels, including forklifts. Primary Industries and Resources SA estimates that 43,000 consumers use LPG in permanently fixed appliances and as many as 50,000 consumers have portable LPG appliances such as barbecues, patio heaters, and gas lanterns.

LPG is transported from Port Bonython in the Spencer Gulf, and from Victoria or NSW LPG plants by road tanker, to metropolitan and regional storage and distribution terminals, five separate LP gas distribution networks, and some smaller electricity generation stations.

Gas exploration and production, and natural gas transport and distribution, is regulated by State legislation.

7.2 Overview

The Electricity Supply Industry Planning Council is required to publish an Annual Planning Report of the adequacy of the electricity supply system to meet the medium and long–term requirements of South Australian electricity consumers. With over 60 percent of South Australia's electricity generation dependent on gas, ESIPC includes a detailed review of gas supply, demand and infrastructure in preparing their report.

South Australia's *Infrastructure Plan* predicts that the State's gas transmission infrastructure will meet market growth requirements for the foreseeable future. The SEA Gas pipeline and South East South Australian (SESA) lateral form the final link in a system connecting all major gas production facilities with the south-eastern Australian market except perhaps for a sales gas line from Queensland to the Moomba pipelines. The physical capacity of the Moomba to Adelaide pipeline and SEA Gas pipeline combined exceeds the projected medium term future demand, but contract volumes for the Moomba to Adelaide Pipeline have the potential to reduce its capacity. The Office for Infrastructure Development's Strategic Infrastructure Plan has a Priority 1 project to encourage further investment in gas infrastructure to connect South Australia via the Moomba area, to gas basins to the north and west, offshore Western Australia and the Northern Territory, with the financial lead taken by the private sector.

South Australia moved to full retail contestability in its gas retail market in July 2004. All gas customers are entitled to choose a gas retailer from the five that are licensed to retail gas to all customers.

7.2.1 System Description

Gas Resources, Reserves

Santos is the operator of the Cooper Basin Joint Venture (Santos, Delhi and Origin Energy are the major partners), which produces gas from the Cooper Basin gas fields. The Moomba Gas Plant processes this plus gas from the south west Queensland fields, for delivery to Adelaide and Sydney.

The Cooper/Eromanga gas fields have uncommitted reserves in the order of 300–700 PJ, a figure which has remained reasonably stable for the last two years, with discoveries proving up at roughly the rate to meet South Australia's total demand for around six years. A raw gas pipeline connects the Queensland gas system from the Ballera gas plant to Moomba, however this cannot be used in its present configuration for transport of gas processed for transmission to market.

The commissioning of the SEA Gas pipeline gave South Australia access to the Victorian gas network, and in particular the Otway Basin's Iona Western Underground Gas Storage facility which currently takes gas from Minerva's — 300 PJ, as well as potential access to Geographe/Thylacine — 850 PJ and Casino — >200PJ. fields

Whilst there is potential to access gas from the vast fields offshore in Western Australia and the Northern Territory, and from the gas fields of PNG where reserves in the order of 12000 PJ are available, only commercial drivers will determine whether a pipeline is built to access these fields for the South Australian market. Opinion is generally that gas swaps between Queensland's coal seam methane or traditional gas producers and the Cooper Basin joint venture producers will fill any potential shortfall in the next 5–10 years.

The Cooper Basin joint venture produces crude oil which is pre-processed at Moomba liquids plant, and transported by pipeline to Port Bonython where LPG is stripped out, stored and sold to both domestic and export distributors.

Large quantities of LPG are produced in Victoria and processed at Westernport. The reserves of the Bass Strait represent many years of demand.

About half of South Australia's LPG is sourced from Port Bonython and the balance is imported from inter-State by road tanker. There are no LPG marine unloading facilities in South Australia.

Gas Processing and Transport

Until 1 January 2004, South Australia's principal natural gas source was the Moomba processing plant in the Cooper Basin, about 800 km north of Adelaide. At that time the SEA Gas pipeline was commissioned and South Australia's reliance on a single resource and transmission system for its gas supply was mitigated.

The Moomba facility also incorporates substantial underground storage for processed sales gas.

The Moomba-Adelaide 858 km main pipeline with 7 compressor stations and 326 km of laterals is owned and operated by Epic Energy. The Moomba to Adelaide Pipeline transports natural gas from the Cooper Basin joint venture's Moomba gas fields and gas processing plant to a number of power generators, industrial customers, gas distributors and retailers. Gas is supplied to Adelaide, Whyalla, Port Pirie, Peterborough and the Barossa Valley. A lateral owned by Envestra and operated by Origin Energy Asset Management supplies gas to the Riverland and Murray Bridge. The Moomba to Adelaide Pipeline has a nominal capacity of 415 TJ/day with its current compression capacity.

A 150 mm lateral pipeline from the Moomba to Adelaide Pipeline to Port Pirie and a 200 mm spur to Whyalla provides gas to those towns but is operating at around 7 TJ pa, close to its capacity.
It represents about 7 percent of South Australia's total gas demand. OneSteel at Whyalla uses the majority of the gas in their process.

The 680 km SEA Gas pipeline from the Iona gas storage facility in Victoria to Adelaide has off takes to supply gas to Torrens Island and Pelican Point power stations, and at Cavan there is a connection to the Moomba to Adelaide Pipeline and the Adelaide distribution system. It is owned and operated by South East Australia Gas Pty Ltd (SEA Gas), an agent for an equal equity partnership between Origin Energy, International Power Australia and TXU. Gas is available to the SEA Gas pipeline from a number of gas fields in the offshore Otway Basin, and subject to capacity availability in the Victorian network, from the Bass Strait and Bass Gas fields of south east Victoria. The pipeline has a capacity of 125 PJ/annum, adequate to transport the State's current annual demand and projected growth through some years, as well as sufficient linepack to maintain total average flow for peak demand over a number of days in the event of a major failure of the Moomba to Adelaide Pipeline . The SEA Gas pipeline is limited to supplying the 80 percent of the State's customers connected to the metropolitan and south east networks, as gas cannot be delivered to the northern customers of the Moomba to Adelaide Pipeline with current arrangements.

A relatively small gas resource and processing plant at Katnook, in the onshore Otway basin near Penola in the State's south east supplies gas to Mount Gambier, and to industrial plants at Millicent and Snuggery via the Katnook-Mount Gambier pipeline. However, the resource is diminishing and is expected to be essentially depleted by the end of 2006, when gas will be supplied from the Victorian gas fields. A small gas field at Ladbroke Grove has supplied gas in conjunction with Katnook gas to a nearby power generator. The gas field is approaching depletion and in March 2005, Origin Energy commenced construction of the 45 km long, 200 mm diameter SESA pipeline from the SEA Gas connection near Poolaijelo in Victoria to terminate at Ladbroke Grove. This will be able to supply gas from the Victorian gas fields to the Mount Gambier region as Katnook depletes.

LP gas is transported principally from Port Bonython in the Spencer Gulf and Hastings (Westernport) in Victoria, and subject to market conditions from NSW and Queensland, by road tanker. A number of LP gas storage centres using 'bullets' are located in the northern metropolitan suburbs and regional centres. Origin Energy operates five regional distribution centres with an aggregate storage capacity for non-automotive LPG to cover several days' demand.

7.2.2 Natural Gas Distribution

Natural gas is distributed to the Adelaide metropolitan area, Port Pirie, Whyalla and Mount Gambier by Envestra, which operates the main gas distribution network in South Australia, with a total length of about 7,189 km. Much of the older gas main was cast iron, but an upgrade program to install polyethylene insert to extend the life of these low-pressure mains by 30 years or more is well advanced.

Origin Energy Asset Management utilises a sophisticated computer simulation model to predict potential bottlenecks and pinch points in the pipeline and reticulation systems of the gas network. Network modelling tools are used to simulate depletion of supply and/or changes in supply pressure under various ambient temperature scenarios. This information is then used to identify the need for reinforcement projects.

7.2.3 LP Gas Distribution

Origin Energy and Kleenheat distribute almost all LP gas for industrial and residential use, whilst automotive LPG is distributed mainly by 'Autogas', a Kleenheat/Elgas joint venture.

Gas is transported as bottled gas and delivered in road tankers for dispensing to fixed gas tank installations in industry; agricultural facilities such as cool stores; hotels and restaurants; residential and aged care villages; and many other applications.

LP gas is reticulated in Port Lincoln, Wallaroo, Roxby Downs, Renmark, and to an extensive retirement village in Victor Harbor. Each distribution network is served by one or more LP gas storage tanks with capacities between 2 and 45 tonnes.

Table 13: LP Gas Distribution Networks in South Australia

Network Location	Length of Main (m)	Operating Pressure (kPa)	Number of Customers
Roxby Downs	18 545	120	1091
Victor Harbor (Rosetta Retirement Village)	1 630	105	305
Renmark (Jane Eliza Estate)	2 688	140	70
Port Lincoln	3 629	105	50
Wallaroo	5 996	105	14

Source: Technical Regulator

7.2.4 Governance

Exploration and production is regulated by the South Australia *Petroleum Act 2000* and Regulations, which also require that pipelines are constructed, operated and maintained in accordance with AS 2885, with requirements for health, safety and environmental management.

The Federal and all State and Territory governments' National Third Party Access Code for Natural Gas Pipeline Systems, is administered in South Australia through the *Gas Pipelines Access (South Australia) Act 1997* which makes provision for the regulation of third party access to natural gas pipeline systems. The uniform national framework applies for third party access to all gas pipelines to facilitate the development and operation of a national market for natural gas. It is designed to prevent abuse of monopoly power and promote a competitive market for natural gas where customers can choose their suppliers, whether producers, retailers or traders. It gives fair and reasonable right of access to third parties to natural gas transmission and distribution pipelines, whether owner, operator or user. The Third Party Access Code applies to all pipelines that are deemed to be 'covered'. A pipeline can become covered in two ways — either deemed to be covered at the time of the Code's inception, or where it has been subject to a decision that it should be covered. Coverage decisions are made by the relevant Minister following a recommendation from the National Competition Council. Epic Energy's Moomba to Adelaide pipeline and the South West Queensland pipeline are covered pipelines.

The Riverland lateral, SEA Gas and the Katnook–Mount Gambier pipelines are "uncovered", and access is obtained purely on a commercial basis.

The South Australian *Gas Act 1997 (The Gas Act)* was enacted to promote efficiency and competition in the gas supply industry. It also has the purpose of promoting the establishment and maintenance of a safe and efficient system of gas distribution and supply with established and enforceable proper standards of safety, reliability and quality in the gas supply industry. The Gas Act requires that proper safety and technical standards for gas installations and appliances are established and enforced to protect the interests of gas consumers. To achieve this, a Technical Regulator is appointed by the Minister, whose function is to monitor and regulate safety and technical standards in the gas supply industry; and with respect to gas installations and gas appliances, as well as to provide advice in relation to safety or technical standards in the gas supply industry. This extends to monitoring the operation of the gas distribution networks to ensure that required quantities and quality of gas is available for use in the metropolitan and regional distribution networks as well as for use in gas appliances.

The *Australian Energy Market Commission Establishment Act 2004* is expected to be enacted during 2005 to fund a Commission which will have the rule-making, market development and other functions conferred under National Energy Laws or Jurisdictional Energy Laws.

The *Essential Services Commission Act 2002* established the Essential Services Commission, to regulate gas sales prices and perform licensing and other functions under relevant industry regulation Acts. It also monitors and enforces compliance with and promotes improvement of standards and conditions

of service and supply under relevant industry regulation Acts. The Essential Services Commission also makes, monitors the operation of, and reviews from time to time, codes and rules relating to the conduct or operations of a regulated industry or regulated entities, as well as providing and requiring consumer consultation processes in regulated industries and assisting consumers and others with information and other services.

7.2.5 Sector Trends

Energy SA, a division of Primary Industry and Resources SA, reports that gas demand is projected to increase by 2–3 percent annually against an increase in 2003–04 of 1.8 percent. The pipeline operators, Epic Energy, SEA Gas and Envestra, all monitor demand and maintain historical data to predict demand for varying periods, however there is insufficient historical data for accurate forecasting of long-term demand in the SEA Gas line.

Planning SA and the Urban Development Institute in South Australia have forecast information, which is used to assist in developing demand prediction, particularly along the growth corridors where main network lines will be needed. This is supported by construction activity data sourced from the Housing Industry Association, BIS Shrapnel and other sources. Additionally, both residential and commercial developers operate on substantial lead times, so demand growth in subdivisions and developments is readily predicted using market information.

The construction of gas–fired generating units by International Power, Origin Energy and AGL has increased gas demand for power generation within South Australia rapidly over the past five years. The annual demand for natural gas in South Australia over the last 10 years is shown in the table below, taken from Primary Industries and Resources SA data.

Table 14: Annual Demand for Natural Gas in South Australia over the last 10 years

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Gas, PJ — Industry, commerce, residential, other	36	41	44	45	46	44	43	44	45	44	44
Generation, PJ	47	52	46	35	34	40	54	54	66	66	54
Total Gas Consumption, PJ	83	93	90	80	80	84	97	98	111	110	98

Where new power generation is planned, environmental and economic considerations are likely to determine that gas will be the preferred fuel. For example, it is possible that the WMC Olympic Dam expansion project could increase annual demand by up to 29 PJ, around 24 PJ/yr for power generation, and 5 PJ for liquid fuels replacement. However, current indications are that this gas would be sourced from the PNG Gas Project via the proposed new PNG pipeline. A number of constraints would require resolution, such as the use of the Ballera-Moomba raw gas pipeline being used for sales gas, or the development of a gas-swapping arrangement. Under these arrangements, there would be no effect on the ability of Santos to deliver gas, nor the Moomba to Adelaide Pipeline to meet its transport commitments.

The commissioning of the SEA Gas pipeline and development of long-term gas supply contracts for a number of generators has reduced the demand for gas from the Cooper Basin.

Gas contracts with the Cooper Basin producers for supply to South Australia started to decline during 2004 following the commissioning of the SEA Gas Pipeline, and this decline may continue until these contracts expire in 2013. The decline in contracts reflects the decline in reserves to the point where uncommitted reserves were in the order of 700 PJ at June 2004 (less than six years of South Australia's demand), although current Cooper Basin exploration programs are expected to prove an additional resource of up to 2500 PJ. Gas swaps with Queensland coal seam methane have the potential to make further supplies available.

Discoveries of significant gas resources and proved reserves in the Victorian sector of the offshore Otway Basin (Geographe/Thylacine — 850 PJ; Minerva — 300 PJ; Casino — >200PJ) are expected to become an important supply to South Australia with the potential to extend the current supplies well beyond the next 10 years. Origin Energy, TXU and International Power, the major investors in the SEA Gas pipeline, have contracted much of this gas for their requirements in South Australia.

Origin Energy are predicting that 2,000 PJ of gas will be discovered in the Otway Basin in the future, made possible by advances in 3D seismic technology and the large unexplored offshore area proximate to the new discoveries.

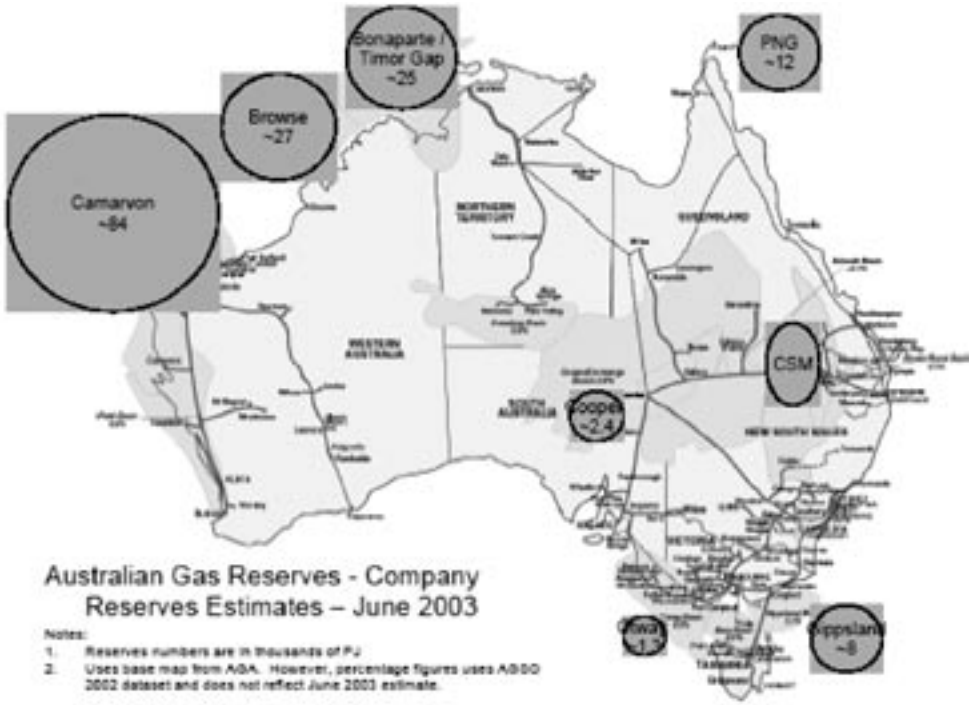
Table 15: Australia's Estimated Gas Reserves at June 2003

Australia's Estimated Gas Reserves at June 2003

Basin	Proven and Probable (PJ)	Awaiting Further Appraisal (PJ)	Total (PJ)	Company Estimates of Reserves (PJ)	Undiscovered Estimate (PJ)
Cooper /Eromanga	2,131	325	2,456	2,900	2,500
Otway	40	1,438	1,478	1,300	2,000
Gippsland	5,407	2,215	7,622	5,800	6,200
Bass	0	546	546	305	–
Bonaparte	–	25,468	25,468	–	–
Browse	–	27,470	27,470	22,600	–
Carnarvon / NWS	22,722	61,435	84,157	23,600	–

Source: ESIPC Annual Report June 2004

Figure 7: Australian Gas Reserves Estimates — June 2003



Source: PIRSA

The ESIPC, in its June 2004 report states *"While not fully contracted, there appears to be sufficient reserves to satisfy South Australian gas demand."*

7.3 Evaluation

7.3.1 Level of Service

Safety of Gas Supply

From a series of audits of Envestra and Origin Energy Asset Management, the Technical Regulator found that there are sound systems in place to ensure that risks to the South Australian community from the operation of gas distribution networks are being managed to an acceptable level. There were 14 gas appliance or component recalls during the year.

Gas pipelines are located under the streets and footpaths of metropolitan Adelaide and some regional centres and it is imperative that they operate safely. Inadequate planning for extending, maintaining, and replacing gas distribution assets could also result in significant cost increases to consumers.

No gas related deaths occurred during the year, however 18 gas related incidents were investigated. There were 7600 new connections to the natural gas distribution system. However the Technical Regulator noted that there has not been any significant decrease in the number of instances of third party damage and that a number of leaks have been reported by the public (safety and reliability indicators).

Public safety is paramount for a gas distributor. Gas distribution systems operate under streets and the public needs to be confident that there will not be any fires, explosions, or gas leaks. In Adelaide, the last major rupture occurred over 20 years ago.

Transmission

On 1 January 2004, gas supply from Victoria's Otway Basin commenced via the newly constructed SEA Gas pipeline. The SEA Gas pipeline is currently delivering one third of South Australia's gas requirements and is expected to increase to one half. This newly constructed pipeline has been an important source of alternative supply during the gas supply shortages that occurred as a result of the fire at Moomba Gas Processing Plant on 1st January 2004. The new SEA Gas pipeline from Victoria to Adelaide has reduced some constraint that may be experienced by the Moomba to Adelaide supply system.

Distribution

The gas distribution network consists of approximately 7000 km of steel, cast iron and plastic pipes and is mainly buried underneath the streets. It is owned by Envestra Ltd and operated, on behalf of Envestra, by Origin Energy Asset Management Ltd.

Envestra's gas distribution licence conditions require a Gas Measurement Management Plan, a number of KPIs (which cover a number of areas including safety, gas measurement, gas quality, reliability and connections) and information regarding incidents and complaints. All of these are submitted to the Essential Services Commission each year for approval. The distribution licence conditions placed on Envestra, together with the requirements of the *Gas Act 1997* and *Gas Regulations* and audits help to ensure that gas distribution networks in South Australia are constructed and operated safely and comply with applicable national safety and technical standards.

The Technical Regulator also monitors the planning, construction, and maintenance of distribution networks to ensure that gas is available in the required quantities and quality for metropolitan and regional distribution networks and for general use in gas appliances.

Reports of interruptions to supply are made to the Technical Regulator, giving a general description of the circumstances in which gas infrastructure owned or operated by the person has failed or malfunctioned or been found to be unsafe and of action taken to rectify, or to prevent or minimise the risk of recurrence of failure, malfunction or unsafe condition.

Gas escapes in the distribution system are detected through two main processes: public reports (reactive) and regular leakage surveys (proactive). In 2003–04, there were 2359 public reported gas leaks as against 2200 in 2002–03.

During 2003–2004, Envestra, through Origin Energy Asset Management, reported 48 incidents (involving attendance of fire brigade, others) to the Technical Regulator, which is significantly lower than the 74 incidents reported during 2002–03.

Safety Management Plan

There is a requirement for a Safety and Management Plan, to enable effective response to security threats, incidents and terrorism alerts. Owners and operators of gas distribution networks are required to summarise the management systems and procedures they have in place for:

- Reducing the risk of death or injury, or damage to property;
- The safe design, installation, commissioning, operation, maintenance and decommissioning of gas infrastructure;
- The maintenance of a supply of gas of the quality required to be maintained by or under the *Gas Act*;
- Ensuring that gas supply is suitable for each gas installation which is situated in a place that will be connected or re-connected to the distribution system;
- Ensuring that an appropriate level of examination and testing of installations is carried out on the new connection of gas supply to a place to provide assurance of the safety of gas installations;
- Ensuring that employees and contractors performing the work are competent and properly trained, perform their work safely, and are provided with a safe system of work;
- Dealing with, reporting and investigating accidents and unsafe situations;
- Monitoring compliance with safety and technical requirements imposed by or under the *Gas Act*; and
- Monitoring gas distribution infrastructure for the purposes of identifying infrastructure that is unsafe or at risk of failing or malfunctioning.

In the *Safety Awareness Plan*, gas retailers are required to:

- Establish and maintain systems for communicating information to consumers regarding safety, in respect of gas infrastructure and gas installations, including gas appliances, and for measuring the customer's utilisation of information systems required by the plan;
- Provide material with information and adequate warnings on the properties of gas;
- Warn the public about the need for due care with respect to gas infrastructure and gas installations, including gas appliances;
- Inform customers about the correct action to be taken with respect to defects or malfunctions of gas infrastructure and gas installations, including gas appliances and means by which consumers can report those defects or malfunctions;
- State the approval schemes for gas appliances and the manner in which a consumer can determine whether a gas appliance has been approved; and
- Provide a point of contact for consumers regarding gas supply difficulties and gas shortages.

7.3.2 Asset Quality

The Moomba Gas Plant was commissioned in 1969. A serious fire in the plant at the start of 2004 curtailed gas production. This left gas supplies in the State dependent on gas storage in the Moomba-Adelaide pipeline (linepack), underground storage at Moomba, and a new gas supply from Victoria via the SEA Gas pipeline, which at the time of the fire was complete, and commissioned within a few days.

Santos advises that it initiated a maintenance management systems improvement program in 2003, which was aimed at meeting or exceeding key reliability criteria, including those of all its gas delivery contracts. In the programme, condition surveys of all critical parts of the gas supply and processing system were subject to inspection and assessment for their reliability, monitoring and replacement to maintain a targeted level of reliability.

Stringent maintenance regimes and condition surveys of all transmission and distribution pipelines are mandated under the *Gas Act* and monitored and reported on annually by the Technical Regulator.

Epic Energy operates the Moomba-Adelaide Pipeline and laterals (excluding the Angaston-Berri lateral), and has implemented a pipeline management system employing reliability centred maintenance principles with stringent reliability performance requirements. The Moomba to Adelaide Pipeline and its laterals are recognised as being in good condition and well maintained.

SEA Gas has contracted maintenance of their pipeline to GasNet Australia, and compressor maintenance to HPS, and as a new pipeline, its condition is excellent.

Envestra's gas distribution network is maintained by Origin Energy Asset Management, which operates its maintenance management system using the latest computerised maintenance management system. Its data is linked to a GIS system and a detailed asset register of all equipment including pipelines, mains, services, metering and pressure regulating equipment etc while the location of all mains and other major assets are recorded spatially in a GIS system. Origin Energy Asset Management has an extensive set of KPIs, through which Envestra monitors the effectiveness of maintenance and management of the distribution system. An ongoing program of replacement or refurbishment of aging assets, such as polyethylene insert lining of 60–70 km of cast iron gas mains each year, is determined from leak and repair history, and in 2004 new mains totalling 161 kms were laid and 75 kms were replaced.

7.3.3 Sustainability

The gas transmission and distribution industry generates little waste and is active in recycling scrap materials. An interesting public comment from Epic Energy was that its operation generates more office than industrial waste.

Envestra is proactive in using materials which impart sustainability, such as the use of polyethylene pipe to encourage >50 year pipeline life. Polyethylene is recyclable. Almost all consumables are recyclable, except filter elements.

Origin Energy's annual Sustainability Report attests to its commitment to operating its business in a sustainable way.

Approximately 3.6 percent of gas delivered into the distribution pipelines system has been lost at the point of delivery (the consumer's meter). This level increased in 2003–04 over the previous year, but remains within industry acceptable limits. Over 80 percent of this is attributed to leakage in the distribution system and Origin Energy Asset Management addresses this with leakage surveys, which are currently risk-based, with high consequence locations surveyed more frequently. A program of ongoing mains renewal is expected to reduce the number of gas escapes reported or detected, leading to a reduction in lost gas.

This report does not address the release of carbon dioxide gas during Cooper Basin production.

7.3.4 Security

In its June 2004 Annual Report, the ESIPC states that *"there appears to be sufficient reserves to satisfy South Australian gas demand for the forecast period without additional capacity from basins other than those connected to the State", and "In the longer term, the reserves that supply the South East Australian market will be exhausted and new reserves will need to be accessed".* Gas reserves in the offshore West Australian and Northern Territory fields, as well as PNG, are potential long-term replacement sources, should commercial drivers encourage establishment of the necessary gas delivery infrastructure. Exploration for, and development of, additional reserves in south east Australia have the potential to provide alternative long-term supply sources.

There was a significant improvement in the security of gas transmission with the SEA Gas pipeline coming on stream with supply from Victoria. However, the contracted capacity of the Moomba to Adelaide Pipeline will roughly halve by 2007 from 418 TJ/day contracted through 2005 to around 200 TJ/day by the end of 2006. The Moomba to Adelaide Pipeline can transport the reduced volume of contracted gas

at a lower pressure, allowing decommissioning of six of the seven compressor stations, leaving a line capacity which will meet immediate needs, typically of 150 TJ/day. In this case, the Moomba to Adelaide Pipeline linepack would reduce from the current availability of about 3 days supply at peak demand to a significantly lesser amount. The Moomba to Adelaide Pipeline line will not provide full redundancy in the event the SEA Gas line is out of service, unless the compressor stations are retained.

Envestra uses sophisticated network planning techniques to identify specific actions necessary for network reinforcement, de-bottlenecking and pinch point mitigation to ensure individual customers' security of supply.

All pipeline operators have a proactive approach to minimising accidental damage with their main techniques being to patrol pipelines, maintain an ongoing education program, particularly for landowners and other utilities and councils, and the "dial before you dig" system to help protect the distribution network.

Appropriate security systems are in place to assist in preventing malicious damage for critical infrastructure. These have been reviewed by third party security experts and are synchronised with the Federal Government security alert status levels.

7.3.5 Funding

Supply and Processing

Gas exploration and process plant development is funded exclusively by private industry.

7.3.6 Transmission Pipelines

Capital works on the Moomba to Adelaide Pipeline line are internally funded against foundation contracts and under tariffs regulated by the Essential Services Commission , whilst operational maintenance work is funded from cash flow.

The construction of the SEA Gas pipeline was project financed with partial equity finance by its equal equity partners, Origin Energy, International Power Australia and TXU.

The SESA pipeline is funded internally by its owner and operator, Origin Energy.

7.3.7 Distribution Network

Generally, Envestra is constrained by regulatory approval for capital expenditure for distribution network extensions. It has to demonstrate to the Regulator that the expenditure is prudent on the basis, for example, of haulage rates chargeable against capital cost. Where a project is marginally uneconomic, there can be grounds for securing a customer contribution to get a project over the hurdle rate. Expenditure on distribution network capital projects must be approved by the Essential Services Commission , as part of the Access Programme and is funded through debt and/or shareholder equity. Capital and general expenditure for ongoing maintenance is funded from cash flow.

7.4 Future Directions

7.4.1 Capacity

When the January 2004 fire occurred at the Moomba Gas Plant, adequate linepack in the Moomba to Adelaide Pipeline, coupled with the ability of the SEA Gas pipeline operators to secure gas supply and commission the line ahead of schedule, allowed effectively uninterrupted supply to continue.

As previously noted, if the Moomba to Adelaide Pipeline pressure is reduced and a number of its compressors are decommissioned, the Moomba to Adelaide Pipeline line pack would reduce from the current availability of about 3 days' supply at peak demand to a significantly lesser amount, depending on pressure reduction, hence reduced stored gas volume. The SEA Gas line does not have the capacity to supply the whole of South Australia's peak demand for extended periods in the event the Moomba to Adelaide Pipeline is unable to supply gas to its markets.

In the event the SEA Gas line supply is disrupted, and if the cause is a major gas supply event such as the Longford fire, or a significant event at the Adelaide end of the pipeline, a supply shortfall could disrupt supply to a number of generators as well as industrial customers with the limited supply available through the reduced capacity of the Moomba to Adelaide Pipeline . In the near term, consideration of a disruption mitigation strategy will be necessary to further improve the reliability of South Australia's gas infrastructure. Unless contracts are put in place for increased supply of gas from current sources or alternative fields, in preparation for a critical loss of supply, there is potential for gas supply to be limited or curtailed.

The construction of the SEA Gas line demonstrates that new infrastructure will be built where there is a compelling business case. In regional areas the business case is not always compelling, but the social case can be made for maintaining employment levels to then maintain schools, hospitals, roads, etc. Regional Councils, Development Boards and industry support groups form part of the cadre working to break the infrastructure first/development first dichotomy. If the infrastructure exists, development projects (whether industrial, commercial, residential or some other) will be attracted, but the infrastructure won't be improved until development demands it. These groups are working to attract industrial development by improving their access to key infrastructure, such as adequate gas for additional power and process to support new industries. This is illustrated graphically in the case of Port Pirie's unsuccessful attempt to secure the SA Magnesium (SAMAG) development.

Gas supply infrastructure in regional areas needs to be strengthened, perhaps using the Victorian Regional Towns Natural Gas Project to smaller regional towns where gas supply was uneconomic, but where the infrastructure improvement is likely to attract new business.

The gas distribution network condition is subject to a program of continual improvement with mains renewal, and expansion as illustrated by Envestra's increasing number of customers in South Australia from around 354,000 in 2003, to 357,500 in 2004.

7.5 Report Card Rating

The South Australian gas industry's **level of service** is assessed as safety of gas supply, safety management and disruptions to supply. A rating of **A** for **transmission safety** and **B** for **distribution** is given, based on the steady improvement in leak detection in the distribution network. Disruptions to supply are well within industry expectations providing the basis for a rating of **A**. The proactive approach by operators and distributors of natural and LP gas with established safety management plans attracts a rating of **A** for safety in both transmission and distribution.

Asset Quality is assessed as asset capacity, condition, availability, reliability and management. A rating of **C** for transmission capacity is based on the need for resolution of the infrastructure availability versus developer's desire for availability of transmission pipeline gas capacity for regional development. However, natural gas distribution **capacity** is rated **A** based on detailed planning and forecasting of demand, committed investment, and a strong regulatory regime. LP gas capacity is adequate and attracts a rating of **C+**, limited by the absence of an LP Gas unloading facility in South Australia.

Based on recent investments in new pipeline infrastructure, the commitment to maintenance, and improvements in **condition**, a rating of **A** can be justified for the condition of transmission pipeline system and a rating of **B** based on the commitment to planning, continued extension, and improvements in leak management of the distribution pipeline system.

Records show a very high **reliability** of transmission, distribution and LPG infrastructure which is in line with industry indicators justifying its rating as **A**.

The rating for **asset management** is based on the existence of current asset and maintenance management practices in all supply, transmission and distribution operations. A rating of **A-** is considered appropriate.

For **sustainability**, the areas of waste management, emissions in the form of gas loss, and commitment to environmental principles were considered. Waste in all sectors is managed well with recycling of scrap at the fore, demanding a rating of **A**. Gas loss in the system is managed, and improvements are being realised, allowing a rating of **B**, whilst evidence of commitment to environmental management principles justifies an **A** rating for distribution and transmission activities. LPG attracts a **B** rating in this area where improved transport methods could limit road transport and attract environmental benefits.

Security is assessed as security of supply, and preparation against accidental damage and malicious damage. Adequate natural gas resources are available for the near future, and because the SEA Gas pipeline has mitigated the supply loss associated with events such as the 2004 Moomba Gas Plant fire, **security of supply** is assessed as **B** for transmission and distribution, and **A** for LP Gas where inter-State sources readily made up the supply shortfall. Transmission and distribution pipelines are subject to accidental damage and adequate education and information systems are in place to prevent damage, attracting a rating of **B**. Adequate preparations based on risk management have been made, also attracting a rating of **B**.

Due to the lack of commitment to funding by the State Government to regional gas infrastructure development, and despite the willingness of enterprise to fund fully commercial projects, such as the SEA Gas and SESA pipelines, a rating of **C** is applied for transmission pipeline funding.

Overall Rating for Gas Infrastructure

The overall rating was developed by a consolidation of each of the above issues, resulting in **B+**.

Transmission Pipelines are rated **B+**, due to the need for increased funding of regional gas infrastructure development. Distribution networks are rated **A-** , as the management and the funding regime, including the mandated funding arrangements, are very positive. LP Gas is rated **B+**. The absence of an unloading facility for LP Gas in South Australia is considered a significant negative.

7.6 Case Study

Envestra and SAGASCO have repeatedly tried to get gas to the Adelaide Hills — Mount Barker and Nairne, as well as to Victor Harbor and Goolwa, but the Government will not underpin the investment. As Mount Barker grows and the case for gas supply strengthens, the residents will reject installation because of perceived damage to the nature strip and disruption during installation. The Mount Barker bus depot could have been home to a clean fleet of natural gas-engined buses. The pipeline could have been extended to Murray Bridge, bringing the security of another gate station for Adelaide.

In contrast, the Victorian Government has committed $70 million to the Victorian Regional Towns Natural Gas Project through Regional Development Victoria for gas supply to smaller regional towns. While gas supply to these towns was uneconomic, infrastructure improvement was considered as likely to attract new business.

Appendix A — Rating Methodology

To enable comparisons to be made, the following scoring criteria have been adopted. This is the same scoring criteria used for the Engineers Australia 2001 Infrastructure Report Card and follows a similar format to those used in the United States of America and the United Kingdom for similar report cards.

The overall grades are based on the consolidation of the Asset Condition, Asset Availability and Reliability, Asset Management, Sustainability including Economics, Environmental, and Social and Community issues.

The overall grades are:

Published Rating		Review Criteria
A	**Very Good**	Infrastructure is fit for its current and anticipated purpose in terms of infrastructure condition, committed investment, regulatory regime and planning processes to enable infrastructure to be fit for its current and anticipated purpose.
B	**Good**	Minor changes required in one or more of the infrastructure condition, committed investment, regulatory regime and planning processes to enable infrastructure to be fit for its current and anticipated purpose.
C	**Adequate**	Major changes required in one or more of the infrastructure condition, committed investment, regulatory regime and planning processes to enable infrastructure to be fit for its current and anticipated purpose.
D	**Poor**	Critical changes required in one or more of the infrastructure condition, committed investment, regulatory regime and planning processes to enable infrastructure to be fit for its current and anticipated purpose.
F	**Inadequate**	Totally inadequate for current and future needs

The overall grading is developed based on a review of the following components of the infrastructure. The following key areas have been given equal emphasis.

Asset Condition

This section is based on the view that the infrastructure is considered to be fit for the purpose that it is currently being used for and its anticipated future use. An important component of this section is the trends in the general condition of the infrastructure in terms of the infrastructure condition relative to the purpose for which it is intended to be used.

Asset Availability and Reliability

The key elements of this sector of the assessment have included the expectation and, where available, the current known customer satisfaction levels with the infrastructure service delivery.

Asset Management

This section of the review included an assessment of the level of active strategic management undertaken to ensure that the infrastructure assets are being maintained for today and future generations in an efficient manner. This section also includes an overview of the impact and nature of regulation and legislative oversight on the efficient management of the infrastructure.

Sustainability

This section of the grading covers the issues associated with long-term sustainability of the infrastructure and considers the following issues.

Economics

Economics of the infrastructure management including an overview of the total expenditure on the infrastructure compared with the expected levels based on the current degradation rates of the infrastructure. An opinion on whether sufficient funds are available to provide the infrastructure to an appropriate level for today and the future.

Environmental

Environmental issues that include the active management of likely environmental impacts and the level of environmental assessments undertaken during the planning for infrastructure renewals and new construction. It takes into account the issues associated with the current and future care of the environment.

Social and community

Social and community impact issues include distribution of infrastructure, equitable provision of infrastructure, the levels of support to customer service obligations, employment opportunities and issues including staff and customer safety.

Appendix B — Acronyms

ACCC	Australian Competition and Consumer Commission
ADWG	Australian Drinking Water Guidelines
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
ANCOLD	Australian National Committee on Large Dams
ANZECC	Australia & New Zealand Environment and Conservation Council
ARG	Australian Rail Road Group
ARI	Average Recurrence Interval
ARMCANZ	Agriculture & Resource Management Council of Australia & New Zealand
ARTC	Australian Rail Track Corporation
ASR	Aquifer Storage & Recovery
AusLink	AusLink White Paper Report 2004 — Building our National Transport Future
AWA	Australian Water Association
BOOT	Build Own Operate Transfer
BTRE	Bureau of Transport and Regional Economics
CAR	Committee for Adelaide Roads
COAG	Council of Australian Governments
DEH	Department of Environment and Heritage
DH	Department of Health
DOC	Dissolved Organic Carbon
DOTARS	Department of Transport and Regional Services
DTEI	Department of Transport Energy and Infrastructure
DTUP	Department of Transport and Urban Planning
DWLBC	Department of Water, Land and Biodiversity Conservation
EIP	Environment Improvement Programme
EPA	South Australian Environment Protection Authority
EPP	Environment Protection Policy
ESCOSA	Essential Services Commission of South Australia
ESD	Environmentally Sustainable Development
ESIPC	Electricity Supply Industry Planning Council
GIS	Geographic Information System
HACCP	Hazard Analysis and Critical Control Point
LGA	Local Government Association
LGA	South Australian Local Government Association
MIEX	Magnetic Ion Exchange
NECA	National Electricity Code Administrator
NEM	National Electricity Market

NEMMCo	National Electricity Market Management Company
NHMRC	National Health and Medical Research Council
NRG	NRG Flinders Pty Ltd
NRM	Natural Resources Management
NWC	National Water Commission
NWI	National Water Initiative
OFID	Office for Infrastructure Development
PIRSA	Primary Industries and Resources SA
PPP	Private Public Partnership
PRV	Pressure Reducing Valve
RAA	Royal Automobile Association of South Australia
RONI	Roads of National Importance.
SA	South Australia
SAFC	South Australian Freight Council
SAMAG	SAMAG Ltd
SA Water	South Australian Water Corporation
STE	Smooth Travel Exposure
STEDS	Septic Tank Effluent Disposal Scheme
TDS	Total Dissolved Solids (an indicator of salinity)
TSA	Transport SA
UUA	United Utilities Australia
UV	Ultra Violet
WMC	Western Mining Corporation
WSAA	Water Services Association of Australia
WSUD	Water Sensitive Urban Design
WTP	Water Treatment Plant
WWTP	Waste Water Treatment Plant

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