Framework, Themes, and Indicator Groups

ACT SoE 2011 Report

August 2010

Office of the Commissioner for Sustainability and the Environment

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- Prof. Joe Baker AO, OBE, former ACT Commissioner for the Environment;
- Ms Maureen Cane, Chief Executive Officer, Communities@Work;
- Mr David Marshall, Chair, Canberra Business Council Tourism Sports & Arts Taskforce;
- Mr Geoffrey McAlpine, former CSIRO Principal Adviser Environment;
- Dr Sarah Ryan, Chair, ACT Natural Resource Management Council; and
- Prof. Will Steffen, Executive Director, The ANU Climate Change Institute.

The OCSE also wishes to acknowledge the valuable contributors who participated in several focus groups on a draft SoE reporting framework, and they are listed in appendix 1.

Executive Summary

In 2009, the ACT Commissioner for Sustainability and the Environment initiated a strategic review of the ACT State of the Environment (SoE) reporting framework to assess it against leading SoE approaches used in Australia and internationally. A primary aim of the review was to guide future ACT SoE reporting so that it continues to be effective and relevant for the ACT community and government. This paper outlines the reporting framework with Objectives, Headline Indicators, Reporting Model, Themes and Indicators to be used for the *ACT SoE 2011 Report*.

A State of the Environment report provides an assessment of the impact of human activities and responses on the environmental condition of a defined geographical area. In the ACT, SoE reporting is a requirement of the *Commissioner for the Environment Act 1993* (the Act). Since 1993/94, the Commissioner for Sustainability and the Environment (OCSE)[1] (and predecessors) have produced six ACT SoE Reports: 1993/94; 1994/95; 1997, 2000, 2003, and 2007. The SoE Report assesses the condition of the ACT environment and progress towards sustainability in accordance with the Act.

In 2007/08, the most recent ACT SoE Report provided an assessment of the condition of the ACT environment through six Issues papers and 38 broad Indicators covering: climate and greenhouse, air quality, conserving biodiversity, catchment quality, community wellbeing and resource use. There were also two overarching papers, *Progressing Sustainability* and *Overview and Recommendations*.[2]

Review and consultation process

An iterative process to strategically review, assess and refine the ACT SoE 2011 reporting framework was undertaken. This process included:

- engaging a consultant (Halcrow Pacific Pty Ltd) to review the 2007/08 SoE reporting framework, develop a draft reporting framework, and advise on final Indicator definitions;
- consulting with four focus groups and a technical Reference Group on a draft reporting framework – the Reference Group has been established to inform the development of the *ACT SoE 2011 Report*; and
- assessing proposed Themes and Indicators and, where appropriate, removing or adding Indicators to best report on the condition of the ACT environment, key trends, and progress towards sustainability.

Objectives for the ACT SoE 2011 Report

An important part of the review of the ACT SoE reporting framework has been establishing a series of objectives for the *ACT SoE 2011 Report* – these are to:

- provide accurate timely and accessible information to the community and government regarding trends and the condition of the environment, underlying pressures and sustainability trends;

[1] The ACT Commissioner for Sustainability and the Environment is an independent statutory position created by the ACT Legislative Assembly under the *Commissioner for the Environment Act 1993*.

[2] See: http://www.environmentcommissioner.act.gov.au/publications/soe/2007actreport

- evaluate the effectiveness of community and government actions, policies and initiatives in terms of progress towards sustainability;
- increase community and government understanding of environmental and suitability trends and interactions;
- satisfy the obligations of the relevant ACT and national legislation; and
- develop recommendations for the Minister.

The ACT SoE 2011 Reporting Model

Different SoE reporting models can be used to structure and bring a consistent order to Themes, Issues and Indicators. SoE models also aid the understanding of how different environmental and sustainability issues are interrelated.

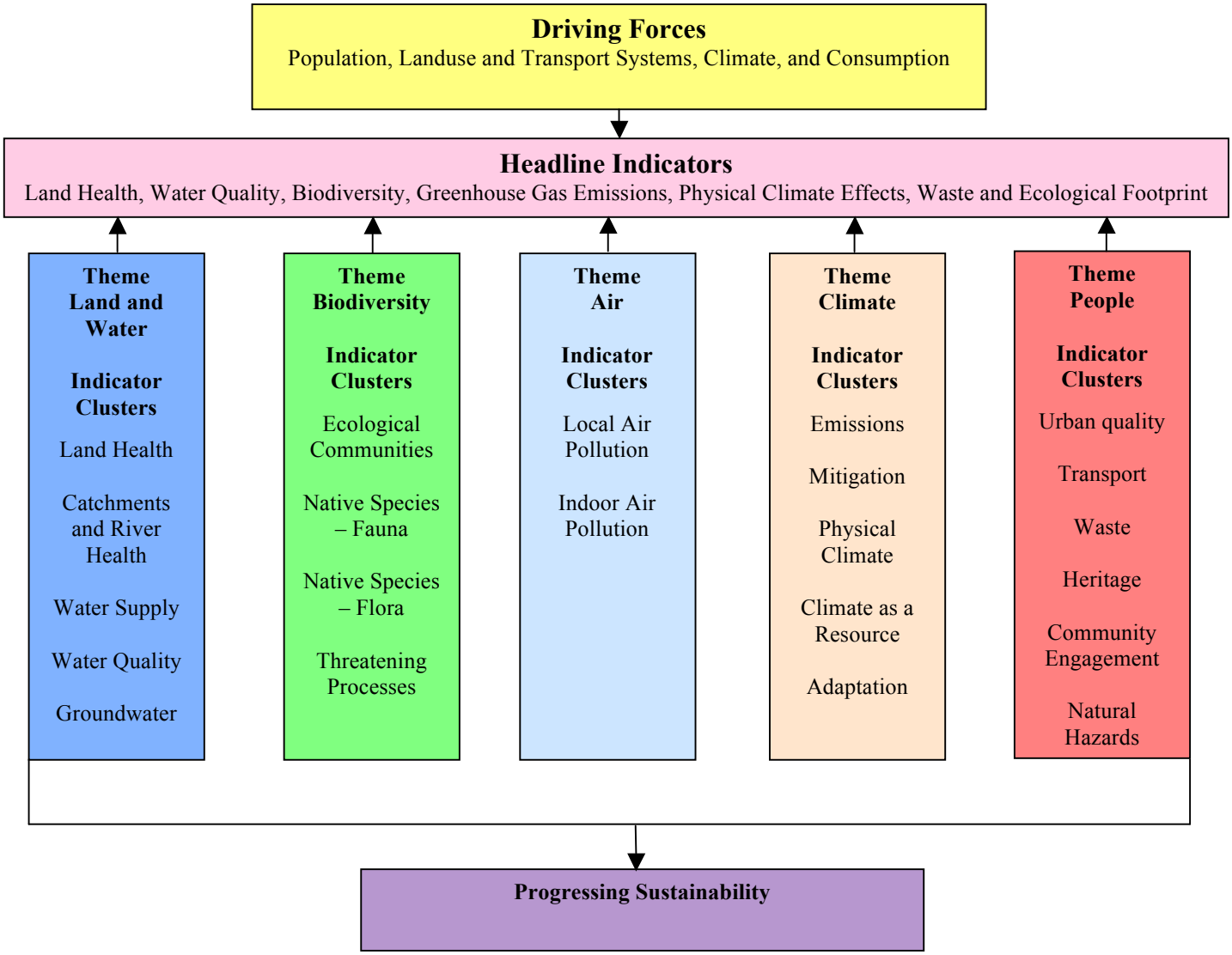
Previous ACT SoE reports have used an adapted *Pressure, State, Response* (PSR) model to structure and report on Themes and Indicators. This model indicates the *pressures* of human activities on the environment, the current *condition* (or state) of the environment and natural resources, and the *responses* by governments, business, organisations and the community. More recently, the *Driving force, Pressure, State, Impact, Response* (DPSIR) model has been increasingly used to better illustrate the fundamental *driving forces* that cause *pressures* on the environment, and to better highlight resulting *impacts* on the environment, including people and communities.

The DPSIR model is the reporting framework for the *ACT SoE 2011 Report*. Adoption of the DPSIR model for the ACT will provide decision-makers with a more integrated, and long term perspective on environment and sustainability performance.

Framework for the ACT SoE 2011 Report

The framework for the *ACT SoE 2011 Report* with Headline Indicators, Themes and Indicators is outlined in figure 1. Each of the different components is then briefly explained.

Figure 1: ACT SoE 2011 Report Framework



Headline Indicators

A small set of Headline Indicators in a SoE report can help provide simple and clear information to decision-makers and the general public about the overall condition of the environment. Headline Indicators can be more widely reported and explained compared to the much larger base SoE report.

Seven Headline Indicators have been selected for the *ACT SoE 2011 Report* to best illustrate key environmental parameters and present information on issues which are either directly or indirectly related, or measure if the condition of the environment is improving. The Headline Indicators are:

1. Ecological Footprint
2. Greenhouse Gas Emissions
3. Physical Climate Effects (Index of key climate effects)
4. Land Health (Index of key land health Indicators)

5. Water Quality (Angle Crossing and Halls Crossing)
6. Biodiversity (Index of key biodiversity Indicators)
7. Waste.

Driving Forces for the ACT SoE 2011 Report

Four *driving forces* that cause fundamental *pressures* on the environment have been identified for the *ACT SoE 2011 Report*:

1. **Population** is a key driving force for SoE reporting and allows broad consideration of population impacts and demographic change on the environment. Population growth and changing demographics in the ACT strongly influence demand for housing, infrastructure, and goods and services, and can have significant impacts on all aspects of the environment.
2. **Landuse and transport systems** affect the health of ecosystems and quality of life. Landuse and transport systems can significantly impact on resource and energy use, and emissions. For example, new housing, industry and infrastructure can require significant amounts of resources and energy in construction and development.
3. **Climate** affects our natural ecosystems and communities. Reporting on the ACT Climate: Decadal weather covering 1950 to 2009 (and from 1910 where possible) will identify how our climate may be changing and the number and type of extreme weather events (also see the Climate Theme).
4. **Consumption** influences our level of resource use, waste generation and emissions, and reflects our approach and attitudes towards environmental protection. Consumption is a key driving force as the amount and type of economic growth directly impacts on the environment. An ecological footprint will be included in this section. This is a measure of the area of land and water needed to support the resource demands (it includes the raw material for food, building, energy, etc) and absorb the wastes of a given population or specific activity, using prevailing technology and resource management practices.

Progressing Sustainability

Sustainability focuses primarily on ensuring that the health, diversity and productivity of the environment[3] is maintained for the benefit of current and future generations. The

[3] As outlined in the *Commissioner for the Environment Act 1993* , namely:
(i) the components of the earth, including soil, the atmosphere and water;
(ii) any organic or inorganic matter and any living organism;
(iii) human made or modified structures and areas;
(iv) ecosystems and their constituent parts, including people and communities;
(v) the qualities and characteristics of places and areas that contribute to their biological diversity and ecological integrity, scientific value and amenity;
(vi) the interactions and interdependencies within and between the things mentioned in subparagraphs (i) to (v);
(vii) the social, aesthetic, cultural and economic conditions that affect, or are affected by, the things mentioned in subparagraphs (i) to (v).

Progressing Sustainability section will place the findings of the SoE into a wider sustainability framework. It will provide information for decision makers and the community on the key challenges and opportunities for progressing sustainability in the ACT.

ACT SoE 2011 Report Themes

Identification of reporting Themes within a broader SoE reporting framework assists with classification and provision of a coherent report structure. Reporting through Themes can also be useful where causal links between, for example, *pressures* and *impacts*, can be difficult to determine.

The five Themes identified for the *ACT SoE 2011 Report* are: Land and Water; Biodiversity; Air; Climate; People, and Sustainability.

Indicators for the ACT SoE 2011 Report

Key Indicators have been identified, defined and grouped within Indicator Clusters for the *ACT SoE 2011 Report*. The purpose of the Indicator Clusters is to group related *condition, pressure, impact* and *response* Indicators, highlight interconnections and positive and negative relationships.

Indicators for the Land and Water Theme

Land is an important natural asset that provides a range of ecosystem services, such as soil nutrients, water filtering, and habitat, that also supports food production and settlement. Water has many values, including maintaining ecosystems and use for drinking water, irrigation, stock watering, and recreation. Over-extraction of freshwater and groundwater can affect environmental flows and the health of ecosystems.

The five Indicator clusters identified for the Land and Water Theme and key areas that will be reported on are outlined below.

- **Land Health Indicator Cluster:** Important factors contributing to overall land health include soil condition, vegetation and ground cover, erosion rates, salinity and soil acidity. Erosion is a natural process that can be accelerated by human activities and adversely affect water quality in streams and rivers. Some land uses can result in contaminated sites including: former sheep dip sites, landfills, service stations, fuel depots and other hydrocarbon-affected sites.
- **Catchments and River Health Indicator Cluster:** Catchment and river health supports a range of ecosystem values and functions. Increasingly, urban wetlands are being constructed to intercept and treat urban stormwater flows and the effectiveness of construction and management of these wetlands is important to improve urban water quality.
- **Water Supply Indicator Cluster:** Environmental flows refer to the release of water in a predetermined manner intended to mimic the natural hydrological pattern in unregulated rivers. The removal and use of water from surface water and groundwater affects environmental flows and changes the amount and quality of water flowing into our lakes and rivers.

- **Water Quality Indicator Cluster:** Water quality influences the health of aquatic and terrestrial ecosystems, and whether water can be safely used for drinking, agriculture, industry and recreation. The maintenance of these values is a critical environmental issue.
- **Groundwater Indicator Cluster:** Groundwater is essential for sustaining the ongoing health of many ecosystems, including surface water bodies, such as rivers, wetlands, and lakes, that are connected to groundwater sources. Changes in groundwater levels and groundwater quality have the potential to degrade these ecosystems causing a loss of terrestrial and aquatic species, and impacts on human health and production.

Indicators for the Biodiversity Theme

Biodiversity is the variability of ecosystems, species and genes. Ecosystems provide essential services, such as clean air, fresh water, soil and habitat for native species. Biodiversity also has recreational, cultural, and landscape values that are part of the ACT identity.

The four Indicator clusters identified for the Biodiversity Theme and key areas that will be reported on are outlined below.

- **Ecological Communities Indicator Cluster:** Different vegetation types are the products of different ecological and environmental conditions and, therefore, reflect different habitats and components of ecosystems. Clearing of vegetation reduces the total area of habitat available to species, affects the connectivity of ecological corridors, and can increase the risk of local extinction. The area, distribution and management of protected areas, and the effectiveness of other conservation responses are important for biodiversity conservation.
- **Native Species – Fauna Indicator Cluster:** Information on protected native species as well as more common native species informs our understanding of population trends and the health of ecosystems. Assessment of the effectiveness of native species conservation measures and pest management helps identify successes and/or gaps in regulation, programs and initiatives to improve future management.
- **Native Species – Flora Indicator Cluster:** Native plants provide habitat and food for birds and animals but can be affected by weeds, seed gathering and firewood harvesting. Assessing the effectiveness of native plant conservation measures can help identify successes and/or gaps in current regulation, programs and initiatives to improve future management.
- **Threatening Processes Indicator Cluster:** Much of Australia's flora and fauna has evolved alongside threatening processes such as fire and may rely on these processes for continued survival. However, changes to these processes (for example, fires of high or low intensity that are either too frequent or insufficiently frequent) or new processes can lead to loss of native species, and communities.

Indicators for the Air Theme

Air quality affects the condition of the environment and directly impacts on human health and amenity. There is a legislative requirement for jurisdictions to monitor air

quality as per the standards for the National Environment Protection Measure for Ambient Air Quality. The two Indicator clusters identified for the Air Theme and key areas that will be reported on are outlined below.

- **Local Air Pollution Indicator Cluster:** The emission of pollutants into the atmosphere from motor vehicles, burning of fossil fuels and fire can lead to concentrations of gases and particles that have adverse impacts on some ecosystems and human health.
- **Indoor Air Pollution Indicator Cluster:** Sources of indoor air pollutants include household products, human activities, such as smoking and indoor fires, and indoor vehicle pollution. Poor indoor air quality can have adverse impacts on human health and wellbeing.

Indicators for the Climate Theme

The differences between weather, climate, climate variability and climate change are the time scales used for the data. Climate change occurs when: climate variability over at least three decades, shows a trend. The *ACT SoE 2011 Report* will compare decadal weather data from the 1950's and onwards, and possibly from the 1910's for some data. The five Indicator clusters identified for the Climate Theme and key areas that will be reported on are outlined below.

- **Emissions Indicator Cluster:** Increasing atmospheric concentrations of greenhouse gas emissions include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Energy use is a key contributor to greenhouse gas emissions, along with methane emissions from landfill sites and waste bodies, and nitrous oxide emissions.
- **Mitigation Indicator Cluster:** New low emission sources of energy and transport, waste, infrastructure, building and industry sector initiatives can mitigate and reduce emissions.
- **Physical Climate Effects Cluster:** In the ACT, understanding the physical climate effects and impacts of climate change on water resources, fire regimes, human health, and native species will help inform the development of appropriate responses.
- **Climate as a Resource:** The ACT climate is a resource and there are further opportunities to harness the power of the wind and sun.
- **Adaptation Indicator Cluster:** Monitoring the effectiveness of adaptation responses will be essential with a changing ACT climate.

Indicators for the People Theme

People and communities are part of the environment as identified in ACT legislation. The way we design and use our urban areas and infrastructure, and how we manage our parks and open space can significantly affect the quality of the environment. Community engagement and environmental awareness can also have significant impacts on our overall level of resource use and waste production.

The six Indicator clusters identified for the People Theme and key areas that will be reported on are outlined below.

- **Urban Quality Indicator Cluster:** Urban density, and the amount and type of greenfield and infill housing can significantly influence urban form and the overall demand for resources, energy and infrastructure. Open space, parks, recreation areas, community facilities and urban trees contribute significantly to the quality and amenity of urban areas, along with providing important social and health benefits.
- **Transport Indicator Cluster:** Transport assets, systems and transport choices have a significant impact on communities and settlements, and the quality of the environment. Different transport modes, such as private vehicles, public transport and walking, have different impacts on the environment and human health.
- **Waste Indicator Cluster:** The amount of urban waste generated and disposed of indicates the pressure of cities and the associated waste on the environment through potential contamination of soils and groundwater, and land used for waste disposal. Hazardous wastes potentially pose either an immediate or long-term risk to the health of humans and the environment.
- **Heritage Indicator Cluster:** There are strong interconnections between the physical environment and heritage. Heritage can include Aboriginal sites, historic heritage places and areas, natural heritage, and other heritage structures or features. The number and condition of heritage listings indicates the community's response to identifying and preserving heritage, and the value placed on heritage in maintaining a sense of place in a region.
- **Community Engagement Indicator Cluster:** Community engagement is important for empowering the community to improve environmental management, and ensuring that issues and concerns are understood and considered as part of decision-making processes.
- **Natural Hazards Indicator Cluster:** A natural hazard may be either a source of potential harm or an existing condition that may cause harm to people or damage to property or the environment. Population growth and urban development in certain locations can increase exposure to natural hazards, such as flood and fire, with significant economic and social costs.

Changes from previous SoE Reports – comparison of Indicators for ACT SoE 2011 Report

The review has streamlined and grouped indicators to more directly relate to themes. While most indicators from previous SoE Reports have been retained, however in some cases they are either grouped differently, or will not be reported, for example: number of general practitioners in the ACT. While these unreported indicators related to sustainability issues, they are not directly related to environmental factors, which is the focus of the ACT SoE 2011 Report's objectives.

Conclusion

The SoE reporting framework, Themes, and Indicators outlined in this summary provide the essential building blocks and content to prepare the *ACT SoE 2011 Report*. The ACT SoE reporting framework will continue to evolve in response to changing environmental priorities and community concerns, and a drive for continuous improvement in reporting to improve the quality of the environment and the quality of life in the ACT.

1. Introduction

In 2009, the ACT Commissioner for Sustainability and the Environment initiated a strategic review of the ACT State of the Environment (SoE) reporting framework to assess it against leading SoE approaches used in Australia and internationally. A primary aim of the review was to guide future ACT SoE reporting so that it continues to be effective and relevant for the ACT community and government. This paper outlines the reporting framework with Objectives, Headline Indicators, Reporting Model, Themes and Indicators to be used for the *ACT SoE 2011 Report*.

A SoE report provides an assessment of the impact of human activities and responses on the environmental condition of a defined geographical area. In the ACT, SoE reporting is a requirement of the *Commissioner for the Environment Act 1993*. Since 1993/94, the Commissioner for Sustainability and the Environment (OCSE)[4] (and predecessors) have produced six ACT SoE Reports: 1993/94; 1994/95; 1997, 2000, 2003, and 2007. The SoE Report assesses the condition of the ACT environment and progress towards sustainability in accordance with the *Commissioner for the Environment Act 1993*.

A component of the OCSE's project for the *ACT SoE 2011 Report*, involved a consultant (Halcrow Pacific Pty Ltd) in 2009, reviewing the ACT 2007 State of the Environment (SoE) Report. This review took into account that since the mid-1990s, the models for presenting SoE information have progressed from the PSR: Pressure, State, Response framework, to the DPSIR: Driving force, Pressure, State, Impact, Response framework (Smeets & Weterings 1999:6-7; Pinter, Hardi & Bartelmus 2005:5-7).

From the consultant's September 2009 report, seventeen recommendations were made to the OCSE, including recommendation seven: consulting with stakeholders to 'confirm and refine' the proposed SoE Report's Indicators (Halcrow 2009:ix). To address recommendation seven, the OCSE conducted four focus groups with expert stakeholders (see appendix 1). Each focus group was based on four of the five *ACT SoE 2011 Report*'s Themes: Biodiversity, Water and Catchments, Climate Change, and Communities and Settlements. The focus groups' objective was: consult with stakeholders to confirm and refine the proposed Indicators for the *ACT SoE 2011 Report*.

The ACT State of the Environment Report 2011 Reference Group[5] (ACT SoE Report 2011 Reference Group) subsequently reviewed the recommendations arising from the focus groups and requested:

- the Indicators for Climate and Communities Themes be refined;
- revisit the number of Indicators for the natural environment;
- the Headline Indicators be reviewed with the aim of providing:
    - Headline Indicators which focus on the outcomes and or results for the environment;
    - if needed, using more than one Headline Indicator for a Theme; and

[4] The ACT Commissioner for Sustainability and the Environment is an independent statutory position created by the ACT Legislative Assembly under the *Commissioner for the Environment Act 1993*.

[5] See Acknowledgements for the Reference Group members.

- if needed, using Headline Indicators that are outside of the core set of Indicators.

The ACT SoE Indicators 2011 Report from the focus groups was updated to reflect and integrate the comments of the ACT State of the Environment Report 2011 Reference Group. A subsequent meeting with the ACT SoE Report 2011 Reference Group required further minor changes to the report. The OCSE engaged the consultant again to further refine the proposed Indicators for the *ACT SoE 2011 Report* and to develop definitions for the Driving Forces, Indicators and the Indicator groups or clusters. This report summarises: the ACT SoE Report 2011 Reference Group's suggestions, the processes the OCSE used to refine the Indicators, and it includes the consultant's work.

An iterative process to assess and refine the *ACT SoE 2011 Report* was undertaken. This process included:

- assessing the ACT Capital Regional Sustainability Steps report (OCSE 2010) to see how common elements could be integrated;
- assessing each Theme's proposed Indicators against each of the *ACT SoE 2011 Report* objectives, which was consistent with the definition of the "Environment" in ACT legislation;
- assessing the types of Indicators in other SoE reports and the Federal Department of Climate Change's reports;
- where required, either recommending the removal of some Indicators or adding some new Indicators;
- consulting individual members of the Reference Group and other experts; and
- liaising with the consultant who finalised the refined *ACT SoE 2011 Report* Indicators.

1.1. Objectives for the ACT SoE 2011 Report

One aspect of the review of the ACT SoE Report framework focused on developing a series of objectives for the *ACT SoE 2011 Report*.

The objectives for the *ACT SoE 2011 Report* are to:

- provide accurate timely and accessible information to the community and government regarding trends and the condition of the environment, underlying pressures and sustainability trends;
- evaluate the effectiveness of community and government actions, policies and initiatives in terms of progress towards sustainability;
- increase community and government understanding of environmental and sustainability trends and interactions (Halcrow 2010:viii);
- satisfy the obligations of the relevant ACT and national legislation; and
- develop recommendations for the Minister.

1.2. Contents page for the ACT SoE 2011 Report

To guide the preparation of the *ACT SoE 2011 Report*, a contents page and structure for the SoER has been developed as outlined below.

Contents
List of figures
List of tables
Message from The Commissioner
Executive Summary – including Headline Indicators;
Assessment of Change in the Condition of the Environment since 1993; and
Recommendations to the Minister
Acknowledgements
Introduction

Chapter 1: Driving Forces and their Interactions with Each Other

- Population
- Landuse and Transport Systems
- Climate
- Consumption.

Chapter 2: Headline Indicators Summary

- Overview of Headline Indicators
- Linkages between Headline Indicators

Chapter 3: Land and Water

- Introduction to the Theme
- Theme summary: Headline Indicators and key issues
- Introduction and description of the Theme and Indicator clusters
- For each cluster:
    - Condition: Indicators, text and graphs (as appropriate)
    - Pressure: Indicators, text and graphs (as appropriate)
    - Impact: Indicators, text and graphs (as appropriate)
    - Response: Indicators, text and graphs (as appropriate)
- Evaluation of environmental management against stated ACT goals and targets
- Recommendation/s
- Snapshot (local response) and photos (2 per issue maximum)
- Commentary and emerging issues
- References.

Chapter 4: Biodiversity

- Introduction to the Theme
- Theme summary: Headline Indicators and key issues
- Introduction and description of the Theme and Indicator clusters
- For each cluster:
    - Condition: Indicators, text and graphs (as appropriate)
    - Pressure: Indicators, text and graphs (as appropriate)
    - Impact: Indicators, text and graphs (as appropriate)
    - Response: Indicators, text and graphs (as appropriate)
- Evaluation of environmental management against stated ACT goals and targets
- Recommendation/s
- Snapshot (local response) and photos (2 per issue maximum)
- Commentary and emerging issues

- References.

Chapter 5: Air

- Introduction to the Theme
- Theme summary: Headline Indicators and key issues
- Introduction and description of the Theme and Indicator clusters
- For each cluster:
    - Condition: Indicators, text and graphs (as appropriate)
    - Pressure: Indicators, text and graphs (as appropriate)
    - Impact: Indicators, text and graphs (as appropriate)
    - Response: Indicators, text and graphs (as appropriate)
- Evaluation of environmental management against stated ACT goals and targets
- Recommendation/s
- Snapshot (local response) and photos (2 per issue maximum)
- Commentary and emerging issues
- References.

Chapter 6: Climate

- Introduction to the Theme
- Theme summary: Headline Indicators and key issues
- Introduction and description of the Theme and Indicator clusters
- For each cluster:
    - Condition: Indicators, text and graphs (as appropriate)
    - Pressure: Indicators, text and graphs (as appropriate)
    - Impact: Indicators, text and graphs (as appropriate)
    - Response: Indicators, text and graphs (as appropriate)
- Evaluation of environmental management against stated ACT goals and targets
- Recommendation/s
- Snapshot (local response) and photos (2 per issue maximum)
- Commentary and emerging issues
- References.

Chapter 7: People

- Introduction to the Theme
- Theme summary: Headline Indicators and key issues
- Introduction and description of the Theme and Indicator clusters
- For each cluster:
    - Condition: Indicators, text and graphs (as appropriate)
    - Pressure: Indicators, text and graphs (as appropriate)
    - Impact: Indicators, text and graphs (as appropriate)
    - Response: Indicators, text and graphs (as appropriate)
- Evaluation of environmental management against stated ACT goals and targets
- Recommendation/s
- Snapshot (local response) and photos (2 per issue maximum)
- Commentary and emerging issues
- References.

Chapter 8: Sustainability

- Introduction
- Key issues, commentary and emerging issues
- References.

References
Abbreviations
Glossary
Appendices

1. SoE reference group and terms of reference
2. Papers supporting the ACT SoE 2011 Report

2. Headline Indicators

A small set of Headline Indicators in a SoE Report can help provide simple and clear information to decision-makers and the general public about the overall condition of the environment.

The focus groups recommended ten high level Headline Indicators covering ecological footprint, water, greenhouse gas emissions, ecological health, natural hazards, urban quality, community wellbeing, transport, waste. However, the ACT SoE Report 2011 Reference Group recommended further consideration of these Headline Indicators for how well they show an environmental outcome.

The ACT SoE Report 2011 Reference Group recommended the following seven Headline Indicators that were adopted for the *ACT SoE 2011 Report*:

- Ecological Footprint - a measure of the area of land and water needed to support the resource demands (it includes the raw material for food, building, energy, etc) and absorb the wastes of a given population or specific activity, using prevailing technology and resource management practices.
- Greenhouse Gas Emissions – the volume of carbon dioxide, methane and nitrous oxide emissions by source;
- Physical Climate Effects – an Index of key physical climate effects covering changes in temperature, rainfall and wind from 1950 to present;
- Land Health – an Index of key land health Indicators addressing vegetation cover, vegetation condition, soil acidity and erosion from a 1993 baseline[6];
- Water Quality (at Angle Crossing and Halls Crossing);
- Biodiversity – an Index of key biodiversity Indicators addressing protected areas and native species from a 1993 baseline; and
- Waste – the volume and type of waste per person per year.

3. Driving Forces

The focus groups recommended ten driving forces:

1. Population, Demographic trends
2. Economy, Average income, ACT government budget
3. Landuse purpose/zone/activity

[6] This baseline has been selected as the year of the first State of the Environment report.

4. Weather and climate, Extreme weather events
5. Australian natural resource management governance
6. Policy decisions
7. Greenhouse gas emissions
8. Greenhouse gas mitigation
9. Climate adaptation
10. Consumption values.

The ACT SoE Report 2011 Reference Group considered that some of the ten Driving Forces:

- had similarities which required grouping, such as:
  - economy, income and consumption values;
  - weather and climate, extreme weather events, climate adaptation, greenhouse gas emissions and mitigation; and
- were considered not to be Driving Forces such as:
  - policy decisions; and
  - Australian natural resource management governance.

In addition, three of the remaining four Driving Forces align well with the ACT Capital Regional Sustainability Steps report's three Driving Forces (OCSE 2010).

Final Driving Forces recommended by the ACT SoE Report 2011 Reference Group and adopted for the *ACT SoE 2011 Report* are:
1. Population,
2. Landuse and Transport Systems,
3. Climate, and
4. Consumption.

Definitions for the four Driving Forces are outlined below.

Population

Population growth and changing demographics in the ACT strongly influence demand for housing, infrastructure, and goods and services, and can have significant impacts on all aspects of the environment. Population is a key driving force for State of the Environment reporting and allows broad consideration of population impacts and demographic change on the environment.

Key components for reporting on population include: population count and distribution based on latest Census and Census updates, and population density. Population characteristics are also important including: the number of male and female persons, number and distribution of persons 15 years and under, and 65 years and over, number and distribution of persons from specified groups, family size, type and distribution, and household size.

The Population Driving Force has two Indicators which will be reported on. These are:

- Population and Demographic Trends: Population totals and trends, age, gender and distribution, and household size, and discussion.

- Population and the Environment: Discussion of population impacts on the environment.

Landuse and Transport Systems

The way that land and transport systems are used, affects the health of ecosystems and the quality of life. Landuse and transport systems significantly impact on resource and energy use, and emissions. For example, new housing, industry and infrastructure can require significant amounts of resources and energy in construction and development. Transport systems significantly influence landuse and urban form and are a key driving force for State of the Environment reporting.

Changes in the intensity of landuse over time indicate changes in the pressure of landuse on the environment, including people. Landuse types of specific interest in the ACT include: urban (including the proportion of urban land used for residential, commercial and industrial purposes and urban green space), forestry (as area used for timber production), water supply and storage, conservation (including national parks, heritage places), agricultural (including pasture/grassland, horticulture, cropping), mines/quarries, energy, and transport. Depending on the data available, any of the categories within each landuse type may be presented separately or together.

It is important to disaggregate the area designated as "urban" residential, commercial and industrial uses as well as urban green space. The amount of land used for each affects the nature and extent of impacts of urbanisation on the environment and the demands for infrastructure such as energy and water supply systems. The way land is used in urban areas also impacts on the quality of life for residents as it affects the amount of privacy, space, and noise experienced by the residential population, resulting in a range of effects on human health. Land development and clearance of development sites may threaten remnant vegetation and reduce the connectivity of ecological corridors that subsequently threatens native species.

The Landuse and Transport Systems Driving Force has two Indicators which will be reported on. These are:

- Landuse and Transport Systems: Landuse zones, development changes, transport systems, and discussion.
- Landuse and Transport Systems and the Environment: Discussion of landuse and transport systems and the environment with sustainability consequences.

Climate

Climate change refers to a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer (Garnaut 2008). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. The United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus

makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes (IPCC 2007).

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability) (IPCC 2007).

The Climate Change and Climate Variability Driving Force has one broad Indicator which will be reported on. This is:

- ACT Climate: Decadal weather covering 1950 to 2009 (from 1910 if possible) with discussion as appropriate covering:
    - air pressure, annual rainfall, temperature (minima and maxima, and range), sunshine, relative humidity, evaporation, wind (speed and direction)
    - heatwaves (3 days above 33.5 C; number of days 36.5 C or more, number of days 35C or more, and number of days 30C or more)
    - number of fogs, number of frost days, number of rain days
    - number of years in drought and extreme events (heatwaves, storms, floods, and duststorms).

Other more specific aspects of climate interactions with the environment are considered in the Climate Theme.

Consumption

Consumption influences our level of resource use and waste generation, and reflects our approach and attitudes towards environmental protection. Consumption is a key driving force that can affect the environment in many ways, for example, through urban development and infrastructure.

The interrelationships between the economy and income and the environment are also significant. The amount and nature of economic growth directly impacts on the environment, which includes the community.

The Consumption Driving Force has three Indicators which will be reported on. These are:

- Consumption values: Attitudes and values to consumption including dwelling size and design, food and waste, transport, energy, local availability of goods and services, and barriers to achieving desired attitudes and values for consumption – with discussion as appropriate.
- Economy and Income: ACT economy, income levels, average income, price of petrol, price of water, price of electricity and gas, and ACT Government budget – with discussion as appropriate.
- Ecological footprint - a measure of the area of land and water needed to support the resource demands (it includes the raw material for food, building, energy, etc) and absorb the wastes of a given population or specific activity, using prevailing technology and resource management practices.

4. Progressing Sustainability

Sustainability focuses primarily on ensuring that the health, diversity and productivity of the environment[7] is maintained for the benefit of current and future generations. The Progressing Sustainability section will place the outcomes of the SoE into a wider sustainability framework. It will provide information for decision makers and the community on the key challenges and opportunities for progressing sustainability in the ACT. Relevant indicators such as biocapacity (which measures the capacity of an area to generate an ongoing supply of resources) are being considered.

5. Themes

The focus groups discussed and agreed on the following Themes:

- Water and Catchments (land, water, air)
- Biodiversity
- Communities and settlements
- Climate change
- Progressing Sustainability.

After some minor changes the ACT SoE Report 2011 Reference Group agreed to name the Themes as below. In addition a new Theme 'Air' was created by separating it from the Water and Catchments Theme. This change was made as geographically the catchments for land and water can be the same but not for air.

The final Themes recommended by the ACT SoE Report 2011 Reference Group and adopted for the *ACT SoE 2011 Report* are:

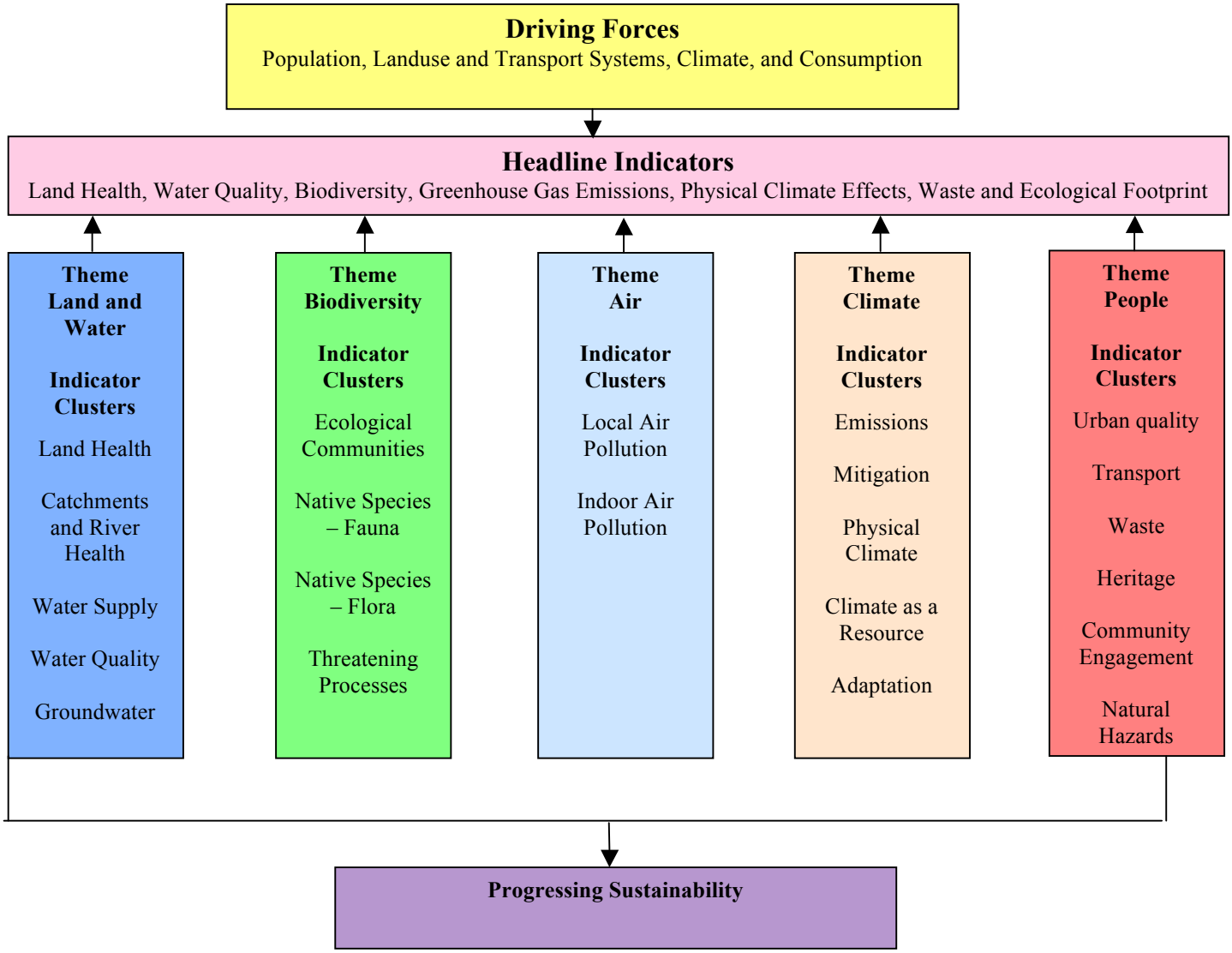
- Land and Water,
- Biodiversity,
- Air,
- Climate, and
- People.

"People" has been identified as a Theme for the ACT SoE 2011 Report in recognition that the ACT definition of the "Environment" includes people and communities.

[7] As outlined in the *Commissioner for the Environment Act 1993* , namely:
(i) the components of the earth, including soil, the atmosphere and water;
(ii) any organic or inorganic matter and any living organism;
(iii) human made or modified structures and areas;
(iv) ecosystems and their constituent parts, including people and communities;
(v) the qualities and characteristics of places and areas that contribute to their biological diversity and ecological integrity, scientific value and amenity;
(vi) the interactions and interdependencies within and between the things mentioned in subparagraphs (i) to (v);
(vii) the social, aesthetic, cultural and economic conditions that affect, or are affected by, the things mentioned in subparagraphs (i) to (v).

5. Framework for the SoE Report

The overall framework for the ACT SoE 2011 Report is outlined in the figure below.



6. Indicators for the ACT SoE 2011 Report

This section outlines the Indicator clusters and definitions for the *ACT SoE 2011 Report*. The Indicator cluster definitions have been primarily developed from past ACT SoER Indicator definitions to ensure continuity. The definitions have also been informed by the Australian and New Zealand Environment and Conservation Council's State of the environment reporting taskforce report *Core Environmental Indicators for Reporting on the State of the Environment* (ANZECC 2000). Other references for Indicator cluster definitions are cited as appropriate.

For selected Indicator clusters, "influence diagrams" could be prepared to illustrate how different Indicators connect to and/or influence other Indicators, both within a cluster and across other clusters. For example, increasing urban density may support walking, cycling and use of public transport that lowers greenhouse gas emissions. However, good urban design will be required to reduce the adverse impacts of increasing density on stormwater quality (with an increase in impervious surfaces), and the potential loss of urban trees and "green assets".

6.1. Indicators for the Land and Water Theme

Indicator clusters were discussed and recommended by the focus groups and the ACT SoE Report 2011 Reference Group. The Indicator cluster definitions for the Land and Water Theme are outlined below.

Land Health Indicator Cluster

Land is an important natural asset as it provides a range of ecosystem services, such as soil nutrients, water filtering, and habitat, that also supports food production. Important factors contributing to overall land health include soil condition, vegetation and ground cover, erosion rates, salinity and soil acidity.

Erosion is a natural process that can be accelerated by human activities. Increased rates of erosion can adversely affect water quality in streams and rivers. Soil acidity can increase from certain agricultural practices, such as applying nitrogen-based fertilisers. Increased soil acidity directly affects agricultural productivity and has the potential to affect other ecosystem functions.

Some land uses can result in contaminated sites including: former sheep dip sites, landfills, service stations, fuel depots and other hydrocarbon-affected sites. Potentially contaminated sites are assessed in accordance with the Environment Protection Authority (EPA) endorsed guidelines.
The effectiveness of catchment management responses, and implementing the ACT NRM Plan (2009) will directly influence land health.

The Land Health Indicator Cluster has eight Indicators which will be reported on. These are:

- Soil Condition (C): the extent and distribution of soil classes and condition including soil carbon and salinity.
- Vegetation and Ground Cover (C): the extent and distribution of vegetation and ground cover.
- Erosion (P): the extent and distribution of erosion by type, and soil loss.
- Soil Acidity (P): the extent and distribution of soil acidity.
- Contaminated Sites (P): the extent and distribution of contaminated sites.
- Catchment Management (R): the effectiveness of catchment management responses in the ACT.
- NRM Plan (R): the effectiveness of the ACT NRM Plan (ACT NRMC 2009).
- Contaminated Site Management (R): the effectiveness of contaminated site management and remediation with particular regard to soil health, water quality, groundwater and human health.

Catchments and River Health Indicator Cluster

Catchment and river health supports a range of ecosystem values and functions. Measurement of river health complements more standard measures of water quality, such as dissolved oxygen and nutrient levels, by introducing an ecosystem perspective. Riparian vegetation protects waterbodies from pollutants travelling overland in runoff, guards against excessive erosion, and is an important energy source (through leaf fall) for aquatic ecosystems. Removing riparian vegetation can degrade waterbodies. Surface water supports a wide range of biological systems including riparian ecosystems, wetlands and aquatic ecosystems. Environmental threats to these systems include loss of water, pollution and introduced species (ANZECC 2000).

Stormwater discharges from urban areas are related to the area of pervious and impervious surfaces. Increasingly, urban wetlands are being constructed to intercept and treat urban stormwater flows. The effectiveness of construction and management of these wetlands is important to maintain functionality and improve urban water quality.

The Catchments and River Health Indicator Cluster has eight Indicators which will be reported on. These are:

- Ecological Health of Streams, Wetlands and Rivers (C): a broad measure of stream, wetland and river health – potentially through an index.
- Riparian and Aquatic Condition (C): a broad measure of riparian and aquatic condition (note primary emphasis on riparian condition compared with the ecological health Indicator above).
- Urban Wetlands (C): the number, size, condition, and influence on water quality.
- Surface Water Dependent Ecosystems (C): a broad measure drawing on riparian condition, native species and ecological communities, for example, biannual assessment of macro-invertebrate community composition.
- Stormwater Discharges (P): non point source discharges including pervious/impervious surface area (point discharges addressed in Water Quality Cluster).
- Water Management (R): the effectiveness of water management for maintaining and enhancing catchment and river health.
- Riparian Management (R): the effectiveness of riparian management for maintaining and enhancing catchment and river health.
- Urban Wetland Management (R): the effectiveness of urban wetland management.

Water Supply Indicator Cluster

The removal and use of water from surface water and groundwater changes the amount and quality of water flowing into our lakes, rivers and estuaries. Environmental flows refer to the release of water in a predetermined manner intended to mimic the natural hydrological pattern in unregulated rivers. Environmental flows are intended to remediate river ecosystems' functionality in spite of the negative effects of flow regulation which, among other factors, reduces peak flood flows, provides less variability in flows and generally results in lower base flows.

Sufficient water supply and access to quality drinking water are essential for human health and production but over-extraction can affect environmental flows and the health

of ecosystems. The *Australian Drinking Water Guidelines* (Australian Government 2004) are a national standard against which to evaluate the quality of drinking water. With an increasing population and the prospect of reduced inflows as a result of future drought or climate change, a key challenge in the medium- to long-term is securing additional water supplies to meet demand along with water demand management and water reuse (also see Water Quality Cluster).

The Water Supply Indicator Cluster has eight Indicators which will be reported on. These are:

- Dam Storage (C): drinking water storage levels.
- Dam Water Quality (C): dam water quality prior to treatment.
- Drinking Water Quality (C): treated drinking water quality.
- Water Use (P): water use by sector.
- Environmental Flows (I): including volume, quality, nature, regime, timing, location into Googong dam, and effects of dam releases.
- New Water Supplies (R): new sources of water supply.
- Water Demand Management (R): the effectiveness of water demand management measures.
- Environmental Flow Management (R): the effectiveness of implementation of environmental flow guidelines.

Water Quality Indicator Cluster

Water quality influences the health of aquatic and terrestrial ecosystems, and whether water can be safely used for drinking, agriculture, industry and recreation. Water has many values, including maintaining ecosystems and use for drinking water, irrigation, stock watering, and recreation. The maintenance of these values is a critical environmental issue.

Surface water quality is a function of the solid and solute loads transported by rivers and streams. Surface water quality is affected by discharges from premises, runoff from agricultural, industrial and urban areas, and natural sediment loads generated from catchments. Any water that is discharged to waterways has the potential to introduce contaminates, such as nutrients, chemicals and heavy metals. Treated effluent is legally discharged to waterways from wastewater treatment plants. The impact on streamflow, groundwater levels, groundwater quality, surface water quality and aquatic biota can be significant at the point of discharge and further downstream.

Stormwater harvesting and water reuse is an important response both to water quality and water quantity issues. Where the quality of discharged water does not meet guidelines then the potential for adverse impacts is greatly increased. Algal blooms are a potential surrogate Indicator of eutrophication or high nutrient load. High nutrient concentrations in surface waters have been linked to algal blooms and poor water quality.

The Water Quality Indicator Cluster has six Indicators which will be reported on. These are:

- Surface Water Quality (C): a broad measure of surface water quality of streams, wetlands and rivers.

- Discharges to Waters (P): point source discharges to waters with non-point source discharges addressed in the Catchments and River Health Cluster.
- Algal Blooms (I): the number, area, frequency and toxicity of algal blooms.
- Water Quality and Human Health Impacts (I): health impacts from poor water quality and algal blooms.
- Effluent Treatment (R): the level of treatment of wastewater discharges and effluent water quality.
- Water Reuse and Stormwater Harvesting (R): the amount of water reuse from wastewater and stormwater harvesting.

Groundwater Indicator Cluster

Groundwater is essential for sustaining the ongoing health of many ecosystems including surface water bodies, such as rivers, wetlands, and lakes, that are connected to groundwater sources. Changes in groundwater levels and groundwater quality have the potential to degrade these ecosystems causing a loss of terrestrial and aquatic species, and impacts on human health and production. Water is taken from groundwater sources for a range of purposes including domestic, commercial, agricultural, and industrial uses. Impacts on groundwater levels and quality can be significant if more water is taken than is being recharged (i.e. within a sustainable yield).

Groundwater can be polluted through inappropriate landuse and discharges to waters, and from contaminated sites, for example, from underground fuel storage at service stations. If water discharges do not meet water quality guidelines, then there is an increased risk of adverse impacts on groundwater dependent ecosystems and on human health.

The Groundwater Indicator Cluster has four Indicators which will be reported on. These are:

- Groundwater Availability (C): the volume and distribution of available groundwater.
- Groundwater Quality (C): the quality of groundwater including pollution from inappropriate landuses, discharges to groundwater and contaminated sites.
- Groundwater Use (P): the amount and distribution of groundwater use.
- Groundwater Management (R): the effectiveness of groundwater management responses especially in terms of sustaining ecosystems and the ongoing availability of groundwater sources.

The complete list of Indicators for the Land and Water Theme are outlined in table 6.1.

Table 6.1: Land and Water Theme Indicators

Indicator Cluster	Indicator (and Type)	Coverage
Land Health	1. Soil Condition (C)	Extent and distribution of soil classes and condition including soil carbon and salinity
	2. Vegetation and Ground Cover (C)	Extent and distribution of vegetation and ground cover
	3. Erosion (P)	Extent and distribution of erosion by type, and soil loss
	4. Soil Acidity (P)	Extent and distribution of soil acidity

Indicator Cluster	Indicator (and Type)	Coverage
	5. Contaminated Sites (P)	Extent and distribution of contaminated sites
	6. Catchment Management (R)	Effectiveness of catchment management responses in the ACT
	7. NRM Plan (R)	Effectiveness of the ACT NRM Plan
	8. Contaminated Site Management (R)	Effectiveness of contaminated site management and remediation
Comments: a) Proposed Land Condition Indicator not required with restructure. b) Proposed Soil Carbon and Salinity Indicators are included in the Soil Condition Indicator. c) No impact Indicator is proposed – water quality is addressed in water quality cluster.		
Catchments and River Health	9. Ecological Health of Streams, Wetlands and Rivers (C)	Broad measure of stream, wetland and river health – potentially through an index
	10. Riparian and Aquatic Condition (C)	Broad measure of riparian and aquatic condition
	11. Urban Wetlands (C)	Number, size, condition, and influence on water quality
	12. Surface Water Dependent Ecosystems (C)	Broad measure drawing on riparian condition, native species and ecological communities, for example, biannual assessment of macro-invertebrate community composition
	13. Stormwater Discharges (P)	Non point source discharges and including pervious/impervious surface areas (also links to water reuse and stormwater harvesting Indicator) Note: point discharges addressed in Water Quality cluster
	14. Water Management (R)	Effectiveness of water management for maintaining and enhancing catchment and river health
	15. Riparian Management (R)	Effectiveness of riparian management for maintaining and enhancing catchment and river health
	16. Urban Wetland Management (R)	Effectiveness of urban wetland management
Comments: d) Proposed Discharges from Land Use Indicator included in Stormwater Discharges Indicator. e) No impact Indicator is proposed. f) New Urban Wetland Management Indicator.		
Water Supply	17. Dam Storage (C)	Drinking water storage levels
	18. Dam Water Quality (C)	Dam water quality prior to treatment
	19. Drinking Water Quality (C)	Treated drinking water quality
	20. Water Use (P)	Water use by sector
	21. Environmental Flows (I)	Including volume, quality, nature, regime, timing, location into Googong dam, and effects of dam releases
	22. New Water Supplies (R)	New sources of water supply
	23. Water Demand Management (R)	Effectiveness of water demand management
	24. Environmental Flow Management (R)	Effectiveness of implementation of environmental flow guidelines
Comments: g) Proposed Dam Releases Indicator is included in Environmental Flows Indicator.		

Indicator Cluster	Indicator (and Type)	Coverage
Water Quality	25. Surface Water Quality (C)	Broad measure of surface water quality of streams, wetlands and rivers
	26. Discharges to Waters (P)	Point source discharges Note: non point source discharges addressed in Catchment and River Health cluster
	27. Algal Blooms (I)	Number, area, frequency and toxicity of algal blooms
	28. Water Quality and Human Health Impacts (I)	Health impacts from poor water quality and algal blooms
	29. Effluent Treatment (R)	Level of treatment of wastewater discharges and effluent water quality
	30. Water Reuse and Stormwater Harvesting (R)	Amount of water reuse from wastewater and stormwater harvesting
Comments: h) Proposed Riparian Management Indicator addressed in Catchments and River Health Riparian Management Indicator. i) Proposed Urban Wetlands Indicator addressed in Catchments and River Health Urban Wetland Management Indicator.		
Groundwater	31. Groundwater Availability (C)	Volume and distribution of available groundwater
	32. Groundwater Quality (C)	Quality of groundwater including pollution from contaminated sites
	33. Groundwater Use (P)	Amount and distribution of groundwater use
	34. Groundwater Management (R)	Effectiveness of groundwater management responses
Comments: j) No changes to that proposed.		
Other Comments: k) Weather Indicators are addressed in Driving Forces section.		

6.2. Indicators for the Biodiversity Theme

Indicator clusters were discussed and recommended by the focus groups and the ACT SoE Report 2011 Reference Group. The Indicator cluster definitions for the Biodiversity Theme are outlined below.

Ecological Communities Indicator Cluster

Biodiversity, the variety of all life forms, is generally considered at three levels: ecosystem diversity, species diversity, and genetic diversity. Ecosystem diversity may be correlated with the extent and condition of native vegetation types within them. Different vegetation types are the products of different ecological and environmental conditions and, therefore, could reflect different habitats and components of ecosystems (e.g. species composition and amount of available habitat). Clearing vegetation reduces the total area of habitat available to species, and can increase the risk of local extinction (ANZECC 2000).

The area and distribution, and management of protected areas is important for biodiversity conservation. However, broader conservation management including management guidelines, education programs, biodiversity offsets and connectivity restoration are also important outside of protected areas.

The Ecological Communities Indicator Cluster has six Indicators which will be reported on. These are:

- Vegetation Communities (C): the extent and distribution of vegetation communities (The National Vegetation Information System (NVIS) is a comprehensive data system that provides information on the extent and distribution of vegetation types in Australian landscapes).
- Vegetation Condition (C): the quality and condition of vegetation including remnant areas and connectivity.
- Protected Areas (C): the area and distribution of protected areas, and new areas.
- Vegetation Clearance (P): the area, distribution, fragmentation of connectivity and loss of soil that also links to Vegetation and Erosion Indicators in Land Health Cluster.
- Conservation Management (R): the effectiveness of conservation management responses including biodiversity offsets and connectivity restoration.
- Protected Area Management (R): the effectiveness of protected area management.

Native Species – Fauna Indicator Cluster

Native animal species are an important component of biodiversity, including ecosystems. The number of species considered extinct, endangered or vulnerable is a surrogate for the loss of species.

Information on other native species can also inform our understanding of population trends and the health of ecosystems. Assessment of the effectiveness of native species conservation measures can help identify successes and/or gaps in current regulation, programs and initiatives to prioritise and improve the success of future actions. Considerations include road kills which can have a significant impact on some native species, such as kangaroos.

Introduced pest species have caused extensive damage to native ecosystems through contributing to species extinctions by predation, habitat alteration, and competing with native species. Introduced pests can also cause considerable economic losses to primary production.

The Native Species – Fauna Indicator Cluster has seven Indicators which will be reported on. These are:

- Status of Native Species – Animals, Birds and Frogs (C): the status of native species – animals, birds and frogs – including threatened species listings and other data for common species.
- Pest Status (P): the extent and distribution of pests.
- Pest Impacts (I): the nature of pest impacts on native species and production.
- Road Kill (I): road kill impacts on native species.
- Threatened Species Conservation (R): the effectiveness of threatened species conservation management.

- Native Species Conservation (R): native species population trends and management issues (e.g. kangaroo management).
- Pest Management (R): the effectiveness of pest management.

Native Species – Flora Indicator Cluster

The status of native plant species is important to assess the loss of species and the impact on biodiversity. Native plants and trees can be affected by seed gathering and firewood harvesting. Assessing the effectiveness of native plant conservation measures can help identify successes and/or gaps in current regulation, programs and initiatives to prioritise and improve the success of future actions.

A weed can be considered as any plant that is having an adverse impact on a valuable resource and requires some form of action to reduce that impact (ANZECC 2000). Weeds can crowd out native species, reduce biodiversity and affect the functioning of ecosystems and production.

The Native Species – Flora Indicator Cluster, has seven Indicators which will be reported on. These are:

- Status of Native Species – Plants (C): the status of native species – plants including threatened species listings and other data for common species.
- Weed Status (P): the extent and distribution of weeds.
- Native Seed Harvesting (P): the extent and distribution of native seed harvesting.
- Firewood Gathering (P): the extent and distribution of firewood gathering.
- Weed Impacts (I): the nature of weed impacts on native species and production.
- Threatened Species Conservation (R): the effectiveness of threatened species plant conservation.
- Weed Management (R): the effectiveness of weed management responses.

Threatening Processes Indicator Cluster

Much of Australia's flora and fauna has evolved alongside threatening processes such as fire and may rely on these processes for continued survival. However, changes to these processes (for example, fires of high or low intensity that are either too frequent or insufficiently frequent) or new processes (such as the impacts of urban areas) can lead to loss of native species, and communities.

The Threatening Processes Indicator Cluster has five Indicators which will be reported on. These are:

- Fire and Fire Regimes (P): the type, area, distribution and extent of fire (including all fires).
- Fuel Reduction (I): the ecological impacts of prescribed burning.
- Ecosystems and Climate Change (I): the impacts of climate change on ecosystems.
- Ecological Degradation (I): a broad measure of effects of urban and other development on ecological communities including urban expansion.
- Fire Management and Ecology (R): the effectiveness of fire management responses in terms of ecology and native species and communities.

The complete list of Indicators for the Biodiversity Theme are outlined in table 6.2.

Table 6.2: Biodiversity Theme Indicators

Indicator Cluster	Indicator (and Type)	Coverage
Ecological Communities	35. Vegetation Communities (C)	Extent and distribution of vegetation communities (The National Vegetation Information System (NVIS) is a comprehensive data system that provides information on the extent and distribution of vegetation types in Australian landscapes)
	36. Vegetation Condition (C)	The quality and condition of vegetation including remnant areas and connectivity
	37. Protected Areas (C)	Area and distribution of protected areas, and new areas
	38. Vegetation Clearance (P)	Area, distribution, fragmentation of connectivity and loss of soil Also links to vegetation and erosion Indicators in Land Health cluster
	39. Conservation Management (R)	Effectiveness of conservation management responses including biodiversity offsets and connectivity restoration
	40. Protected Area Management (R)	Effectiveness of protected area management
Emerging Issues 1. Biodiversity offsets **Comments:** l) Proposed Native Species Indicator is address in Native Species cluster. m) Proposed Clearing/Fragmentation of connectivity Indicator is included in Vegetation Clearance Indicator. n) Proposed Loss of Species, Loss of Soil, and Off-stream Wetlands addressed in other clusters. o) Proposed Road Kill Indicator moved to Native Species cluster. p) Proposed Management Responses and Connectivity Restoration Indicators included in Conservation Management Indicator.		
Native Species – Fauna	41. Status of Native Species – Animals, Birds and Frogs (C)	Status of native species – animals, birds and frogs – including threatened species listings and other data for common species
	42. Pest Status (P)	Extent and distribution of pests
	43. Pest Impacts (I)	Nature of pest impacts on native species
	44. Road Kill (I)	Road kill impacts on native species [and production?]
	45. Threatened Species Conservation (R)	Effectiveness of threatened species conservation management
	46. Native Species Conservation (R)	Native species population trends and management issues eg. kangaroo management
	47. Pest Management (R)	Effectiveness of pest management
Emerging Issues 2. Domestic Animals and Impacts – addresses impacts on Native Species in urban and peri-urban areas. **Comments:** q) Proposed Bird and Frog Indicators included in Status of Native Species. r) Proposed Urban Development Indicator addressed in Ecological Community Degradation in ecological community cluster. s) Proposed Domestic Animals Indicator nominated as an emerging issue. t) Proposed Fragmentation of Connectivity in Vegetation Clearance Indicator in ecological community cluster. u) Proposed Degradation and Loss of Soil Indicators addressed in other clusters.		

Indicator Cluster	Indicator (and Type)	Coverage
Native Species - Flora	48. Status of Native Species – Plants (C)	Status of native species – plants including threatened species listings and other data for common species
	49. Weed Status (P)	Extent and distribution of weeds
	50. Native Seed Harvesting (P)	Extent and distribution of native seed harvesting
	51. Firewood Gathering (P)	Extent and distribution of firewood gathering
	52. Weed Impacts (I)	Nature of weed impacts on native species [and production?]
	53. Threatened Species Conservation (R)	Effectiveness of threatened species plant conservation
	54. Weed Management (R)	Effectiveness of weed management responses
Threatening Processes	55. Fire and Fire Regimes (P)	Type, area, distribution and extent of fire (including all fires)
	56. Fuel Reduction (I)	Ecological impacts of prescribed burning
	57. Ecosystems and Climate Change	Impacts of climate change on ecosystems
	58. Ecological Degradation (I)	Broad measure of effects of urban and other development on ecological communities and species including urban expansion
	59. Fire Management and Ecology (R)	Effectiveness of fire management responses in terms of ecology and native species and communities
Comments: v) Other proposed Indicators addressed in other clusters – primarily Natural Hazards in the People Theme.		

6.3. Indicators for the Air Theme

The new Air Theme was separated from an initial Land and Water Theme as the catchment for air has a different geographical boundary compared to water catchments and their associated land. In addition, indoor air pollution is a concern and there is a legislative requirement for jurisdictions to monitor air quality as per the standards for the National Environment Protection Measure for Ambient Air Quality (DEWHA 2010).

Indicator clusters were discussed and recommended by the focus groups and the ACT SoE Report 2011 Reference Group. The Indicator cluster definitions for the Air Theme are outlined below.

Local Air Pollution Indicator Cluster

The emission of pollutants into the atmosphere can lead to concentrations of gases and particles that have adverse impacts on some ecosystems and human health. Motor vehicles are a major source of air pollutants, and emissions are strongly influenced by factors such as the age of the vehicle fleet, driver behaviour, and vehicle maintenance. Other emissions may result from the burning of fossil fuels, industrial processes, and fire. The National Pollutant Inventory (NPI) provides information about substance emissions in Australia. The NPI shows emission estimates for 93 toxic substances along with the source and location of those emissions.

The Local Air Pollution Indicator Cluster has five Indicators which will be reported on. These are:

- Local Air Quality (C): includes Carbon monoxide, Nitrogen dioxide, Photochemical oxidants (as Ozone), Sulfur dioxide, Lead, Particles as PM10, Particles as PM2.5 (NEPM requirements) and also Volatile Organic Compounds.
- Vehicle Emissions (P): the type and volume of vehicle emissions.
- Other Emissions (P): the type and volume of other emissions and includes particulates and smoke from fires.
- Air Emissions and Health Impacts (I): health impacts from local air emissions.
- Air Quality Management (R): the effectiveness of air quality management responses (also links with Fire Management Indicator in the People Theme).

Indoor Air Pollution Indicator Cluster

Sources of indoor air pollutants include household products, human activities, such as smoking and indoor fires, indoor vehicle pollution, building materials and external factors (from outdoor air pollution). Poor indoor air quality can have adverse impacts on human health and wellbeing. Indoor air quality is not regularly recorded and there is limited data available on indoor air quality in the ACT.

The Indoor Air Pollution Indicator Cluster has three Indicators which will be reported on. These are:

- Indoor Air Quality (C): includes Carbon Monoxide, Nitrogen Dioxide, Lead, Particles, Volatile Organic Compounds, Formaldehyde and Benzene – data may not be available.
- Indoor Air Quality Health Impacts (I): health impacts from indoor air emissions.
- Indoor Air Quality Management (R): the effectiveness of indoor air quality management – data may not be available.

The complete list of Indicators for the Air Theme are outlined in table 6.3.

Table 6.3: Air Theme Indicators

Indicator Cluster	Indicator (and Type)	Coverage
Local Air Pollution	60. Local Air Quality (C)	Includes Carbon monoxide, Nitrogen dioxide, Photochemical oxidants (as Ozone), Sulfur dioxide, Lead, Particles as PM10, Particles as PM2.5 (NEPM requirements) and also Volatile Organic Compounds
	61. Vehicle Emissions (P)	Type and volume of vehicle emissions
	62. Other Emissions (P)	Type and volume of other emissions and includes particulates and smoke from fires
	63. Air Emissions and Health Impacts (I)	Health impacts from local air emissions
	64. Air Quality Management (R)	Effectiveness of air quality management responses Also links to Fire Management Indicator in the People Theme
Indoor Air Pollution	65. Indoor Air Quality (C)	Includes Carbon Monoxide, Nitrogen Dioxide, Lead, Particles, Volatile Organic Compounds, Formaldehyde and Benzene – data may not be available
	66. Indoor Air Quality Health Impacts (I)	Health impacts from indoor air emissions

	67. Indoor Air Quality Management (R)	Effectiveness of indoor air quality management – data may not be available

Comments:

w) Local Air Quality Indicator includes seven elements affecting air quality that were previously proposed as separate Indicators.
x) Non-vehicle emissions renamed as Other Emissions.
y) Proposed Fire Management Indicator addressed in Biodiversity cluster but cross-linked.
z) New Indoor Air Quality Health Impacts and Management Indicators.
aa) Proposed Outdoor Air Quality Indicator is removed as addressed in Local Air Pollution.

6.4. Indicators for the Climate Theme

The differences between weather, climate, climate variability and climate change are the time scales used for the data. Climate is weather over a longer time. Climate change occurs when climate variability over at least three decades shows a trend. Climate change is a change in the state of the climate that can be identified (for example, by using statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period, typically decades or longer. (Garnaut 2008:610). This report uses climate over three or more decades to identify a climate trend (Pers. Comm. Prof.Will Steffen, 9 April 2010).

Indicator clusters were discussed and recommended by the focus groups and the ACT SoE Report 2011 Reference Group. The Reference Group recommended major changes to the climate change Indicators to provide a new framework for climate change Indicators in the ACT SoE 2011 Report and future SoE reports. In addition, some Indicators belonged in the Air quality Theme such as airborne lead. It was noted the SoE report's short timeframe for reporting on weather Indicators is insufficient to show trends. Hence it is recommended the ACT SoE 2011 Report uses decadal weather data for the ACT climate which is more useful and the data can be compared across the decades from the 1950's and onwards or possibly from the 1910's for some data. For example: temperature, fire and extreme events. In addition, it is recommended the OCSE reviews the Indicators, when the anticipated Federal Department of Climate Change and Energy Efficiency's five year reporting framework for urban adaptation is released in late 2010.

The selected Indicator Clusters address emissions, mitigation, physical climate effects, climate as a resource, and adaptation. Because this will be the first SoE report on these indicators, depending on data availability, not all of the proposed Indicators may be used. They are provided as a framework for this and subsequent SoE reports. The Indicator cluster definitions for the Climate Theme are outlined below.

Emissions Indicator Cluster

Increasing atmospheric concentrations of greenhouse gas emissions include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Natural processes form some of these gases but they are also generated by human activities. Their ability to absorb infrared radiation causes climate change when the gases reflect sunlight back to the Earth's surface, which leads to a warming of the Earth's lower atmosphere (Garnaut 2008). "The climate system appears to be changing faster than earlier thought likely. Key manifestations of this include the rate of accumulation of carbon dioxide in the

atmosphere, trends in global ocean temperature and sea level, and loss of Arctic sea ice." (DCC 2009).

Energy use is a key contributor to greenhouse gas emissions, along with methane emissions from landfill sites and waste bodies, and nitrous oxide emissions.

The Mitigation Indicator Cluster has eight Indicators which will be reported on. These are:

- Atmospheric Concentration of Carbon Dioxide (ppm) (C).
- Atmospheric Concentration of Methane (C).
- Atmospheric Concentration of Nitrous Oxide (C).
- Energy Use (P): energy use by type and by sector (e.g. residential, commercial, industrial, agriculture and transport), energy use per $1000 GDP and discussion of trends.
- CO_2 Emissions (P): CO_2 emissions per year, per sector and per capita.
- Methane Emissions (P): including from landfill sites and water bodies.
- Nitrous Oxide Emissions (P).
- Ozone Layer (I): the extent of the ozone layer and impacts.

Mitigation Indicator Cluster

New low emission sources of energy are essential, as are initiatives to reduce emissions in transport, waste, infrastructure, building and industry sectors.

The Mitigation Indicator Cluster has three Indicators which will be reported on. These are:

- Energy Supply (R): energy sources and trends, ACT Government purchase of renewable energy, and effectiveness of renewable energy and energy efficiency programs.
- Emission Reduction (R) in Waste and Transport: the effectiveness of initiatives to reduce emissions in Waste (e.g. methane capture at landfill sites and site remediation) and Transport sectors (e.g. ACTION gas fuelled buses, electric vehicles, ACT Government fleet fuel efficiency, public transport, sustainable transport).
- Emission Reduction by Infrastructure, Buildings and Industry (R): the effectiveness of initiatives to reduce emissions in Infrastructure (e.g. energy efficient street lighting), Buildings (e.g. passive solar, green star, rebates for energy efficiency, housing density) and Industry sectors (e.g. use of feed in tariffs and retailers that source 10% renewable energy).

Physical Climate Effects Cluster

Australia is experiencing the early impacts of climate change and it is predicted that we face more substantial impacts in the future. Higher temperatures, more frequent and severe weather events, and a further decrease in rainfall and water availability could lead to major declines in agricultural production, damage to natural marine ecosystems, and damage to coastal infrastructure (DCC 2010). In the ACT, understanding the impacts of climate change on water resources, fire regimes, human health, and native species will help inform the development of appropriate responses.

The Physical Climate Effects Cluster has four Indicators which will be reported on. These are:

- Climate and Water Resources (P): the pressures from a changing climate on water resources including rainfall, inflows into dams, and evaporation.
- Climate and Fire (P): the pressures from a changing climate with Macarthur index above 40 (also links to Threatening Processes Cluster in the Biodiversity Theme).
- Climate and Human Health (I): including heat related illness and death, food and water shortages, malnutrition and disease.
- Climate and Native Species (I): major changes to native species and ecosystems from a changing climate.

Climate as a Resource Indicator Cluster

Climate is a resource and in the ACT there are further opportunities to harness the power of the sun and wind.

The Climate as a Resource Cluster has one Indicator which will be reported on. This is:

- Climate as a Resource (R): discussion of climate as a resource for renewable energy, agriculture, tourism and other production.

Adaptation Indicator Cluster

As identified in the Physical Climate Effects Cluster, Australia and the ACT are experiencing the early impacts of climate change and it is predicted that we face more substantial impacts in the future. Monitoring the effectiveness of adaptation responses to a changing climate will be essential.

The Adaptation Cluster has one Indicator which will be reported on. This is:

- Climate Adaptation (R): covering infrastructure, buildings, water and energy resources, and transport in terms of climate impacts and responses.

The complete list of Indicators for the Climate Theme are outlined in table 6.4.

Table 6.4: Climate Theme Indicators

Indicator Cluster	Indicator (and Type)	Coverage
Emissions	68. Atmospheric Concentration of CO_2 PPM (C)	Atmospheric Concentration of CO_2 PPM
	69. Atmospheric Concentration of Methane (C)	Atmospheric Concentration of Methane
	70. Atmospheric Concentration of Nitrous Oxide (C)	Atmospheric Concentration of Nitrous Oxide
	71. Energy Use (P)	Energy use by type and by sector (e.g. residential, commercial, industrial, agriculture and transport), energy use per $1,000 GDP, and discussion of trends
	72. CO_2 Emissions (P)	CO_2 emissions per year, per sector and per capita

	73. Methane Emissions (P)	Including from landfill sites and water bodies
	74. Nitrous Oxide Emissions (P)	Nitrous Oxide Emissions
	75. Ozone Layer (I)	Extent of the ozone layer and impacts
Comments: bb) Proposed Energy use per $1,000 GDP included in the Energy Use Indicator and not in the People Theme. cc) Proposed Transport Indicator partly covered in CO_2 emissions Indicator (per sector), but transport elements mainly addressed in the People Theme.		
Mitigation	76. Energy Supply (R)	Energy sources and trends, fuel sales, ACT Government purchase of renewable energy, and effectiveness of renewable energy and energy efficiency programs
	77. Emission Reduction (R) in Waste and Transport	Effectiveness of initiatives to reduce emissions in Waste (eg. methane capture at landfill sites and site remediation) and Transport sectors (eg. ACTION gas fuelled buses, electric vehicles, ACT Government fleet fuel efficiency, public transport, sustainable transport)
	78. Emission Reduction by Infrastructure, Buildings and Industry (R)	Effectiveness of initiatives to reduce emissions in Infrastructure (eg. energy efficient street lighting), Buildings (eg. passive solar, green star, rebates for energy efficiency, housing density) and Industry sectors (eg. use of feed in tariffs and retailers that source 10% renewable energy)
Comments: dd) Proposed Transport Indicator partly covered in Emission Reduction in Waste and Transport Indicator, but transport elements mainly addressed in the People Theme.		
Physical Climate Effects	79. Climate and Water Resources (P)	The pressures from a changing climate on water resources including rainfall, inflows into dams, and evaporation
	80. Climate and Fire (P)	The pressures from a changing climate with Macarthur index above 40. Also links to Threatening Processes cluster in Biodiversity
	81. Climate and Human Health (I)	Including heat related illness and death, food and water shortages, malnutrition and disease
	82. Climate and Native Species (I)	Major changes to native species and ecosystems from a changing climate
Comments: ee) Proposed Temperature Trends and Extreme Events Indicators to be addressed in Driving Forces section.		
Climate as a Resource	83. Climate as a Resource (R)	Discussion of climate as a resource for renewable energy, agriculture, tourism and other production
Adaptation	84. Climate Adaptation (R)	Covering infrastructure, buildings, water and energy resources, and transport in terms of climate impacts and responses

6.5. Indicators for the People Theme

People and communities are part of the environment as identified in ACT legislation. Indicator clusters were discussed and recommended by the focus groups and the ACT SoE Report 2011 Reference Group. The process to refine the indicators and their clusters is described in the Annex, (a standalone working document available from the OCSE). The Indicator cluster definitions for the People Theme are outlined below.

Urban Quality Indicator Cluster

Urban quality is determined by many factors. Urban density, and the amount and type of housing, are informed by urban design and, can significantly influence urban form and the overall demand for resources, energy and infrastructure. The split between greenfield and infill development is also an important factor influencing urban quality, urban form and the efficiency of urban development.

Open space, parks, recreation areas, community facilities and urban trees contribute significantly to the quality and amenity of urban areas, along with providing important social and health benefits. Community safety is a key contributor to the overall amenity of an area.

The Urban Quality Indicator Cluster has fourteen Indicators which will be reported on. These are:

- Urban Density (C): covers urban density across the ACT and changes over time.
- Housing Types (C): includes housing stock, type and size.
- Community Facilities (C): the number, type and use of community facilities.
- Open Space, Amenity and Recreation Areas (C): includes open space, parks and recreational areas in terms of area, distribution, standards, use and distance to access.
- Urban Trees (C): the number and distribution of urban trees as essential "green assets".
- Urban Development (P): greenfield and infill split.
- Housing Demand (P): includes housing demand, and changes in household formation and other social influences on housing type and size.
- Community Safety (P): safety statistics relating to people and property, and perceptions of safety (also links to Transport Incidents Indicator).
- Noise Complaints (P): details on type and number of noise complaints.
- Urban Areas and Human Health Impacts (I): includes obesity rates, and other urban health problems.
- Green Star Development (R): type, number and location of green star development.
- Inner City and Higher Density Development (R): includes diversification of town centres.
- Efficiency of Development (R): includes commentary on efficiency of development.
- Open Space Management (R): covers management of open space and recreational areas, including connectivity, accessibility and quality.

Transport Indicator Cluster

Transport assets and transport choices have a significant impact on communities and settlements and the quality of the environment. Different modes of transport, such as private vehicles, public transport and walking, have different impacts on the environment. Private motor vehicles (cars) usually have the most impact, particularly in terms of per capita energy consumption and air emissions, buses have an intermediate impact, and walking or cycling have the least. The average time of travel for each transport mode indicates the level of congestion experienced.

Increasing reliance on private vehicles can result in greater infrastructure requirements (roads and parking), with likely increases in energy consumption, noise levels, accidents and associated fatalities. Reductions in the level of motor vehicle use can free up financial, energy and land resources for other activities. Transport accessibility also impacts on human health.

The Transport Indicator Cluster has six Indicators which will be reported on. These are:

- Transport Assets (C): includes land area used for roads.
- Transport Modes and Use (C): includes modal split, transport use trends and vehicle size trends.
- Transport Accessibility (C): the accessibility of transport and includes pedestrian access to shops.
- Commuting and Congestion (P): includes time spent commuting and congestion.
- Transport and Human Health Impacts (I): includes a range of human health impacts from transport infrastructure and use (e.g. noise, pollution, accidents, safety and obesity).
- Transport Management (R): the effectiveness of transport management responses.

Waste Indicator Cluster

Solid waste includes household and commercial waste, inert household and commercial waste, construction waste, commercial waste from food processing and distribution, office generated waste, industrial waste from manufacturing processes and waste from research activities. The amount of urban waste generated and disposed of (either legally or illegally dumped) indicates the pressure of cities and the associated waste on the environment through potential contamination of soils and groundwater, and the physical area of land used for waste disposal.

Hazardous waste can be either the waste from manufacturing processes, hydrocarbon storage and some research procedures, or simply the residue from past landuses. It is generally unsuitable for direct disposal to either landfills or the sewer system, and must be disposed of by using specialised procedures. Hazardous wastes potentially pose either an immediate or long-term risk to the health of humans and the environment.

The Waste Indicator Cluster has four Indicators which will be reported on. These are:

- Waste (P): waste totals and trends by sector.
- Movement of Controlled Waste (P): includes packaging.
- Waste and Human Health (I): includes any pollution incidents.

- Waste Management (R): the effectiveness of implementation of waste policy by ACT Government and includes volume of recycling, and the effectiveness of treatment of controlled and hazardous waste (including regulations).

Heritage Indicator Cluster

There are strong interconnections between the physical environment and heritage. The ACT Heritage Register aims to represent and protect the rich natural and cultural heritage of the ACT, encompassing both Aboriginal and post European cultural values.[8] There is a growing awareness of heritage places and objects and the importance of protecting them for the future. Heritage can include Aboriginal sites, historic heritage places and areas, natural heritage, and other heritage structures or features which have historic, scientific, aesthetic, social or traditional value. The number and condition of heritage listings indicates the community's response to identifying and preserving heritage, and the value placed on heritage in maintaining a sense of place in a region. A sense of place is an important factor in our quality of life. Places and objects of heritage value are identified by government and non-government agencies developing lists, registers and databases that cover historic, Indigenous and natural environments.

The Heritage Indicator Cluster has six Indicators which will be reported on. These are:

- Historic Heritage Places (R): includes number of sites and condition.
- Indigenous Heritage Places (R): includes number of sites and condition.
- Natural Heritage Places (R): includes number of sites and condition.
- Loss of Historic Heritage and Indigenous Heritage Sites (P): with details on the loss of sites.
- Climate Change Impacts on Condition of Heritage Sites (P): a broad discussion on climate change impacts on Heritage Sites.
- Heritage Protection, Management and Reuse (R): the effectiveness of protection and management of historic heritage places, protection and management of Indigenous heritage, and protection and management of natural heritage.

Community Engagement Indicator Cluster

Community engagement is important for empowering the community to improve environmental management, and ensuring that issues and concerns are understood and considered as part of decision-making processes. Awareness raising and education can inform the community of: environmental challenges, successful solutions and how to live more sustainably. A wide range of mechanisms can be used to promote effective engagement and awareness raising across the community.

The attitudes and actions of individuals are an important factor in their impact on the environment (as individuals or as household members). Surveying community attitudes is an important feedback mechanism for analysing the effectiveness of environmental policies, programs and education, as well as for judging support for initiatives (ANZECC 2000).

[8] ACT Heritage Register, see: http://www.tams.act.gov.au/live/heritage/act_heritage_register

The Community Engagement Indicator Cluster has four Indicators which will be reported on. These are:

- Community Environmental Awareness and Education (C): the level of community environmental awareness (e.g. through survey results, and number and type of environmental education programs.
- Community Environmental Participation (C): the level and extent of community environmental participation (e.g. in community, Parkcare and Landcare groups).
- Environmental Activities and Events (C): the number and type of environmental activities and events.
- Environmental Education Programs (R): the effectiveness of environmental and sustainability education programs.

Natural Hazards Indicator Cluster

A natural hazard may be either a source of potential harm or an existing condition that may cause any of the following: harm to people and either damage to property or the environment. Population growth and urban development in certain locations can increase exposure to natural hazards, such as flood and fire. As urban development extends into areas of higher risk, the impacts of flooding, fire and wind storms on human settlements can have significant economic and social costs on the community (Middelmann 2007).

The Natural Hazards Indicator Cluster has seven Indicators which will be reported on. These are:

- Flooding (C): details of flood risk by area and type.
- Fire and Settlement (C): details of fire risk relating to the community.
- Fire Impacts (I): fire impacts affecting the community.
- Flood Impacts (I): number and type of floods, and flood impacts relating to community.
- Wind Storms (I): the number and type of wind storms affecting the ACT.
- Fire Management (R): fire management from a human settlement perspective (also links to Fire Management and Ecology Indicator).
- Flood Management (R): the effectiveness of flood management responses including structural and non-structural actions.

The complete list of Indicators for the People Theme are outlined in table 6.5.

Table 6.5: People Theme Indicators

Indicator Cluster	Indicator (and Type)	Coverage
Urban Quality	85. Urban Density (C)	Covers urban density across the ACT and changes over time
	86. Housing Types (C)	Includes housing stock, type, and size
	87. Community Facilities (C)	Number, type and use of community facilities
	88. Open Space, Amenity and Recreation Areas (C)	Includes open space, parks and recreational areas in terms of area, distribution, standards, use and distance to access
	89. Urban Trees (C)	The number and distribution of urban trees

Indicator Cluster	Indicator (and Type)	Coverage
	90. Urban Development (P)	Greenfield and infill split
	91. Housing Demand (P)	Housing demand, changes in household formation and other social influences on housing type and size
	92. Community Safety (P)	Safety statistics relating to people and property, and perceptions of safety (also links to Transport Incidents Indicator)
	93. Noise Complaints (P)	Details on type and number of noise complaints
	94. Urban Areas and Human Health Impacts (I)	Includes obesity rates, and other urban health problems
	95. Green Star Development (R)	Type, number and location of green star development
	96. Inner City and Higher Density Development (R)	Includes diversification of town centres
	97. Efficiency of Development (R)	Includes commentary on efficiency of development
	98. Open Space Management (R)	Covers management of open space and recreational areas, including connectivity, accessibility and quality
Comments: ff) Proposed Parks and Open Space Indicator included in broader Open Space, Amenity and Recreation Areas Indicator. gg) Proposed Population Indicator included in broader Housing Types and Demand Indicator. hh) Proposed Housing Size Indicator included in broader Housing Types and Demand Indicator. ii) Proposed Decrease in Density over time Indicator addressed in Urban density Indicator. jj) Proposed Peri-urban impact Indicator covered in Emerging Issue 2: Domestic Animals and Impacts kk) Proposed Usage of Reserves Indicator covered in broader Open Space, Amenity and Recreation Areas Indicator. ll) Proposed Natural habitats being made into reserves Indicator covered in Protected Areas Indicator in Biodiversity section.		
Transport	99. Transport Assets (C)	Includes land area used for roads
	100. Transport Modes and Use (C)	Includes modal split, transport use trends and vehicle size trends
	101. Transport Accessibility (C)	Includes pedestrian access to shops
	102. Commuting and Congestion (P)	Includes time spent commuting and congestion
	103. Transport and Human Health Impacts (I)	Includes a range of human health impacts from transport infrastructure and use eg. noise, pollution, accidents (refer above), safety and obesity
	104. Transport Management (R)	Effectiveness of transport management responses
Comments: mm) Proposed Transport Congestion and Time Spent Commuting Indicators merged as Commuting and Congestion Indicator. nn) Proposed Pedestrian Access to Shops broadened to be included in Transport Accessibility Indicator. oo) Proposed Transport Use Trends included in combined Transport Modes and Use Indicator. pp) New Transport Management response Indicator.		
Waste	105. Waste (P)	Waste totals and trends by sector
	106. Movement of Controlled Waste (P)	Includes packaging

Indicator Cluster	Indicator (and Type)	Coverage
	107. Waste and Human Health (I)	Includes any pollution incidents
	108. Waste Management (R)	Effectiveness of implementation of waste policy by ACT Government and includes volume of recycling and treatment of controlled and hazardous waste (including regulations)
Comments: qq) Proposed Contaminated Sites and Remediation Indicators addressed in Land Health cluster. rr) Proposed Groundwater contamination Indicators addressed in Groundwater cluster. ss) Proposed pollution incidents Indicator include in Waste and Human Health Indicator. tt) Proposed Volume of Recycling Indicator included in Waste Management Indicator.		
Heritage	109. Historic Heritage Places (C)	Includes number of sites and condition
	110. Indigenous Heritage Places (C)	Includes number of sites and condition
	111. Natural Heritage Places (C)	Includes number of sites and condition
	112. Loss of Historic Heritage and Indigenous Sites (P)	Includes details on loss of sites
	113. Climate Change Impacts on Condition of Heritage Sites (P)	Broad discussion on climate change impacts on Heritage Sites
	114. Heritage Protection, Management and Reuse (R)	Effectiveness of protection and management of historic heritage places, protection and management of Indigenous heritage, and protection and management of natural heritage
Comments: uu) Proposed individual Heritage loss pressure Indicators have been combined. vv) Proposed individual Heritage management response Indicators have been combined.		
Community Engagement	115. Community Environmental Awareness and Education (C)	Level of community environmental awareness eg. through survey results, and number and type of environmental education programs
	116. Community Environmental Participation (C)	Level and extent of community environmental participation eg. in community, Parkcare and Landcare groups
	117. Environmental Activities and Events (C)	Number and type of environmental activities and events
	118. Environmental Education Programs (R)	Effectiveness of environmental and sustainability education programs
Comments: ww) Proposed Environmental Education Indicator has been combined with Environmental Awareness Indicator.		
Natural Hazards	119. Flooding (C)	Details of flood risk by area and type
	120. Fire and Settlement (C)	Details of fire risk relating to community
	121. Fire Impacts (I)	Fire impacts on the community
	122. Flood Impacts (I)	Number and type of floods, and flood impacts on community
	123. Wind Storms (I)	Number and type of wind storms and impacts on community

Indicator Cluster	Indicator (and Type)	Coverage
	124. Fire Management (R)	Fire management from a human settlement perspective Also links to Fire Management and Ecology Indicator
	125. Flood Management (R)	Effectiveness of flood management responses including structural and non-structural actions
Other Comments: xx) Consumption Indicators are addressed in Driving Forces section. yy) Energy Indicators are addressed in Climate Change and Climate Variability section.		

6.7 Changes from previous SoE Reports – comparison of Indicators for ACT SoE 2011 Report

The review has streamlined and grouped indicators to more directly relate to themes. While most indicators from previous SoE Reports have been retained, however in some cases they are either grouped differently, or will not be reported, for example: number of general practitioners in the ACT. While these unreported indicators related to sustainability issues, they are not directly related to environmental factors, which is the focus of the ACT SoE 2011 Report's objectives.

7. Conclusion

The SoE Report framework, Themes, and Indicators outlined in this report provide the essential building blocks and content to prepare the next ACT SoE Report in 2011. The overall SoE Report framework will continue to evolve in response to changing environmental priorities and community concerns, and a drive for continuous improvement in reporting, to improve the quality of the environment and the quality of life in the ACT.

Glossary

Environment means each of the following:
a) the components of the earth, including soil, the atmosphere and water;
b) any organic or inorganic matter and any living organism;
c) human made or modified structures and areas;
d) ecosystems and their constituent parts, including people and communities;
e) the qualities and characteristics of places and areas that contribute to their biological diversity and ecological integrity, scientific value, and amenity;
f) the interactions and interdependencies within and between the things mentioned in paragraph (a) to (e);
g) the social, aesthetic, cultural and economic conditions that affect, or are affected by, the things mentioned in paragraphs (a) to (e). (ACT 1997:164)

Driving Forces and their Indicators:

- are 'socio economic and socio cultural forces driving human activities, which increase or mitigate pressures on the environment' (UNEP GRID Arendal 2009),
- are 'the social, demographic and economic developments in societies and the corresponding changes in life styles, overall levels of consumption and production patterns' (Smeets & Weterings 1999:8).
- describe the underlying pressures related to socioeconomic and political agents of change, such as population growth, GDP, and consumption (UNEP 2006 cited in Halcrow 2010).

Headline Indicators:
The purpose of environmental headline Indicators is to provide simple and clear information to decision-makers and the general public about progress in environmental policies and the key factors determining the state of the environment and whether we are moving towards environmental sustainability. The Indicators should be designed to reach the headlines of newspapers (European Environment Agency).[9]

Indicator: a parameter, or a value derived from parameters, that describes the state of a phenomenon, environment or area (OECD 1993:5 cited in Halcrow 2010).

[9] See: http://glossary.eea.europa.eu/terminology/concept_html?term=environmental%20headline%20indicator

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Appendix 1: Focus group attendees

Water and Catchments, 19 November 2009
Dr Sarah Ryan NRM Council
Mr Ross Knee ACTEW
Mr Michael Ross Department of the Environment, Climate Change, Energy and Water
Mr Stewart Chapman Department of the Environment, Climate Change, Energy and Water
Professor Ian Falconer (Water Consultant)
Mr Jonathan Millard, Department of the Environment, Water, Heritage and the Arts
Mr Boon Lim Department of the Environment, Water, Heritage and the Arts
OCSE: Ms Ruth Kharis, Mrs Narelle Sargent.

Biodiversity Workshop, 26 November 2009
Dr David Shorthouse
Ms Sharon Lane Department of Territory and Municipal Services
Mr John Hibberd Conservation Council
Ms Jenny Bounds Canberra Ornthologists Group
Ms Dayani Gunawardana Department of the Environment, Water, Heritage and the Arts
Mr Jonathan Millard, Department of the Environment, Water, Heritage and the Arts
OCSE: Ms Ruth Kharis, Mrs Narelle Sargent.

Climate Change and Greenhouse Indicators Workshop, 26 November 2009
Mr Michael Doherty, CSIRO
Dr Janette Lindesay, ANU
Mr Jonathan Millard, Department of the Environment, Water, Heritage and the Arts (DEWHA),
Ms Lynette Sebo (DEWHA),
Ms Kylie Carman-Brown, ACT Planning and Land Management Authority (ACTPLA)
OCSE: Ms Ruth Kharis, Mr Larry O'Loughlin, Mrs Narelle Sargent.

Communities and Settlements Indicators Workshop, 30 November 2009
Mr Jonathan Miller, Chief Minister's Department
Mr Warren Nicholls, community member
Mr Jonathan Millard, Department of the Environment, Water, Heritage and the Arts (DEWHA)
Ms Lee-Ann Shepherd (DEWHA)
Ms Kylie Carman-Brown, ACT Planning and Land Management Authority (ACTPLA)
Mr John Hibberd, Conservation Council
OCSE: Ms Ruth Kharis, Mrs Narelle Sargent.