VICTORIAN STATE OF THE ENVIRONMENT 2018 REPORT

SUMMARY REPORT

Commissioner *for* Environmental Sustainability Victoria

VICTORIA State Government

Traditional Owners

The Commissioner for Environmental Sustainability proudly acknowledges Victoria's Aboriginal community and their rich culture and pays respect to their Elders past and present.

We acknowledge Aboriginal people as Australia's first peoples and as the Traditional Owners and custodians of the land and water on which we rely. We recognise and value the ongoing contribution of Aboriginal people and communities to Victorian life, and how this enriches us.

We embrace the spirit of reconciliation, working towards the equality of outcomes and ensuring an equal voice.

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Dr Gillian Sparkes
Commissioner for Environmental Sustainability, Victoria

Foreword

Welcome to the Victorian State of the Environment 2018 report, an environmental report card that measures the health of Victoria's environment every five years. This report is a key tool to enable transparent evaluation and disclosure of the condition of Victoria's environment.

Over the past four years, my team and I have been working with our partners and collaborators across the community, government and industry and leading an initiative to bring a stronger scientific evidence base and focus on policy coherence to Victorian environmental management. This State of the Environment report has the legislative authority to make recommendations to government and requires the government to respond to those recommendations. It is a comprehensive scientific baseline of Victoria's environmental condition measured by key indicators. But it is more than that. It is the product of an exhaustive reporting process that has assessed the monitoring and management systems through which we all strive for better environmental outcomes. It is this systems approach to our analysis and the adaptive management principles which underpin it, that has informed the recommendations I present in this report.

My job as Commissioner is to provide independent and objective reporting to inform policy-makers, regulators, environmental managers, scientists and the wider Victorian community about the state of our natural environment, and to advise government. Another critical part of my job is to shine a light on the areas of Victoria's environment that are working well, and those we need to improve.

This report supports me to fulfil these requirements. It provides an assessment of the available science on Victoria's environment and a synopsis of the challenges ahead, enabling me to make recommendations for future focus. It has been prepared according to the *State and Benefit: Framework for the Victorian State of the Environment 2018 Report* tabled in the Victorian Parliament in December 2015.

Through the assessment of 170 scientific indicators –up from 90 and 120 indicators in the 2013 and 2008 State of the Environment reports respectively – this report tells the story of the health of Victoria's environment at a time of unprecedented population growth.

Status	Indicators %	Trend	Indicators %	Data Quality	Indicators %
Good	11	Improving	10	Good	47
Fair	37	Stable	30	Fair	31
Poor	32	Deteriorating	30	Poor	22
Unknown	20	Unclear	30		

Table 1. A comparison (%) of the status, trend and data quality of the 170 indicators assessed

Victoria is forecast to grow at an average rate of 1.5% per annum to almost 8 million citizens by 2031, and 10 million by 2051. As Victoria's population and economy continue to grow, the addition of Future Focus and Accounting for the Environment components for each scientific assessment chapter are intended to help focus effort and investment over the medium-term, to benefit the environment on behalf of all Victorians. The addition of the Megatrends and Applying International Frameworks analyses, bring a global perspective to this report to improve our understanding of the value and benefit that the environment brings to Victoria's $400 billion economy.

Since 2015, we have been improving the way State of the Environment reporting is delivered in Victoria. As a result, the Commissioner has been assigned seven new, independent environmental reporting functions, for the first time since the role was established in 2003. This State of the Environment report for Victoria aims to provide the most comprehensive, scientific baseline on the health of Victoria's environment to date. Better understanding of the gaps in our science and monitoring programs will enable a shift by government towards 'getting the science we need, not just the science we can get' to inform policy, regulatory and management decisions. Ultimately, this will lead to better outcomes for Victoria's environment in the face of the increasing pressures of population growth and a changing climate. However, responding to these pressures will require a paradigm shift beyond traditional methods over the next decade, towards a new approach, including better use of citizen science.

Beyond Traditional Methods

Each scientific assessment chapter in Part III of this report includes summaries of current Victorian Government settings, including policies. There has been good progress in the environmental frameworks that have been developed since 2014. However, the increased pace of change and impact of pressures on the environment mean that a business-as-usual approach to developing policies, programs and an ad hoc investment in monitoring, science and reporting is unlikely to meet our requirements for effective, adaptive management practices into the future.

There is significant opportunity and need for government to build capability, harness citizen science and move beyond traditional methods of monitoring and reporting. Models for environmental management and protection that are more responsive, predictive and inclusive in relation to citizen involvement will better serve Victoria in the future. This will require an increased focus on building our research, data and analytics skills and capabilities, and a shift to a more operational paradigm where environmental policy-makers, practitioners and the community have access to the information they need, when they need it.

As Commissioner, I have been an advocate for reform in the way Victoria undertakes monitoring and reporting on the environment. I have been encouraging better investment and use of digital platforms, data analytics and citizen science, and a shift in how we monitor and protect Victoria's natural assets. Reallocation of existing resources, as well as new investment by government in these capabilities and workforce skills, is critical to build capability across Victoria for monitoring, managing and protecting an environment under increasing pressure.

Sustainable Development Goals

The 17 United Nations Sustainable Development Goals (SDGs) are referred to throughout the report, demonstrating how we are actively aligning Victoria with international environmental reporting frameworks. This is the start of our journey to rewire and bring coherence to the system so that the SDGs frame environmental monitoring and reporting in Victoria, helping to drive ecologically sustainable development over the next decade.

This is the first known attempt in Australia to apply the SDG framework to environmental reporting at a sub-national level. I see the SDGs as the missing link, providing an operating framework to bring effect to a key objective of the *Commissioner for Environmental Sustainability Act 2003* – to facilitate ecologically sustainable development in Victoria. It is a very exciting milestone for me personally, as I can see this work will open up much richer data analyses and more meaningful conversations with the community, underpinned by the SDGs and clear targets for ecologically sustainable development over the next decade.

Environmental-Economic Accounting

This report is also informed by the United Nations System of Environmental-Economic Accounting (SEEA). With expertise provided by the Victorian Department of Environment, Land, Water and Planning (DELWP), the SEEA is a critical framework for future environmental reporting and indicator selection. The SEEA framework integrates economic and environmental data. To adopt SEEA in Victoria would fulfil one of my key objectives, to transition state of the environment reporting to include the benefits of Victoria's natural assets and not just the state of their condition.

Future Focus

The recommendations in this report aim to leverage effort and investment, build on current initiatives, target improvement in multiple environmental outcomes and focus on addressing the gaps required to deliver contemporary policy and legislative frameworks and targets (such as the *Climate Change Act 2017, Biodiversity 2037 and Water for Victoria)*. They are informed by recommendations from other respected reports, align with achieving the SDG's ecologically sustainable development targets and support the development of a system of environmental-economic accounts for Victoria.

My aim is that this report will inform and inspire community, government and business leaders, and guide our future focus to assist all Victorians to keep working hard to protect and preserve our environment – our natural capital.

I would like to thank the science experts who contributed their time and academic expertise, and generously helped peer-review multiple iterations of the scientific assessments included in this report.

I also thank my incredibly dedicated and hard-working team of science writers and administrative staff for their effort over a long period: it has been above and beyond. We are indebted to our DELWP colleagues for their time, expertise and support, and wider stakeholder groups, from citizen scientists measuring water quality on the Yarra River to the Monash Sustainable Development Institute for support with our work on the implementation of the SDGs.

To the members of the Commissioner's Reference Group, the Environmental Reporting Project Control Board and the Technical Advisory Group, who have generously volunteered their time and expertise in the four years since the groups were established: your guidance and feedback has been invaluable to achieving the reforms and reports produced by my team since 2015.

It is an honour to serve my community as Victoria's Commissioner for Environmental Sustainability. I am pleased to present the State of the Environment 2018 report, and hope that the findings and recommendations are utilised in ways that benefit Victoria's environment and communities for many years to come.

I invite you to download the report and explore environmental case studies, news and information via our website (www.ces.vic.gov.au) and keep in touch with our work through your preferred social media channels.

Dr Gillian Sparkes

Commissioner for Environmental Sustainability, Victoria

Organisations

Aboriginal Victoria

Arthur Rylah Institute

Department of Economic Development, Jobs, Transport and Resources

Department of Environment, Land, Water and Planning

Department of Health and Human Services

Environment Protection Authority, Victoria

Environment Victoria

Fisheries Victoria

Infrastructure Victoria

Melbourne Water Corporation

Museums Victoria

Parks Victoria

Sustainability Victoria

Trust for Nature

VicForests

Victorian Aboriginal Heritage Council

Victorian Catchment Management Council

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Individuals and Organisations

Our thanks go to the following individuals and organisations for their considerable contribution to the development and review of the *State of the Environment 2018 Report*.

Commissioner's Reference Group

Kane Thornton	Clean Energy Council
Mark Wakeham	Environment Victoria
Peter Forster	Environmental Farmers Network
Chris Chesterfield	CRC for Water Sensitive Cities
Rohan Henry	Independent
Kaye Rodden	Landcare Victoria Inc
Claire Dunn	Municipal Association of Victoria
Victoria Marles	Trust for Nature
Joan Liley	Victorian Catchment Management Council
Anthony Boxshall	Victorian Marine and Coastal Council
Steve Sheridan	Victorian Farmers Federation
Matt Ruchel	Victorian National Parks Association
Bryon Powell	Wathaurung Aboriginal Corporation
Amelia Young	Wilderness Society Victoria Inc.

Expert Reviewers

David Lindenmayer	Australia National University
Lynette Bettio	BOM
David Karoly	CSIRO
Michael Grose	CSIRO
Penny Whetton	Independent
Peter Macreadie	Deakin University
Geoff Wescott	Independent
Nathan Robinson	Federation University
Michael Clarke	La Trobe University
Nick Bond	La Trobe University
Craig Nitschke	University of Melbourne
Alan York	University of Melbourne
Kathryn Williams	University of Melbourne
Lauren Bennett	University of Melbourne
Michael Brear	University of Melbourne
Rod Keenan	University of Melbourne
Sean Walsh	University of Melbourne
Trent Penman	University of Melbourne
Greg Parry	Independent
Grant Williamson	University of Tasmania
Bruce Mountain	Victoria University
Paul Boon	Victoria University

The Commissioner for Environmental Sustainability Act 2003 *(the Act) includes a statutory requirement for the Commissioner to 'prepare and submit to the Minister a periodical Report on the State of the Environment of Victoria prepared at intervals not exceeding 5 years'.*

The Victorian State of the Environment 2018 report provides a comprehensive scientific baseline of the state of Victoria's environment, and a considered analysis of the available science on Victoria's environment and the pressures and challenges ahead. It incorporates the science and builds on the findings of the State of the Bays 2016, Victorian Catchment Condition and Management 2017, State of the Yarra and its Parklands 2018 and the Victorian State of the Forests 2018 reports. This evidence base enables the authority of the Commissioner, according to the Act, to be exercised to confidently recommend and prioritise actions to influence and inform the focus, effort and investment by the Victorian Government over the next decade.

The approach taken to prepare this report is consistent with the State and Benefit framework for the Victorian State of the Environment 2018 report (the framework) which was tabled in the Victorian Parliament in December 2015 as required under the Act. The indicator assessments by theme (Part III) provide the first, comprehensive scientific baseline analysis on Victoria's environment. This baseline will enable a shift from reporting on "what we know" to reporting on "what we need to know" and will improve management interventions and, ultimately, environmental outcomes. It is a fundamental reform element and underpinning principle of the framework. Applying international frameworks and environmental reporting obligations, especially the United Nations SDGs and SEEA, is also a fundamental reform element of the framework and they are included in this report to advance Victoria's adoption of these innovative and influential frameworks.

The Act also requires that the Minister must, within 12 months of tabling this report in Parliament cause a statement of the response of the Government to be laid before each House [of Parliament] specifying the action (if any) proposed to be taken by the Government with respect to the recommendations'.

ACHLMAs ..... Aboriginal Cultural Heritage Land Management Agreements
ARC ..... Assessment of River Condition Program
ABS ..... Australian Bureau of Statistics
AEMO ..... Australian Energy Market Operator
BoM ..... Bureau of Meteorology
CAM MoU ..... Intergovernmental Memorandum of Understanding Agreement on a Common Assessment Method for Listing of Threatened Species and Threatened Ecological Communities
CbiCS ..... Combined Biotope Classification Scheme
CCMR ..... Catchment Condition and Management Report
CCS ..... Carbon Capture and Storage
CES Act ..... Commissioner for Environmental Sustainability Act 2003
CFA ..... Country Fire Authority
CMA ..... Catchment Management Authority/ies
CPUE ..... Catch Per Unit Effort
CSH ..... Change in Suitable Habitat
C&D ..... Construction and Demolition
C&I ..... Commercial and Industrial
DEDJTR ..... Victorian Department of Economic Development, Jobs, Transport and Resources
DELWP ..... Victorian Department of Environment, Land, Water and Planning
DHHS ..... Victorian Department of Health and Human Services
EFG ..... Ecological Fire Group
EMV ..... Emergency Management Victoria
EPA ..... Environment Protection Authority, Victoria
EPT ..... Ephemeroptera, Plecoptera and Trichoptera
ESD ..... Ecologically Sustainable Development
EVCs ..... Ecological Vegetation Classes
EVDs ..... Ecological Vegetation Divisions
FGC ..... Fractional Ground Cover
FFDI ..... Forest Fire Danger Index
GDP ..... Gross Domestic Product
GHG ..... Green House Gas
GMUs ..... Groundwater Management Units
GSP ..... Gross State Product
GSS ..... Growth Stage Structure
HDM ..... Habitat Distribution Models
HLPF ..... High Level Political Forum
IBRA ..... Interim Biogeographic Regionalisation for Australia
ICE ..... Internal Combustion Engine
IEA ..... International Energy Agency
IGEM ..... Inspector General for Emergency Management Victoria
IPAPF ..... Invasive Plants and Animals Policy Framework

ISC	Index of Stream Condition
IUCN	International Union for Conservation of Nature
KAB	Keep Australia Beautiful
KFRS	Key Fire-Response Species
KPI	Key Performance Indicator
LPG	Liquefied Petroleum Gas
LTS	Long-Term Sites
LULUCF	Land use, land-use change and forestry
MAC	Ministerial Advisory Committee
MSW	Municipal Solid Waste
MV	Museums Victoria
NEM	National Electricity Market
NFPS	National Forest Policy Statement
NLI	National Litter Index
NRM	Natural Resource Management
NSDC	National Sustainable Development Council
OCES	Office of the Commissioner for Environmental Sustainability
OCED	Organisation for Economic Co-operation and Development
PFAS	Per- and poly-fluoroalkyl substances
PFOS	Perfluoro-octane sulfonate
PTV	Public Transport Victoria
PV	Parks Victoria
RASP	Regional and Strategic Partnership
RCPs	Representative Concentration Pathways
REZs	Renewable Energy Zones
RFAs	Regional Forest Agreements
RiverMAP	River Monitoring and Assessment Program
SDGs	United Nations Sustainable Development Goals
SDSN	Sustainable Development Solutions Network
SECP	South East Coastal Plain
SEEA	United Nations System of Environmental-Economic Accounting
SEPP	State Environment Protection Policy
SEPP Waters	State Environment Protection Policy Waters
SEPP WoV	State Environment Protection Policy Waters of Victoria
SFM	Sustainable Forest Management
SGR	State Game Reserve
SMP	Strategic Management Prospects
SNA	System of National Accounts
SoE	Victorian State of the Environment Report
SoF	Victorian State of the Forests Report
SoY	State of the Yarra and its Parklands Report

SV	Sustainability Victoria
SWRRIP	Statewide Waste and Resource Recovery Infrastructure Plan
TF	Tolerable Fire Interval
TfV	Transport for Victoria
TFN	Trust for Nature
THEZ	Timber Harvesting Exclusion Zone
UN	United Nations
VAGO	Victorian Auditor-General's Office
VAHC	Victorian Aboriginal Heritage Council
VCMC	Victorian Catchment Management Council
VEAC	Victorian Environmental Assessment Council
VEFMAP	Victorian Environmental Flow Monitoring and Assessment Program
VEWH	Victorian Environmental Water Holder
VFA	Victorian Fisheries Authority
VLUIS	Victorian Land Use Information System
VNR	Voluntary National Review
VRET	Victorian Renewable Energy Target
VRIAR	Victorian Recycling Industry Annual Report
VVN	Victorians Value Nature
WEOG	Western European and Others Group
WMPs	Waste Management Policies
WSPAs	Water Supply Protection Areas

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Waste (W)

Transport (T)

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This report has three parts:

Summary Report Part I presents the State of the Environment (SoE) 2018 report card, indicator summaries, areas for future focus and summary of the report recommendations. A comparison of status, trend and data quality for the 170 indicators of Victoria's environmental health (assessed in Part III), along with a synopsis of the low and high-performing indicators, is included to assist with prioritising action on the recommendations.

Summary Report Part II presents an overview of the global megatrends impacting Victoria's environment, and the application of international frameworks to State of the Environment reporting. Megatrends, influential at a global level and for Victoria, have been identified and used to help frame the Future Focus sections and recommendations. Deloitte Access Economics was commissioned to bring together the most relevant megatrends of likely influence. *Megatrends and the Victorian Environment 2018* highlights the global influences for consideration in the Victorian context.[2] In addition, two international frameworks, the UN SDGs and SEEA are highlighted for their potential to improve environmental reporting and environmental outcomes.

Scientific Assessments Part III: relies on publically available scientific data which has been peer-reviewed by experts in each field, and subsequently assessed and synthesised by the science team supporting the Commissioner, to provide an evaluation of Victoria's environmental health against 170 indicators.

The scientific assessments span 13 themes, from cultural landscape health and management, to climate change impacts and transport. The assessment against each theme adopts the following format:

1. Background
2. Current Victorian Government Settings: Legislation, Policy, Programs
3. Indicator Assessments
4. Future Focus
5. Accounting for the Environment.

Issues Relevant to Every Theme

Part III: The scientific assessments consider the available science, drivers, pressures and cultural issues pertaining to each theme.

Ecologically sustainable development is defined in the Act (s.4) and is an organising principle of State of the Environment 2018 (SoE 2018). The principle provides a logical basis for deciding on the scope of the report – both in terms of indicators as well as corresponding United Nations SDG targets.

Scientists estimate that humans have occupied Victoria's south-east for at least the past 30,000 years.[3] The archaeology of sites in Victoria illustrates Traditional Owners' cultural association with the land. Traditional Owner engagement and contribution is important across all of the report.

The Future Focus and Accounting for the Environment sections draw priorities from the scientific assessment and aim to focus future effort and investment by government in the medium-term.

Data Availability

The scientific assessments review data limitations and information challenges for each theme. There are several overarching challenges:

- align monitoring and data integration efforts across policy functions of government
- overcome the limitation of statewide assessments which are sometimes based on incomplete and/or localised monitoring regimes
- integrate citizen science into conventional monitoring systems for use in policy development and independent, public reporting
- assess trends over time when methodology changes between reporting cycles
- understand non-market values of natural assets (and the current state of those values) to inform environmental-economic accounts.

VICTORIAN STATE OF THE ENVIRONMENT 2018 REPORT

SUMMARY REPORT PART I

Commissioner *for* Environmental Sustainability Victoria

VICTORIA State Government

The following report card is a summary of the more detailed assessments in Part III: Science Assessments.

Status Summary

The Status Summary presents an overall analysis of the status assessments for 164 of the 170 indicators.

One-third of the Marine and Coastal Environments indicators (33%) have been assessed as in a 'good' state. This is well above the average of 11% of overall indicators assessed as 'good' in SoE 2018. This is considered as being principally due to the high quality of monitoring, management and protection in the marine national parks and marine sanctuaries. Conversely, it is significant that the 52 indicators that have been assessed as 'poor' (32%), include 21 of the 35 biodiversity indicators (60%).

Trend Summary

The Trend Summary presents an overall analysis of the trend assessments for 169 of 170 indicators. The trend expresses whether the status of the indicator is deteriorating, improving or remaining stable. The 11% of indicators that are assessed as 'improving' include more than half of the energy indicators (56%). Although 89% of the energy indicators have been assessed as in a 'poor' state, this indicates that the data is tracking in a positive direction. Conversely, the 50 indicators that have been assessed as 'deteriorating' (30%) include more than half of the biodiversity indicators (51%).

Data Quality Summary

The Data Quality Summary presents an overall analysis for all 170 indicators. Almost half of the indicators (47%) are supported by 'good' data, which means that the status and trend assessments for these indicators are presented with confidence. One-fifth of all indicators (22%) has been assessed as having 'poor' data (which may indicate no data at all). Biodiversity and Marine and Coastal Environment are overrepresented in the 'poor' data category (31% and 29% of their total indicators respectively), which indicates that an improved evidence base is critical for these themes.

Performance

High Performance – the analysis presented here consolidates indicators with a 'good' status assessment, a 'stable' or 'improving' trend assessment, and 'good' data quality. 'High' suggests that not only is the indicator performing well, and expected to continue to do so, but that there is a high level of confidence in the assessment. Nine indicators (5%) have been assessed as 'high-performing', including three of Air Quality (27% of that theme's indicators) and three of Water Quality (30% of that theme's indicators).

Low Performance – the analysis presented here consolidates indicators with a 'poor' status assessment, 'stable' or 'deteriorating' trend assessment, and 'good' data quality. This suggests that not only is the indicator of concern and not demonstrating improvement, but that there is a high level of confidence in the assessment. That is, we are confident that this indicator is showing poor condition and will remain so without intervention. 16% of all indicators have been assessed as 'low-performing', including 9 of the 35 biodiversity indicators (26% of that theme's indicators).

Table 2: Assessments Report Card

Legend

Status

N/A **Not Applicable**
The indicator assessment is based on future projections or the change in environmental condition and providing a status assessment is not applicable. Only a trend assessment is provided.

Unknown
Data is insufficient to make an assessment of status and trends.

Poor
Environmental condition is under significant stress, OR pressure is likely to have significant impact on environmental condition/ human health, OR inadequate protection of natural ecosystems and biodiversity is evident.

Fair
Environmental condition is neither positive or negative and may be variable across Victoria, OR pressure is likely to have limited impact on environmental condition/human health, OR moderate protection of natural ecosystems and biodiversity is evident.

Good
Environmental condition is healthy across Victoria, OR pressure is likely to have negligible impact on environmental condition/ human health, OR comprehensive protection of natural ecosystems and biodiversity is evident.

Trend

N/A **Not applicable**
This indicator assessment is based on current environmental condition only and it is not applicable to provide a trend assessment. Only a status assessment is provided.

Unclear

Deteriorating

Stable

Improving

Data quality

Poor
Evidence and consensus too low to make an assessment

Fair
Limited evidence or limited consensus

Good
Adequate high-quality evidence and high level of consensus

CLIMATE CHANGE IMPACTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
CC:01 Observed average rainfall	POOR	↘	DATA QUALITY: Good
CC:02 Snow cover	FAIR	↘	DATA QUALITY: Good
CC:03 Observed surface temperature	FAIR	↘	DATA QUALITY: Good
CC:04 Projected changes in temperature	N/A	↘	DATA QUALITY: Good
CC:05 Projected changes to average rainfall	N/A	↘	DATA QUALITY: Fair
CC:06 Regional climate projections	N/A	↘	DATA QUALITY: Good
CC:07 Observed sea level	FAIR	↘	DATA QUALITY: Fair
CC:08 Projected sea level	N/A	↘	DATA QUALITY: Good
CC:09 Sea-surface temperature	POOR	↘	DATA QUALITY: Good

CLIMATE CHANGE IMPACTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
CC:10 Annual greenhouse gas emissions			 DATA QUALITY Good
CC:11 Victorian ecosystem carbon stocks	 Stable for land sector and Unknown for marine and coastal ecosystems		 DATA QUALITY Fair
CC:12 Occurrence and impacts of extreme weather			 DATA QUALITY Good
CC:13 Extent and condition of key climate-sensitive ecosystems		?	 DATA QUALITY Fair
CC:14 Community awareness of climate risks and associated responsibilities	 Good (for awareness of climate risks and mitigation) and Unknown (for adaptation to climate change)	?	 DATA QUALITY Fair
CC:15 Councils (or other organisations) with urban forestry plans or urban greening or cooling-related strategies			 DATA QUALITY Fair
CC:16 Considering climate change risks in land use planning (including in the coastal zone)	 Generally Poor for inland councils and Fair for coastal councils	?	 DATA QUALITY Fair
CC:17 Percentage of agri-businesses using long-term weather and climate change projections			 DATA QUALITY Fair

AIR

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
A:01 Ambient ozone levels (summer smog)	GOOD	→	DATA QUALITY: Good
A:02 Carbon monoxide and nitrogen dioxide	GOOD	↗	DATA QUALITY: Good
A:03 Particle pollution (PM_{10} and $PM_{2.5}$)	UNKNOWN: Elsewhere in Victoria; POOR: Brooklyn; FAIR: Geelong, the Latrobe Valley and most of Melbourne	→	DATA QUALITY: Fair
A:04 Sulfur dioxide	GOOD	→	DATA QUALITY: Good
A:05 Stratospheric ozone	FAIR	→	DATA QUALITY: Good
A:06 Odour and noise	UNKNOWN	↘	DATA QUALITY: Fair
A:07 Light pollution	UNKNOWN	?	DATA QUALITY: Poor
A:08 Emissions of major air pollutants by sector	FAIR	?	DATA QUALITY: Fair
A:09 Health impacts of air pollution	FAIR	?	DATA QUALITY: Poor
A:10 Health impacts of noise pollution	UNKNOWN; FAIR: Fair for Melbourne and Unknown for the rest of Victoria	?	DATA QUALITY: Poor
A:11 Indoor air quality	UNKNOWN	?	DATA QUALITY: Poor

BIODIVERSITY

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data quality
B:01 Invasive freshwater plants and animals	UNKNOWN	?	DATA QUALITY: Poor
B:01A Trend in carp *(Cyprinus carpio)* distribution	POOR	↘	DATA QUALITY: Good
B:02 Invasive terrestrial plants	POOR	↘	DATA QUALITY: Good
B:03 Invasive terrestrial animals	POOR	↘	DATA QUALITY: Poor
B:03A Trend in deer populations and their distributions	POOR	↘	DATA QUALITY: Poor
B:03B Trend in horse populations and their distributions	POOR	↘	DATA QUALITY: Fair
B:04 Trend in populations and distributions of threatened freshwater species in the wild.	UNKNOWN	?	DATA QUALITY: Poor
B:04A Trend in population number and distribution of trout cod *(Maccullochella macquariensis)*	FAIR	→	DATA QUALITY: Fair
B:04B Trend in population number and distribution of Macquarie perch *(Macquaria australasica)*	FAIR	→	DATA QUALITY: Good

BIODIVERSITY

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
B:04C Trend in population number and distribution of Murray crayfish *(Euastacus armatus)*			 DATA QUALITY Fair
B:04D Trend in population number and distribution of spotted tree frog *(Litoria spenceri)*			 DATA QUALITY Good
B:04E Trends in population number and distribution of Booroolong tree frog *(Litoria booroolongensis)*			 DATA QUALITY Good
B:04F Trends in population number and distribution of Baw Baw frog *(Philoria frosti)*			 DATA QUALITY Good
B:05 Threatened species that are wetland dependent		?	 DATA QUALITY Poor
B:06 Trends in populations and distributions of threatened terrestrial species			 DATA QUALITY Poor
B:06A Vascular plants			 DATA QUALITY Fair
B:06B Vertebrates			 DATA QUALITY Fair
B:06C Invertebrates			 DATA QUALITY Fair

BIODIVERSITY

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
B:07 Private land conservation	FAIR	↗	DATA QUALITY: Good
B:08 Conservation of Victorian ecosystems	FAIR	→	DATA QUALITY: Good
B:09 River health	POOR	→	DATA QUALITY: Good
B:10 Riparian vegetation habitat extent	POOR	?	DATA QUALITY: Poor
B:11 Area of functional floodplain	UNKNOWN	?	DATA QUALITY: Poor
B:12 Distribution and abundance of frogs	POOR	↘	DATA QUALITY: Good
B:13 Distribution and abundance of fish	POOR	↘	DATA QUALITY: Good
B:14 Distribution and abundance of waterbirds in the Murray Darling Basin	POOR	↘	DATA QUALITY: Fair
B:15 Distribution and abundance of macroinvertebrates	FAIR	→	DATA QUALITY: Fair

BIODIVERSITY

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
B:16 Wetland extent and condition		?	DATA QUALITY Poor
B:17 Health and status of Ramsar wetlands in Victoria		?	DATA QUALITY Poor
B:18 Net gain in extent and condition of native vegetation		↘	DATA QUALITY Good
B:19 Landscape scale change		↘	DATA QUALITY Fair
B:20 Change in suitable habitat		→	DATA QUALITY Good
B:21 Area of management in priority locations		→	DATA QUALITY Fair
B:22 Victorians value nature		?	DATA QUALITY Poor
B:23 Number of Victorian Government organisations that manage environmental assets that contribute to DELWP Standard Output Data		?	DATA QUALITY Poor

LAND

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
L:01 Land use types in Victoria	FAIR	N/A	DATA QUALITY: Good
L:02 Changes in major land uses in Victoria	UNKNOWN (N/A)	→	DATA QUALITY: Good
L:03 Changes in land tenure	FAIR	→	DATA QUALITY: Good
L:04 Greenfield versus infill development	FAIR	→	DATA QUALITY: Good
L:05 Soil carbon content	UNKNOWN	?	DATA QUALITY: Fair
L:06 Area affected by salinity	FAIR	↗ ? Improving for the river catchments that drain to the Murray River and Unclear elsewhere	DATA QUALITY: Fair
L:07 Soil acidification	UNKNOWN	?	DATA QUALITY: Fair
L:08 Soil erosion	FAIR	↘	DATA QUALITY: Poor
L:09 Contaminated sites	UNKNOWN	?	DATA QUALITY: Fair

LAND

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
L:10 Land management activities	FAIR	↗	DATA QUALITY: Fair
L:11 Participation in natural resource management activities	GOOD	↗	DATA QUALITY: Good
L:12 Use of best practice on agricultural lands	UNKNOWN	?	DATA QUALITY: Poor
L:13 Proportion of agricultural area under productive and sustainable agriculture	UNKNOWN	?	DATA QUALITY: Poor

FORESTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data quality
Fo1.1A Area of forest by type and tenure - forest canopy cover		?	DATA QUALITY Poor
Fo:01B Area of forest by type and tenure - forest type		↗	DATA QUALITY Good
Fo:01C Area of forest by type and tenure - plantation forest		→	DATA QUALITY Good
Fo:02 Area of forest type by growth stage		↗	DATA QUALITY Good
Fo:03 Area of forest type by growth stage distribution in protected zones		↗	DATA QUALITY Fair
Fo:04 Fragmentation of native forest cover		?	DATA QUALITY Fair
Fo:05 Number of in-situ and ex-situ conservation efforts for forest dependent species		?	DATA QUALITY Poor
Fo:06 The status of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment		↘	DATA QUALITY Good
Fo:07 Degree of disturbance to native forest species caused by invasive species		↘	DATA QUALITY Good

FORESTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
Fo:08A Scale and impact of agents and processes affecting forest health and vitality – mortality, dieback, canopy health sub-section	FAIR	?	DATA QUALITY Fair
Fo:08B Scale and impact of agents and processes affecting forest health and vitality – bushfire affected area and climate sub-section	FAIR	↘	DATA QUALITY Good
Fo:09A Area and type of human-induced disturbance – planned burns	FAIR	?	DATA QUALITY Good
Fo:09B Area and type of human-induced disturbance – grazing	UNKNOWN	→	DATA QUALITY Poor
Fo:10 Total forest ecosystem biomass and carbon pool by forest type, age class and successional stages	FAIR	?	DATA QUALITY Fair
Fo:11 Contribution of forest ecosystems to the global greenhouse gas balance	POOR	↗	DATA QUALITY Good
Fo:12 Area and percentage of forest and net area of forest available and suitable for wood production	POOR	↘	DATA QUALITY Good
Fo:13 Area of native forest harvested	FAIR	→	DATA QUALITY Good
Fo:14 Annual production of wood products from State forests compared to sustainable harvest levels	FAIR	↘	DATA QUALITY Good

FORESTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
Fo:15 Proportion of timber harvest area successfully regenerated by forest type	FAIR	→	DATA QUALITY: Good
Fo:16 Extent to which the legal framework (laws, regulations, guidelines) supports the conservation and sustainable management of forests	FAIR	↗	DATA QUALITY: Fair
Fo:17 Extent to which the institutional framework supports the conservation and sustainable management of forests	FAIR	↘	DATA QUALITY: Fair
Fo:18 Extent to which the economic framework supports the conservation and sustainable management of forests	FAIR	?	DATA QUALITY: Fair
Fo:19 Capacity to conduct and apply research and development aimed at improving forest management, including development of scientific understanding of forest ecosystem characteristics and functions	GOOD	→	DATA QUALITY: Good
Fo:20 Investment and expenditure in forest management	FAIR	→	DATA QUALITY: Good
Fo:21 Value ($) of forest derived ecosystem services	FAIR	?	DATA QUALITY: Fair

FIRE

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
Fi:01 Area of native vegetation burnt in planned fires and bushfires		↘	DATA QUALITY Good
Fi:02 Impacts of bushfires		?	DATA QUALITY Poor
Fi:03 Actual fire regimes compared to optimal fire regimes		↘	DATA QUALITY Good
Fi:04 Bushfire risk		↘	DATA QUALITY Poor

List of acronyms for Marine and Coastal Environments indicators:

All Gippsland Lakes (GLA)

Beware Reef Marine Sanctuary (BRMS)

Corangamite Catchment Management Authority (CCMA)

Corner Inlet (CI)

East Gippsland Catchment Management Authority (EGCMA)

Glenelg Hopkins Catchment Management Authority (GCMA)

Marine National Parks and Sanctuaries (MNPS)

Nooramunga Marine & Coastal Park (NMCP)

Northern Port Phillip Bay (NPPB)

Other Marine & Coastal Areas (OMAC)

Port Phillip Bay (PPB)

Phillip Island (PI)

Southern Port Phillip Bay (SPPB)

St Kilda (STK)

West Gippsland Catchment Management Authority (WGCMA)

Western Port (WPT)

MARINE AND COASTAL ENVIRONMENTS

Indicator	Status UNKNOWN	POOR	FAIR	GOOD	Trend	Data quality
MC:01 Mangrove extent			CI NMCP	WPT OMAC	?	DATA QUALITY Good
MC:02 Saltmarsh extent	OMAC		PPB	GLA WPT	OMAC ? PPB → GLA ? WPT ↘	DATA QUALITY Fair - PPB & WPT Poor - GLA & OMAC
MC:03 Seagrass condition	WPT OMAC		GLA CI	PPB	WPT ? GLA ? PPB → OMAC ? CI ↘	DATA QUALITY Fair
MC:04 Seagrass-dependent fish	PPB WPT OMAC GLA				?	DATA QUALITY Poor

MARINE AND COASTAL ENVIRONMENTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
MC:05 Estuarine condition	UNKNOWN	?	DATA QUALITY: Poor
MC:06 Mobile invertebrates on intertidal reefs	UNKNOWN: WPT, OMAC, PPB GOOD: MNPS	WPT ? OMAC ? PPB ? MNPS →	DATA QUALITY: Good MNPS DATA QUALITY: Poor OMAC,PPB & WPT
MC:07 Sessile invertebrates on intertidal reefs	UNKNOWN: OMAC GOOD: MNPS	OMAC ? MNPS →	DATA QUALITY: Good MNPS DATA QUALITY: Poor OMAC
MC:08 Mobile megafaunal invertebrates on subtidal reefs	UNKNOWN: OMAC POOR: NPPB GOOD: MNPS, SPPB	OMAC ? MNPS ? NPPB ↘ SPPB →	DATA QUALITY: Good MNPS, NPPB, SPPB DATA QUALITY: Poor OMAC
MC:09 Subtidal reef fish	UNKNOWN: OMAC FAIR: NPPB GOOD: MNPS, SPPB	OMAC ? NPPB ? MNPS ? SPPB ↗	DATA QUALITY: Good SPPB & MNPS DATA QUALITY: Fair NPPB DATA QUALITY: Poor OMAC

MARINE AND COASTAL ENVIRONMENTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data quality
MC:10 Macroalgae-dominated subtidal reefs	OMAC (UNKNOWN); NPPB (FAIR); SPPB MNPS (GOOD)	OMAC ? NPPB ? MNPS ? SPPB ↘	DATA QUALITY Good - SPPB & MNPS DATA QUALITY Poor - NPPB & OMAC
MC:11 Macroalgae on intertidal reefs	OMAC (UNKNOWN); PPB MNPS (GOOD)	OMAC ? PPB → MNPS →	DATA QUALITY Good - PPB & MNPS DATA QUALITY Poor - OMAC
MC:12 Migratory shorebirds	OMAC (UNKNOWN); PBB CI (FAIR)	OMAC ↘ PBB ↘ CI ↘	DATA QUALITY Fair - PPB & C I& OMAC
MC:13 Little penguins	OMAC (UNKNOWN); STK PI (GOOD)	OMAC ? STK → PI →	DATA QUALITY Good - STK & PI DATA QUALITY Poor - OMAC
MC:14 Piscivorous (fish-eating) birds	OMAC (UNKNOWN); CI WPT (GOOD)	OMAC ? CI ↗ WPT ↘	DATA QUALITY Good - CI & WPT DATA QUALITY Poor OMAC
MC:15 Marine and coastal waterbirds	OMAC PPB (UNKNOWN); WPT GLA (FAIR)	OMAC ? WPT ↘ PPB ? GLA (Trend depends on species)	DATA QUALITY Good - WPT & GLA DATA QUALITY Poor - OMAC & PPB

MARINE AND COASTAL ENVIRONMENTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data quality
MC:16 Over-abundant sea urchins on subtidal reefs	OMAC / NPPB / BRMS / SPPB NMCP	OMAC ? NPPB ↘ BRMS ? SPPB → NMCP →	DATA QUALITY Fair - SPPB, BRMS & NMCP NPPB DATA QUALITY Poor
MC:17 Invasive marine species	OMAC / PPB	OMAC ? PPB ↘	DATA QUALITY Fair - PPB DATA QUALITY Poor - OMAC
MC:18 Catchment inputs into coastal watersl reefs	WPT GCMA / PPB CCMA WGCMA / EGCMA	WPT ? GCMA ? PPB ↗ CCMA ? WGCMA ? EGCMA ?	DATA QUALITY Good - PPB & WPT & CMAs
MC:19 Point source discharges to marine waters	?	?	DATA QUALITY Poor
MC:20 Harmful algae blooms reefs	OMAC / PPB GLA	OMAC ? PPB → GLA ?	DATA QUALITY Good - PPB & GLA DATA QUALITY Poor - OMAC
MC:21 Enterococci bacteria	OMAC / PPB	OMAC ? PPB →	DATA QUALITY Good - PPB DATA QUALITY Poor - OMAC

MARINE AND COASTAL ENVIRONMENTS

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
MC:22 Impacts of fisheries production		?	 DATA QUALITY Poor
MC:23 Conservation of coastal ecosystems in protected areas		→	 DATA QUALITY Fair
MC:24 Conservation of marine ecosystems in protected areas	 GLA and East Gippsland Inlets; Five marine bioregions	→	 DATA QUALITY Good

WATER RESOURCES

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
WR:01 Water resources and storage trends	FAIR	→	DATA QUALITY: Good
WR:02 Projected runoff to dams and catchments	N/A	↘	DATA QUALITY: Good
WR:03 Condition of flow regimes	POOR	↘	DATA QUALITY: Good
WR:04 Delivering water for the environment	FAIR	→	DATA QUALITY: Good
WR:05 Number of dams, weirs and levees	FAIR	?	DATA QUALITY: Fair
WR:06 Surface water harvested for consumptive use	POOR	→	DATA QUALITY: Good
WR07 Percentage of waterways and groundwater areas, subject to extraction, with a limit on extraction	GOOD	→	DATA QUALITY: Good
WR:08 Water recycling	FAIR	↗	DATA QUALITY: Good
WR:09 Percentage of agricultural land with approved irrigation	UNKNOWN	?	DATA QUALITY: Poor

WATER RESOURCES

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
WR:10 Groundwater ecosystems		?	 DATA QUALITY Poor
WR:11 Groundwater quality	 Good in eastern Victoria, Poor in north western Victoria and Fair elsewhere		 DATA QUALITY Fair
WR:12 Groundwater levels	 Stable: most shallow aquifers. Deteriorating: lower aquifers in the Gippsland Basin and northern region, and confined aquifers around Western Port and the Otway Ranges		 DATA QUALITY Fair
WR:13 Groundwater harvested for consumptive use			 DATA QUALITY Good

WATER QUALITY

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
WQ:01 Occurrence of algal blooms		?	DATA QUALITY: Fair
WQ:02 Dissolved oxygen concentration in rivers		→	DATA QUALITY: Good
WQ:03 Salinity concentrations in rivers	Poor in the Glenelg Hopkins catchment, Fair in the Wimmera and Port Phillip and Westernport catchments, Good in the other catchments	→	DATA QUALITY: Good
WQ:04 Total nitrogen concentration in rivers	Good in the North East and East Gippsland catchments, Fair in the Goulburn Broken and West Gippsland catchments, and Poor in other catchments. Unknown in the Mallee catchment.	→	DATA QUALITY: Good
WQ:05 Total phosphorus concentrations in rivers	Good in the East Gippsland catchment, Fair in the North East and West Gippsland catchments, and Poor in other catchments. Unknown in the Mallee catchment.	→	DATA QUALITY: Good
WQ:06 Turbidity levels in rivers	Fair in the East Gippsland, North East and Glenelg Hopkins catchments, and Poor in other catchments.	↘	DATA QUALITY: Good
WQ:07 pH		→	DATA QUALITY: Good

WATER QUALITY

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
WQ:08 Proportion of bodies of water with good ambient water quality	POOR	↘	DATA QUALITY: Good
WQ:09 Volume of sewage discharge to surface waters	UNKNOWN	?	DATA QUALITY: Poor
WQ:10 Reported inland water pollution incidents	FAIR	↘	DATA QUALITY: Fair

WASTE

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data quality
W:01 Total waste generation	FAIR	→	DATA QUALITY: Good
W:02 Generation of municipal waste per capita	FAIR	→	DATA QUALITY: Good
W:03 Total food waste generated	POOR	→	DATA QUALITY: Good
W:04 Diverson rate	FAIR	→	DATA QUALITY: Good
W:05 Litter and illegal dumping	GOOD	↗	DATA QUALITY: Poor
W:06 Total hazardous waste managed	FAIR	→	DATA QUALITY: Fair

TRANSPORT

Indicator	Status UNKNOWN / POOR / FAIR / GOOD	Trend	Data Quality
T:01 Travel demand			 DATA QUALITY Good
T:02 Greenhouse gas emission and emission intensities from transport			 DATA QUALITY Good
T:03 Air pollution from transport	 Improving for motor vehicles and Unclear for rail and shipping		 DATA QUALITY Poor

ENERGY

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
E:01 Energy use per capita		↗	DATA QUALITY Good
E:02 Total energy consumption by fuel		→	DATA QUALITY Good
E: 03 Consumption of renewable energy as a share of total energy consumption		↗	DATA QUALITY Good
E:04 Total net energy consumption by industry sector		→	DATA QUALITY Good
E:05 Total electricity consumption		↗	DATA QUALITY Good
E:06 Total electricity generation by fuel		↗	DATA QUALITY Good
E:07 Share of renewable energy generation of total electricity generation		↗	DATA QUALITY Good
E:08 Energy used in the transport sector		↘	DATA QUALITY Good
E:09 Per capita transport energy use		→	DATA QUALITY Good

Table 3. Status Summary

Status	Climate Change Impacts	Air	Biodiversity	Land	Forests	Fire	Marine and Coastal Environments	Water Resources	Water Quality	Waste and Resource Recovery	Energy	Transport	Total	Proportion
Good	1	3		1			8	1	3	1			18	11.0%
Fair	6	3	7	6	16	2	7	7	2	4	1		61	37.2%
Poor	5		21		5	2	2	2	4	1	8	2	52	31.7%
Unknown	1	5	7	5	4		7	2	1			1	33	20.1%
Total	13	11	35	12	25	4	24	12	10	6	9	3	164	100%

** Note: Six indicators are not applicable for status assessment and are not included.*

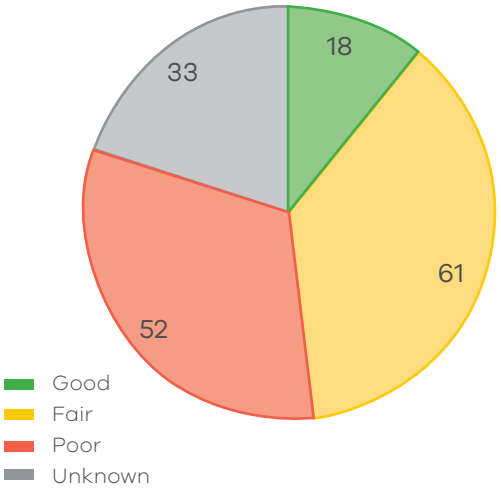

Figure 1. Indicator assessments status summary

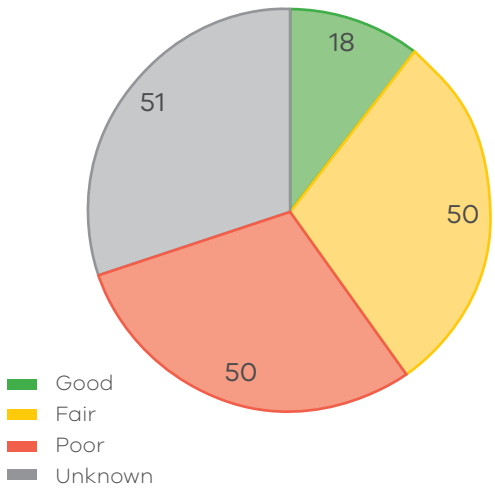

Figure 2. Indicator assessments trend summary

Table 4. Trend Summary

Trend	Climate Change Impacts	Air	Biodiversity	Land	Forests	Fire	Marine and Coastal Environments	Water Resources	Water Quality	Waste and Resource Recovery	Energy	Transport	Total	Proportion
Improving	3	1	1	2	4			1		1	5		18	10.6%
Stable	1	4	7	3	5		9	7	5	5	3	1	50	29.6%
Deteriorating	10	1	18	1	7	3	3	2	3		1	1	50	29.6%
Unclear	3	5	9	6	9	1	12	3	2			1	51	30.2%
Total	17	11	35	12	25	4	24	13	10	6	9	3	169	100%

** Note: An indicator in the Land chapter is not applicable for trend assessment and is not included.*

Table 5. Data Quality Summary

Data Quality	Climate Change Impacts	Air	Biodiversity	Land	Forests	Fire	Marine and Coastal Environments	Water Resources	Water Quality	Waste and Resource Recovery	Energy	Transport	Total	Proportion
Good	9	4	14	5	14	2	2	8	7	4	9	2	80	47.0%
Fair	8	3	10	3	8		15	3	2	1			53	31.2%
Poor		4	11	5	3	2	7	2	1	1		1	37	21.8%
Total	17	11	35	13	25	4	24	13	10	6	9	3	170	100%

** Note: Six indicators are not applicable for data quality assessment and are not included.*

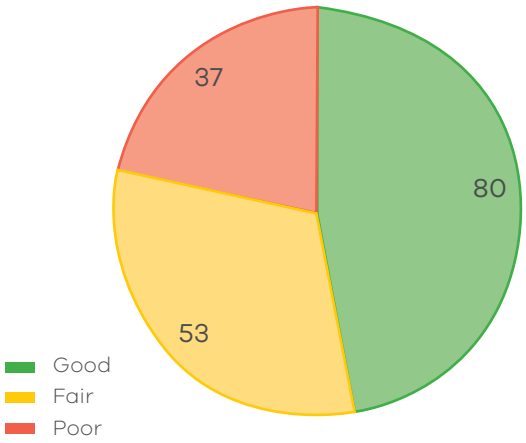

Figure 3. Indicator assessments data quality summary

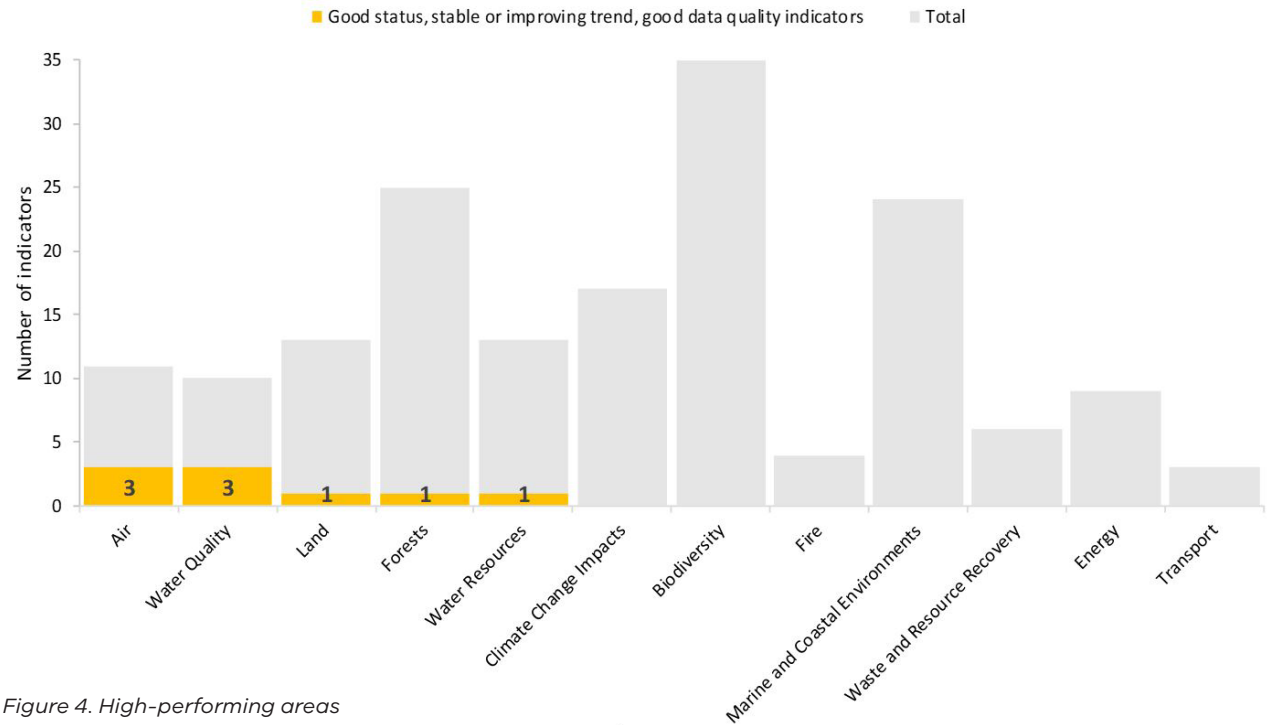

Figure 4. High-performing areas

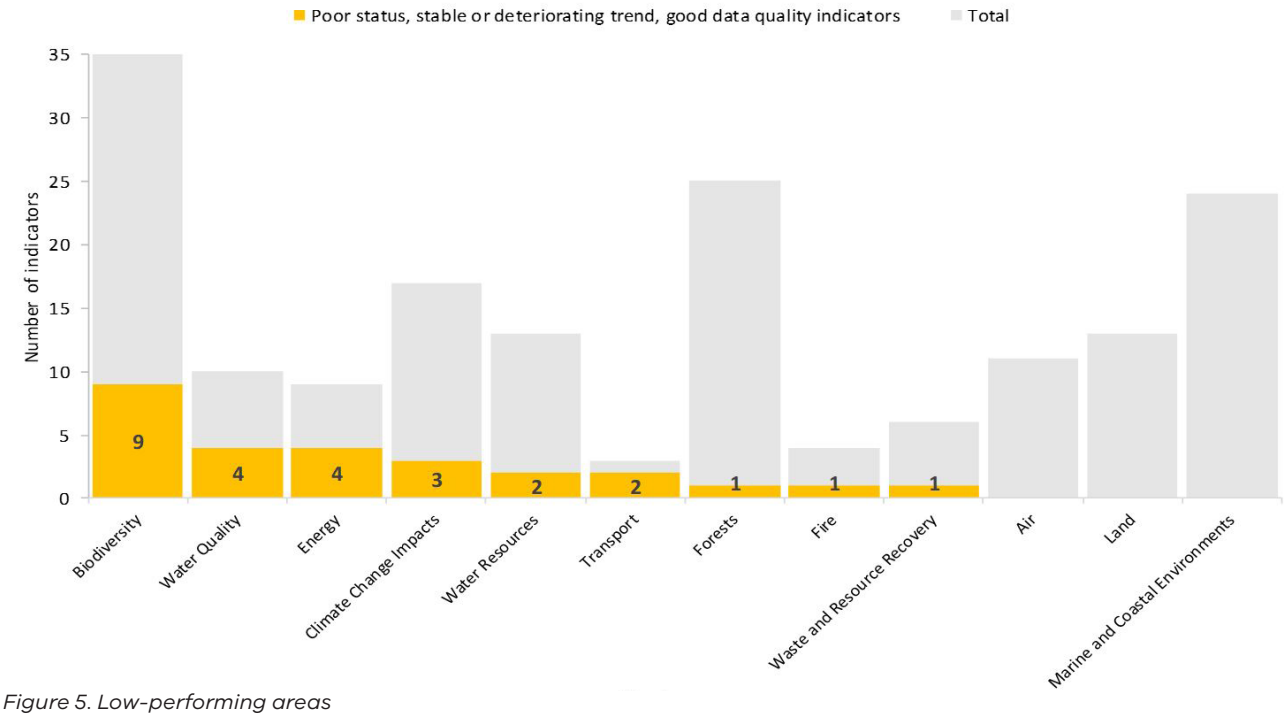

Figure 5. Low-performing areas

Future Focus

The recommendations included in this Future Focus section are informed and driven by the science presented in Part III of this report. The selection of these recommendations was also influenced by the key megatrends identified as having significant impact on the future of Victoria's environment:

1. the physical impacts of climate change
2. reducing our carbon footprint
3. 'clued-up' citizens shaping business and government practices
4. disruptive technologies
5. natural resource constraints.[4]

The Future Focus discussion and recommendations are intended to support environmental improvement over the next decade to 2030. This is not an arbitrary time horizon. It aligns the recommendations of this report with the '2030 Agenda for Sustainable Development' and the reporting arrangements of the SDGs. All 193 member states of the UN have committed to achieving each goal and target by 2030 in order to 'leave no one behind'. Although most of the recommendations in this report do not specifically suggest precise delivery timelines, except where noted, it is anticipated that they would be fully implemented by 2030, with clear progress evident within five years, commensurate with the next SoE report due in 2023.

The principles on which these recommendations were developed are:

- prioritise recommendations that improve multiple environmental outcomes
- focus on improving the evidence base to deliver key policy and legislative actions and targets
- ensure recommendations are informed by the findings of other respected reports (The OCES acknowledges the significant research undertaken by others, including the Victorian Environmental Assessment Council, Victorian Auditor-General's Office (VAGO), Victorian Catchment Management Council, Ministerial Advisory Committee for the Independent Inquiry into Environment Protection Authority Victoria, the Finkel Review and the Independent Panel for Climate Change).

- align recommendations with achieving ecologically sustainable development and SDG targets by 2030, and support the development of a system of environmental-economic accounts for Victoria.

As per the legislative authority of the Act, all SoE recommendations must be responded to by the Victorian Government within 12 months of the tabling of this report in Parliament.

Table 6 presented at the end of this section, provides a summary of the recommendations and their alignment with the key environmental themes in Part III and the SDG targets and goals. The recommendations can broadly be grouped into the following strategic capabilities:

- Science impact: This is about 'knowing what we need to know, when we need to know it' in a format that is useful for scientists, regulators, managers, economists and the community. This includes responding to systemic environmental challenges and emerging global megatrends and developing environmental-economic accounting as a core skill for government.
- Coordination and governance: This focuses on improving the clarity of roles and responsibilities, and reviewing allocation of existing funding models and accountabilities to deliver priorities. New money is not always needed: improving the coordination of existing resources, effort and investments will enable better outcomes.
- Delivery: A comprehensive suite of policy and action plans have been developed by the Victorian Government since 2014. Focus must now shift to delivery of this policy regime and better investment in underpinning science and skills to enable adaptive management.
- Data, monitoring, spatial information and analytics: More investment in skills and capabilities is needed from DELWP and portfolio agencies.
- Citizen science and education: Building community understanding, participation and awareness can improve policy and environmental outcomes.

Cultural Landscape Health and Management

Develop cultural indicators for future SoE reporting

There are opportunities to enhance the role of Victoria's Traditional Owners in cultural landscape health and management based on the objectives outlined in the Aboriginal Heritage Act 2006. Importantly, Aboriginal cultural heritage needs to be recognised as a fundamental part of Aboriginal community life and cultural identity, and celebrated as a significant part of the heritage of all Australians. There are many sources of information that can provide insights to progress towards medium and long-term outcomes for cultural landscapes.

Recommendation 1: That the Victorian Government, in consultation with Traditional Owners and relevant agencies, develop contemporary cultural indicators to inform future environmental reporting. These indicators must reflect the priorities of Traditional Owners, have practical and cost-effective data-collection methods, and be meaningful and demonstrate change within a five-year reporting period.

For further detail, see the Cultural Landscape Health and Management chapter.

Climate Change Impacts

Improve localised climate projections

Localised climate projections at a finer spatial resolution, and more accurate rainfall projections, are required to improve management outcomes. Greater detail in climate projections can improve the proactive planning for many natural assets and sectors, including agriculture, with rainfall projections a particularly valuable tool for long-term policy development. An excellent example of this is the runoff projections that have been produced at river-basin level in indicator WR:02 (Projected runoff to dams and catchments). Rainfall projections are currently associated with reasonably large uncertainties (relative to other climate variables such as temperature) and reducing these uncertainties would enhance environmental management, planning and outcomes.

Recommendation 2: That DELWP, in coordination with research partners, conduct further analysis to improve localised climate projections (particularly in agricultural regions). These projections would aim to reduce the uncertainties associated with rainfall projections as a minimum.

For further detail, see the Climate Change Impacts chapter.

Note: refer to recommendation 15: Monitoring and reporting on the targets for Victoria's energy transition regarding obligations under the Climate Change Act 2017.

Air

Improve air-quality assessment capability

EPA Victoria currently compiles an air-pollution inventory to quantify the sources of air pollution spatially and temporally across Victoria. However, the immediacy of data access is an issue, with data generally not available until at least two years after the base year of the pollution inventory. Future versions of the inventory need to be more dynamic, and coupled with meteorology and ambient air-quality modelling. Blending air-quality monitoring and modelling will enable more robust and real-time assessments of the Victorian population's exposure to air pollution.

As determined by VAGO,[5] Victoria's current air-monitoring network is inadequate and needs to be expanded, to cover more of regional Victoria and the growth areas of Melbourne, and have the flexibility to target hotspots such as major roadsides and industrial areas. This is an opportunity to ensure adequate air-monitoring in disadvantaged communities and, by working with the Victorian community, to design a comprehensive and targeted monitoring network. Monitoring must be expanded to include ultrafine particles and would include consultation with the National Environment Protection Council to determine whether an ambient air-quality standard is required for ultrafine particles.

In 2016, a Ministerial Advisory Committee completed an inquiry into EPA Victoria. The committee's recommendations included for EPA Victoria to 'assess the adequacy of its air and water-monitoring networks, particularly in relation to air quality, and consider options to improve data-sharing and accessibility, and community communication' (recommendation 6.3). It also recommended implementation, through DELWP, of statewide environmental monitoring, a spatial data system and reporting on outcomes (recommendation 7.2).[6]

It is critical that the implementation of these two recommendations be prioritised and expedited to enable comprehensive, real-time (or near real-time) estimates of air pollution across Victoria, including in areas currently without local air-monitoring stations. The results would be published online and clearly explained, so any member of the community could understand their local air quality. Health researchers would be able to use the data to develop population exposure metrics.

The Air chapter identifies the significant knowledge gap for indoor air quality in Victoria. This is significant, considering that Victorians are likely to spend up to 90% of their time indoors.[7]

It is also critical to couple improved data on population exposure with modern health studies that improve understanding of the health effects associated with air pollution in Victoria, particularly those incorporating indoor air quality. There needs to be an ongoing commitment to epidemiology in Victoria, and to pushing the boundaries of this science to shift the focus to developing accurate exposure metrics. Being able to quantify and understand the population's exposure to air pollution will be an essential component of air-quality management, enabling the future development of air-quality policies and timely assessments on the effectiveness of policy interventions.

Recommendation 3: That EPA Victoria prioritise the implementation of the EPA Inquiry Recommendations 6.3 and 7.2 to develop a publicly accessible, real-time assessment of air quality across Victoria that incorporates air-quality monitoring data, citizen science observations, air-quality modelling and an up-to-date air-pollution inventory. Future monitoring and assessments would also be expanded to include ultrafine particles and data on indoor air quality.

Improve community access to timely information on pollen levels in air

Up to 50% of the population has the potential to suffer from the allergy conditions of hay fever and seasonal asthma, with 25% of the population suffering regularly.[8]

Pollen is monitored at eight locations across Victoria, with a single measurement recorded and reported every 24 hours at each location through a process reliant on significant manual work.[9] Recent investment in this field has focused on enhancing pollen forecasting – and a six-day outlook of daily pollen forecasts is now provided for the eight locations with pollen monitors.[10] Additional three-day epidemic thunderstorm asthma forecasts are provided by region across the state.[11] This information is available to the public online and via the mobile phone app Melbourne Pollen Count. App users can help researchers by answering a hay fever symptom survey.[12]

As many Victorians are affected by pollen levels, and pollen is a factor in the formation of epidemic thunderstorm asthma events, future SoE reports will include an indicator that reports on the status and trends for pollen levels. Advances in forecasting need to be complemented by a contemporary pollen-monitoring network that operates with statewide coverage, increased automation and real-time observations. The ability to measure pollen on an hourly, or at minimum three-hourly, basis would enable the development of a pollen profile. This would enhance the ability of allergy sufferers to reduce their exposure risk, and allow forecasters to produce forecasts at a finer time resolution than a daily forecast. Developments in technology are leading to increasing automation of pollen monitoring in other parts of the world, with eight automatic pollen monitors installed in Bavaria, Germany during 2018.[13] [14]

Recommendation 4: That Victoria's Chief Environmental Scientist, supported by relevant government agencies and research partners, lead the establishment of a contemporary pollen-monitoring network to enable community access to information on pollen levels in the air in a timely manner, through actions including increasing the number of locations monitored, the frequency of the monitoring, and automating the monitoring process.

For further detail, see the Air chapter.

Biodiversity

Improve Victoria's biodiversity outcomes on public land

As this report demonstrates, the data and science available to answer many of the critical questions about biodiversity condition and extent in Victoria is inadequate. This fragmented evidence base is an impediment to adaptive management and improving biodiversity outcomes. This fragmentation has three overarching causes.

Firstly, various investment programs across multiple land management groups have created different and inconsistent data sources and terminologies for reporting on the state of biodiversity, land and forest assets in Victoria. These inefficiencies impact on the ability to present a coherent and integrated evidence base to improve management interventions and ultimately, biodiversity outcomes. Streamlining its approach to land-management to reduce inefficiencies will assist DELWP to deliver a well-coordinated and coherent approach.

Secondly, these measures will require complementary investment in improving data capability to routinely monitor progress towards biodiversity outcomes. This will result in improved accessibility and utility of data in more meaningful timeframes for biodiversity, land and water decision-making. Improved data capability has been recognised as an 'enabler' in DELWP's Science Statement for increasing connectivity and discoverability of science across the department, with partners, stakeholders and the community.

Finally, Victoria's biodiversity science and data capability, although underpinned by world-class scientists and research institutions (including DELWP's Arthur Rylah Institute), is diminished by a lack of coordination and strategy in approach to investing in critical research to enable better and more timely decision-making and policy interventions. This is a critical theme that links many of the recommendations presented in this report – and the broader narrative of addressing knowledge gaps and improving the evidence base for environmental management.

This report highlights the need for improved functionality of biodiversity science across the Victorian Government environment portfolio to improve the collection, coordination, curation and interpretation of biodiversity science. Perhaps most critical is the need to integrate biodiversity science to inform solutions to complex problems, cumulative threats (climate change, fire, drought, flood, heatwave, invasive pests, development) and cumulative challenges (forests, water, marine and coastal management).

A Chief Biodiversity Scientist for Victoria would provide the leadership that is missing in Victoria to improve investment and coordination in biodiversity science and research. The Chief Biodiversity Scientist would report directly to the Secretary of DELWP, complement the current roles of EPA Victoria's Chief Environmental Scientist, Parks Victoria's Chief Conservation Scientist and Victoria's Lead Scientist, and provide the DELWP Secretary and the Minister for Environment with esteemed counsel on biodiversity, threatened species and the impacts of climate change, invasive pests and extreme events on biodiversity values and assets. This science leadership role would also extend to advising on the delivery of the biodiversity targets that the Victorian Government has committed to in Biodiversity 2037. A key function of this role would be to ensure that biodiversity research investment by the Victorian Government is targeted to management and policy priorities across the portfolio, and that the science is better curated, coordinated and tailored to improve the collective research impact of the investment on adaptive management.

The Chief Biodiversity Scientist would be equipped with the authority to provide esteemed counsel on the Victorian Government's collective biodiversity research effort and on enhancing biodiversity outcomes consistent with the objectives of *Biodiversity 2037*.

Recommendation 5: That DELWP streamline the governance and coordination of investment in the science and data capability of all government biodiversity programs and improve the coherence and impact of the publicly-funded, scientific endeavour. Further, that DELWP establish the position of the Chief Biodiversity Scientist to oversee this coordinated effort and provide esteemed counsel to the DELWP Secretary and the Minister for Environment to improve the impact of investment in biodiversity research across the Victorian environment portfolio.

Improve Victoria's biodiversity outcomes on private land

The rate of biodiversity loss on private land requires greater focus and effort by government. Victoria has nearly 23 million hectares of land: public land accounts for 37% and private land 63%.[15] Private land conservation through permanent protection has been increasing across the state. However, it occurs at a slower rate than biodiversity loss and needs to be addressed as a priority over the next decade.

The recommended Chief Biodiversity Scientist would, in consultation with stakeholders across the portfolio, provide esteemed counsel to the DELWP Secretary and the Minister for Environment on the science that underpins private land conservation and on enhancing biodiversity outcomes on private land consistent with the objectives of *Biodiversity 2037*.

Recommendation 6: That DELWP improve biodiversity outcomes on private land by accelerating private land conservation. This will require resourcing permanent protection measures that focus on high-priority ecosystems and landscapes, and investing in local government capability to enforce the existing Guidelines for the Removal, Destruction or Lopping of Native Vegetation and the Invasive Plants and Animals Policy Framework.

For further detail, see the Biodiversity chapter.

Land

Improve understanding of soil and land conditions and threats

To manage Victoria's land health during a time of climate change, it is essential that a long-term plan is created for the collection, consolidation, reporting and assessment of land data across the state. It may be a decade before the benefits of this plan are realised, but it is critical that responsible agencies commence work now so that adequate assessments of land health can be used to drive statewide improvements in land-health condition across Victoria.

The main challenges to soil monitoring are the inherently high variability of soils (the changes are minor and occur over decades), and that measuring soil characteristics can be expensive. These are national issues. New collaboration and funding models linking public and private databases and federated data could provide greater opportunity for soil-health monitoring. Alignment of these new models with the work undertaken by the Cooperative Research Centre for High Performing Soils to develop and measure soil-health indicators for the future could be the foundation for a state soil and land condition monitoring program.

Further analyses of the threats and impacts of land use and land-use change would also improve policy development and decision-making across a variety of sectors, including agriculture, planning and water management. An analysis of the tools that support ongoing land-use assessments, including the Victorian Land Use Information System, and the optimum frequency for updating land-use datasets and maps would be required.

Recommendation 7: That Agriculture Victoria lead the design and delivery of a state soil and land condition monitoring program, that includes analysis of the threats and impacts of land use and land-use change, to improve decision-making across a variety of sectors including agriculture, planning and water management.

For further detail, see the Land chapter.

Note: This recommendation complements recommendation 6: Improve biodiversity outcomes on private land. The investigation of the threats and impacts of land use and land-use change would determine the impact of private land on Victoria's ecosystems and inform actions to maintain and improve biodiversity on private land.

Forests

Understand the impacts of forest fragmentation on biodiversity and improve assessment of protected areas

A systematic approach to understanding the status and future trends of Victorian public forests is critical. DELWP developed the Victorian Forest Monitoring Program (VFMP) in 2011. The VFMP completed its first full cycle of field measurements in 2015 and is expected to complete its second cycle by 2020. It is critical that minimal changes to the VFMP data-collection methods occur following the completion of the second full cycle of data retrieval. Consistency in methodology, with only essential amendments, would allow the identification of underlying trends and improve the utility of the evidence base. Any changes to data collection and analysis methods to achieve more accurate data must not disrupt comparative analysis with existing datasets or future trend analyses.

Further, although the VFMP maps forest fragmentation at the state scale (including private forests), it does not provide a complete assessment of forest fragmentation and its impacts on biodiversity in native forests. Long-term monitoring and detailed spatial research have been conducted to explore impacts of fragmentation on native forests and forest-dependent species at the regional scale (such as mountain ash forests in the Central Highlands) and this research has demonstrated that forest fragmentation is becoming intensified, and its impact on threatened species has been increasing.[16, 17, 18, 19, 20] The study of biodiversity impacts from forest fragmentation is also impeded by the lack of an authoritative list of Victorian forest-dependent species.

Further research is critical to complement VFMP mapping and understand the impact of forest fragmentation on biodiversity at the state scale. This research program would also assist in the establishment and management of protected areas. The International Union for Conservation of Nature (IUCN) protected areas in Victoria increased by 140,000 hectares between 2004 and 2016. However, there is little evidence of the level of long-term species protection provided by the classification of these areas. A viability analysis, for example, would provide risk assessment and management options to better protect target species in protected areas. Such analysis would also provide an indication of species conservation benefits if an increase in protected areas was to occur.

Recommendation 8: That DELWP maintain their commitment to resourcing and maintaining the VFMP and enhance it to (i) improve statewide understanding of the impacts of forest fragmentation on forest-dependent species (including the development of an authoritative list of Victorian forest-dependent species), and (ii) improve assessment of protected areas by conducting detailed research to identify the benefits of various types of IUCN-protected areas for target species. Any amendments to the VFMP must not disrupt future trend analyses.

For further detail, see the Forests chapter.

Fire

Understand fire impacts on the environment statewide using a structured, integrated framework

Ecological values are not currently included in the DELWP residual risk prediction program (PHOENIX RapidFire) used to inform the risk-based approach to forest fire management, Safer Together.[21] To address this and assess the impact of current fire management strategies on Victoria's native species and ecosystems, as recommended by the 2009 Victorian Bushfires Royal Commission,[22] DELWP, in partnership with La Trobe University, developed an ecosystem resilience monitoring program in 2017–18 to collect, analyse and interpret comprehensive data on how bushfire and fire management activities affect plants, animals and their habitats in the landscape.

This program is described in the *Guidelines for Ecosystem Resilience Monitoring, Evaluation and Reporting within the Victorian Bushfire Monitoring Program: Scientifically-based Monitoring Project – Final Report*. The ecosystem-resilience monitoring program has been piloted and includes recommendations for deployment. It is structured around a dual-scale approach to monitoring: regional and statewide. Regional monitoring activities focus on the immediate and short-term effects of fuel-management actions (primarily planned burns) on species of local interest and/or significance (such as the impact of planned burns on the greater glider by causing the loss of hollow-bearing trees in Alpine-North East). The statewide program would examine the effects at a broader scale and the long-term relationships between plants and animals, and fire, at sites across the landscape with a varied fire history.

The full implementation of this program would help establish a science-based, state-scale approach to the monitoring, evaluation and reporting framework for ecosystem resilience on public land in Victoria. An approach that includes both flora and fauna species at the state scale has never been implemented before.

Conserving flora and fauna species in fire-prone landscapes in Victoria requires an evidence-based approach to identify how fires affect ecosystems that can be modified by cumulative threats. There are two contemporary fire management paradigms: fire mosaic paradigm and functional types paradigm.[23] Current fire management has adopted the functional types paradigm, which focuses on plant responses to recurrent fires. This paradigm is guided by life-history traits of plants such as the Tolerable Fire Interval (TFI) and aims for temporal variation within acceptable fire intervals. By contrast, the fire mosaic paradigm focuses on animal responses to fire events, aiming to create spatially diverse fire mosaics for promoting biodiversity and assisting the persistence of isolated, localised species.

Research indicates[24] that both paradigms need to be integrated in evidence-based monitoring for fire management for biodiversity conservation, as animals and plants are interdependent and influenced by the spatial and temporal dimensions of fire regimes. The new ecosystem-resilience program will provide an opportunity to integrate these two paradigms to better evaluate and report on the effectiveness of bushfire for maintaining resilient and biodiverse ecosystems.

Recommendation 9: That the Victorian Government establish a structured framework based on the findings of the dual-scale ecosystem-resilience monitoring program, piloted by DELWP in 2017–18, and undertake a detailed analysis of the persistence of key fire-response species to increased fire frequency in Victoria, particularly in areas where below-minimum TFI exists.

For further detail, see the Fire chapter.

Marine and Coastal Environments

Create a Marine and Coastal Knowledge Framework

The key recommendation of State of the Bays 2016 was the development of a marine framework as a mechanism for 'addressing knowledge gaps, reducing uncertainties and forming the future evidence base for assessing management interventions and environmental outcomes'.[25] DELWP has begun the development of the Marine Knowledge Framework, which is specific to marine science in Western Port and Port Phillip Bay.

In preparation for the State of the Marine and Coastal Environment 2021 report, the framework needs to be expanded to include:

- the development and implementation of a marine and coastal knowledge strategy with clear goals, actions, outcomes, timelines and evaluation that integrates agency and academic research, citizen science and Traditional Owner ecological knowledge
- a comprehensive review of marine and coastal indicators, with the data needs of the indicators given priority in data collection, analysis and reporting, and the indicators measured regularly to identify trends
- measurement of ecological function, condition and changes in marine and coastal ecosystems (including the 95% of coastal waters outside parks and sanctuaries, which are rarely monitored)
- assessment of the distribution of marine species responding to climate change
- understanding of marine and coastal attitudes, perceptions of, and connections for, Victorians (through polling)
- assessment of the ecological impacts of commercial and recreational fisheries
- assessment of the impacts of coastal urbanisation, development, population growth and increasing number of visitors to the coast
- assessment of water quality along the open coast.

Recommendation 10: That DELWP expand the Marine Knowledge Framework to include all state marine and coastal environments.

For further detail, see the Marine and Coastal Environment chapter.

Water Resources

Improve future water-resource assessments and decision-making

Two significant issues that emerge from the Water Resources chapter are that water-supply shortfalls for Victoria are expected to occur due to a drying climate and population growth, and that there is an absence of detailed knowledge on how the environmental water reserve and the allocation of water for consumptive purposes is affecting waterway health.

The *Water Act 1989* was amended in 2005 with a requirement for Victoria to complete a Long-Term Water Resource Assessment (LTWRA) every 15 years.[26] The LTWRA is action 8.6 of the *Water for Victoria* plan and the first LTWRA was undertaken in 2018.[27 28 29] It is anticipated that it will be released in 2019.

A LTWRA must identify whether either or both of the following has occurred:

1. there has been any decline in the long-term availability of surface water or groundwater (and whether the burden of decline has fallen disproportionately on the environmental water reserve or on the allocation of water for consumptive purposes)[30]
2. there has been any deterioration in waterway health for reasons related to flow.[31 32]

There is an opportunity to improve future water-resource decision-making if the evidence base established by the current LTWRA is used to develop metrics for water availability and ecosystem health. These metrics would include corresponding thresholds that would determine actions required when thresholds are crossed.

Given the significant changes to water resources, water quality, climate and population that can occur in a 15-year period, more frequent LTWRAs are likely to be required to report on these metrics and thresholds, to ensure environmental values and the health of aquatic ecosystems are being preserved.

Recommendation 11: That DELWP use the current LTWRA to identify metrics for monitoring the condition of, and risks to, Victoria's water resources and waterway health for reasons related to flow, and commit to long-term monitoring. Complementary thresholds would also be established for these metrics, and actions determined for circumstances when thresholds are crossed. Further, in a changing climate, it is recommended that DELWP review the 15-year period between LTWRAs, as more frequent assessments may be required to maintain ecosystem health and function.

For further detail, see the Water Resources chapter.

Water Quality

Improvements in the availability of statewide water-quality data have meant a much more robust assessment of water-quality indicators in this report than in SoE 2013. This reflects steps undertaken since SoE 2013 to increase data availability, in line with that report's recommendations and subsequent VAGO and DELWP audits that identified a deficiency in data-usage and sharing. There are still considerable improvements to be achieved by coordinating monitoring programs and data between government agencies, industry and the community. Advances in monitoring will also need to be complemented by improvements to data, trend analysis and modelling.

Implement an agile Water-Quality Monitoring Framework

Future water-quality monitoring needs to include a network of long-term sites, complemented by targeted monitoring of water-pollution hotspots. Where and how this monitoring is completed, and who does it, needs to be determined in a transparent process, guided by evidence, and ultimately recommending clearly defined roles and responsibilities. The water-quality monitoring framework would be developed by DELWP with support from other agencies and the community. The framework would be a risk-based approach that uses threats and pressures on water quality to guide where and how monitoring is undertaken.

These reforms will support Victoria's progress in becoming a modern regulatory environment for water-quality protection. They align with recommendations 6.3 and 7.2 of the 2016 Ministerial Advisory Committee Inquiry into EPA Victoria to 'assess the adequacy of its air and water-monitoring networks, particularly in relation to air quality, and consider options to improve data-sharing and accessibility, and community communication' (recommendation 6.3) and to implement, through DELWP, statewide environmental monitoring, a spatial data system and reporting on outcomes (recommendation 7.2).[33] The reforms will be essential for monitoring delivery of the *State Environment Protection Policy (Waters)* and the *Environment Protection Amendment Act 2018*.

Combining targeted monitoring of pollution hotspots with monitoring at priority long-term sites will help inform pollution-prevention interventions in hotspots and enable quantitative evaluations of those actions. Enhancements to EPA's pollution-reporting database would assist the determination of potential hotspot areas for monitoring.

Recommendation 12: That DELWP, working with its portfolio agencies, implement an agile water-quality monitoring framework that (i) clarifies the roles and responsibilities of all agencies and the community, (ii) improves monitoring of pollution hotspots, and (iii) builds on EPA Victoria's implementation of EPA Inquiry recommendations 6.3 and 7.2.

For further detail, see the Water Quality chapter.

Waste and Resource Recovery

Develop indicators and reporting for the circular economy

Waste is produced at all stages of extraction, consumption and production, as well as at the end of a product's lifecycle. Victoria produced approximately 12.9 million tonnes of solid waste in 2016–17 – about as much as has been produced over the past five years.[34] The Victorian Government has committed to developing a circular economy strategy for Victoria by June 2020. This commitment is consistent with, and builds on, the current Victorian Statewide Waste and Resource Recovery Infrastructure Plan (SWRRIP) released in 2015 and amended in 2018.

The SWRRIP, and the regional plans (WRRIPs), are developed on the principles of a circular economy. A circular economy aims to:

- re-define growth by decoupling economic activity from the consumption of finite resources and design waste out of the system
- keep resources in use for as long as possible
- extract maximum value from resources while in use
- recover and regenerate products and materials at the end of each service-life so that material is not lost from the system as a waste, but becomes a resource for another use.

The concepts of waste minimisation and recycling of materials are central to the current model of waste management and resource recovery in Victoria, but transitioning our current linear economy (a 'take-make-dispose' supply-chain approach) to a circular economy model will require a paradigm shift.

Designing and implementing the transition pathway will require deep community and business engagement, and whole-of-government buy-in. It will also require more comprehensive and intensive monitoring, and a deeper understanding of system operation, than government has currently, and a shared understanding of the roles and responsibilities of all partners. A circular economy cannot focus only on waste and recycling if it is to drive change in the way people consume resources. It needs to encompass all aspects of the resources cycle, including resource extraction, imports, consumer behaviour and procurement by government. It also needs to consider approaches by, and impacts on, all sectors and markets.

To achieve this, the circular economy strategy in preparation must be supported by evidence that sets a baseline and includes performance measures to enable government and businesses to demonstrate progress and foster transparency and accountability in delivery. This will require a review of the adequacy of the planning and procurement practices of the Victorian waste management and resource recovery groups, and the Victorian Government more broadly. The Victorian Government Procurement Board could provide advice on mechanisms for executing circular economy outcomes, particularly with a focus on leveraging government procurement to create and develop markets. Changes to Financial Reporting Directions (prepared by the Department of Treasury of Finance in accordance with Australian Accounting Standards) may be a useful mechanism.

This recommendation aims to shift reporting on waste and resource recovery from transactional, ad hoc accounting to a strategic evidence base that better tracks and reports on the operation of Victoria's waste and resource recovery system – now, and as it transitions to a circular economy model over the next decade. The reporting needs to clarify the roles and responsibilities of the agencies and partners in the system and what data they are responsible for collecting, interpreting and/or maintaining.

Recommendation 13: That Sustainability Victoria, in 2019, develop indicators and implement a comprehensive monitoring and reporting framework to measure delivery of the current SWRRIP and WRRIPs against their circular-economy design principles. From July 2020, that Sustainability Victoria expand that monitoring and reporting framework to track the progress of the implementation of the strategy and publicly report, at least annually, on Victoria's transition to a circular economy.

Align the Institutional Framework for Waste and Resources Recovery to Support a Circular Economy

One of the key priorities of the SWRRIP is the consolidation of infrastructure to collect and process recovered resources. Household and municipal waste from across local government areas is an anchor for investment in infrastructure by providing reliable, base-load volumes and creating the opportunity for potentially longer contract terms which are conducive to investment in best-practice technologies for resource reuse and recovery. Victoria has seven regional Waste and Resource Recovery Groups (WRRGs), the largest of which is the Metropolitan WRRG, servicing the majority of Victoria's population. The WRRGs share an important purpose: to undertake collective, strategic procurements for local government. Given the importance of collaborative procurement in making large volumes of recovered materials available to the market, it would be timely to evaluate success against desired objectives, and what changes may be required to achieve the delivery of a circular economy. There is scope to accelerate the pace and scale of joint procurements; however, evidence is required to identify where barriers exist and how best to remove them.

Resource recovery infrastructure needs to be established and upgraded so that recovered materials are sorted and processed to a higher standard. These recycled materials need strong domestic markets – so that various types of wastes are 'pulled' through into other material uses and products by stimulating market demand.

Recommendation 14: That the Victorian Government, commencing within the metropolitan region as a minimum, align the institutional planning and procurement processes (including leveraging Victorian Government procurement) to support the delivery of the circular economy strategy from July 2020. Ultimately, this alignment would be adopted statewide and enable an orderly transition to a circular economy in Victoria by 2030. In developing the action plan to deliver the circular-economy strategy, the roles and responsibilities of all agencies should be clarified to nominate those agencies responsible for delivering policy, procurement, program, reporting and regulatory roles. Further, that the Victorian Government commit to long-term, systemic, statewide community education to support this transition and assist the change in behaviours that will be required to improve long-term system outcomes. Reducing consumption and contamination levels in kerbside recycling would be the initial focus.

Energy

Monitor and report on the targets for Victoria's energy transition

Victoria's *Climate Change Act 2017* explicitly acknowledges the goal of the 2015 Paris Agreement to hold the increase in the global average temperature 'to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels recognising that this would significantly reduce the risks and impacts of climate change'.[35]

In addition to legislating Victoria's 2050 net-zero-emissions target, the *Climate Change Act 2017* requires the premier and relevant minister to establish five-yearly interim targets to keep Victoria on-track to meeting the 2050 target. The *Climate Change Act 2017* requires the minister to obtain expert advice on options for the interim targets, indicative trajectories for Victoria to 2050 based on interim target options, and efficient and cost-effective opportunities for achieving the interim targets. Interim emissions targets for the 2021–25 and 2026–30 periods must be set on or before 31 March 2020.[36]

Reducing greenhouse gas emissions from energy is Victoria's principal challenge to meet its greenhouse gas emissions reduction goals. The Independent Expert Panel constituted under *Climate Change Act 2017* to provide advice on interim emissions reduction targets has identified opportunities to achieve emissions reductions through an energy transition in electricity generation, transport, industry and the built environment. Major opportunities include shifting to zero and low-carbon electricity generation, electrification of energy services (combined with low-carbon electricity) and increasing end-use efficiencies.[37] Measuring progress against emissions targets and associated policies, including the Victorian Renewable Energy Targets and the Energy Efficiency and Productivity Strategy, will require appropriate indicators.

The integration of high concentrations of distributed energy resources (including rooftop solar and small-scale battery storage) into Victoria's electricity system requires distribution networks to become 'smarter',[38, 39] integrating information and communications technology to allow network operators to better understand local, low-voltage network conditions and provide signals or incentives to individual resources to respond and provide system support.[40]

Similarly, Victoria's transport infrastructure will change over time to meet the challenge of substantial emissions reductions from reducing its reliance on fossil-fuel combustion for energy. These changes may range from increased availability of charging infrastructure for electric vehicles (or refuelling infrastructure for other fuels such as hydrogen), which is an important enabler for a low-carbon fleet transition, to the broader adoption and integration of low-emissions urban-planning principles, such as those found in the Green Building Council's Green Star Communities.[41]

Energy use by Victoria's buildings and industry must also change in the transition to a net-zero-emissions future. This will include substantially increasing the energy efficiency of building stock, as well as the efficiency of industrial processes and their electrification.

Recommendation 15: That DELWP establish a set of indicators, and implement measures to collect appropriate data, to track the impact of energy emissions reduction to meet interim targets set under the Climate Change Act 2017. The reporting should also track the transition of Victoria's grid, transport and industry infrastructure to support a low-carbon future.

Improve data capability to track the impact of Victoria's energy transition on consumers and markets

Victorian consumers are likely to play an increasingly important role in the energy sector during Victoria's transition to its net-zero-emissions target. As the extensive (and largely unanticipated) investment Victorian consumers have made in rooftop photovoltaic systems over the past decade shows, energy consumers can no longer be assumed to be passive purchasers of energy. Nonetheless, their choices are limited to purchasing energy-using devices – from cars to heaters and washing machines – and choosing a supplier of electricity, gas or liquid fuels.

Victoria's almost complete smart-meter coverage makes engaging active consumers possible, with or without distributed energy resources. However, consumer education and consumer trust are essential for gaining the engagement required for the efficient and effective coordination of demand-side resources, which can include broad behavioural change that alters the demand for energy services.[42, 43]

Further, changes are likely to be required for the National Electricity Market (NEM) to assist the transition to a low-emissions electricity system. When the NEM was established there was no variable renewable generation supplying its regions, and the Finkel Review described the NEM as 'a market for different times'.[44] Victoria will need to work with the other NEM states and the Australian Government to assist the NEM to evolve to incorporate high proportions of variable renewables and distributed energy resources.[45, 46, 47]

Governance arrangements, in particular consumer protection measures, will need to be extended to cover new energy products and business models to ensure that consumers understand the risks of participation in new markets and engaging with new types of energy businesses (for example, distributed energy resource aggregators).[48] New institutions (such as distributed system and distributed market operators) may also be required to operate distribution system-level markets and coordinate and dispatch resources.[49]

Recommendation 16: That DELWP implement measures to collect data and track the impact of the transition to a low-emissions electricity system on (i) consumer sentiment and behaviour, (ii) investment in distributed, low and zero-emissions electricity generation, and (iii) the associated markets, governance and business models.

For further detail, see the Energy chapter.

Transport

Monitor noise and air for thorough, timely information

Additional research must be undertaken to acquire data and understand the impacts of transport noise on Victorians. A logical starting point would be a real-time noise-monitoring network across Victoria, with a strong focus on monitoring near major transport hotspots, including busy roads, under flight-paths and along public transport routes. The noise-monitoring network would need to be established in conjunction with regular strategic noise-mapping that provides the spatial distribution of noise levels, allows for the identification of hotspots and estimates the population exposure and resulting health burden.

The other significant issue associated with transport is ambient air quality. This is closely related to population exposure, which is set to dramatically increase in line with population growth and planning strategies that aim to locate medium and high-density housing developments near metropolitan activity centres. This means that many more people are likely to be living near major roads, which might reduce travel times, but could increase exposure to air pollution from motor vehicles and the risk of respiratory illness. The risk of asthma increases by 50% for Australians that live within 200 metres of a major road.[50] EPA Victoria currently monitors air quality alongside only one major roadway in Victoria (in Melbourne's CBD), which is insufficient to understand the impact of air pollution in Victoria associated with motor vehicles.

Recommendation 17: That EPA Victoria, in coordination with other Victorian Government agencies, improve transport-related air and noise monitoring, including:

- **developing a real-time noise-monitoring network across Melbourne (with a view to expansion across larger cities in regional Victoria), focusing on monitoring near major transport hotspots that include busy roads, flight paths and along public transport routes**

- **increasing the number of roadside air-monitoring stations**
- **publishing the noise and air data on the internet in real-time.**

For further detail, see the Transport chapter.

Note: this recommendation complements recommendation 3: Improve air-quality assessment capability.

Megatrends

Develop spatial information capability

Spatial information provides fundamental and essential information that informs Victorian Government planning and decision-making across the environment portfolio. It can also be applied to assess regulatory compliance. Technological advances in spatial information has led to significant increases in accuracy. However, legislative and regulatory reform is not keeping pace with this technological advance.

This inconsistency generates several risks, including:

- outdated and unreliable data sources
- a reliance on physical maps that can be lost or degraded in the field
- confusion across and within government agencies as there is no single and accepted source of truth, resulting in each group developing their own spatial information database with varying levels of accuracy.

A spatial information resource that can be used as a single source of truth, that is regularly and routinely updated and can be accessed on a shared database across and within government agencies, and be publicly available, will help mitigate the above risks and reduce misinformation in the media and the public domain.

The government has committed to providing more detailed spatial information maps for any future allocation orders[51] in response to an ABC investigation regarding timber harvesting activity by VicForests).[52, 53]

Recommendation 18: That DELWP develop its spatial information capability and database, and ensure it is regularly and routinely updated, to inform decision-making across the environment portfolio.

For further detail, see the Megatrends section of Part II and the Forests chapter of Part III.

International Frameworks

Establish a system of environmental–economic accounts for Victoria

A key feature of SoE 2018 is the exploration of the use of the United Nations SEEA. Environmental-economic accounting expertise (provided by DELWP) has informed this SoE report, with every scientific assessment chapter including a discussion of data requirements to inform a future set of environmental–economic accounts for Victoria.

The State and Benefit framework for this SoE report aims to transition Victoria's environmental reporting regime from focusing solely on the state of Victoria's natural capital, to emphasise the direct and indirect benefits that Victorians and the Victorian economy derive from healthy and sustainable ecosystems. Reflecting this logic, environmental–economic accounting becomes a critical tool to achieve this and support investment in, and management and protection of, the environment.

In the past, the measurement of environmental assets and the benefits they provide has occurred separately, and the results could not be combined easily for policy and decision-making. Using the SEEA guidelines and standards to integrate the state and benefit components provides a robust approach to assessing multiple benefits and trade-offs among alternative policy or management options.

In 2015, DELWP produced a plan to deliver a set of environmental–economic accounts by 2020: *Valuing and Accounting for Victoria's Environment: Strategic Plan 2015–2020*.[54] Although it is unclear if DELWP will be able to meet the 2020 deadline, commitment to the vision of the plan remains important. Subsequent to the release of the plan, the Victorian Government has been a leader in the interjurisdicational effort of environment ministers to release *A Common National Approach to Environmental-Economic Accounting: Strategy and Action Plan (2017)*. [55]

Recommendation 19: That DELWP establishes environmental–economic accounting as a core capability and delivers a set of environmental-economic accounts for Victoria by 2022, consistent with the SEEA guidelines, the DELWP Valuing and Accounting for Victoria's Environment strategy and aligned with the agreed common national approach. Further, that the Minister for Environment include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to incorporate reporting against Victoria's environmental-economic accounts in State of the Environment reporting for Victoria from 2023.

For further detail, see the System of Environmental-Economic Accounts section of Part II.

Apply the SDGs to State of the Environment reporting

Comprehensive mapping of SoE indicators against SDG targets was undertaken to inform environmental reporting and information requirements. Ideally, the Victorian Government would complement this analysis by mapping current legislation, policy and programs against the targets so that future data reform and prioritisation is consistent with management priorities and an adaptive management cycle.

Developing the SDGs as an operating framework represents a fundamental shift for SoE, from reporting on what is occurring in the natural environment, to include additional analysis on how environmental change impacts society and how these impacts are managed. Assessing the SDG targets, and developing a set of environmental-economic accounts for Victoria (see recommendation 19), will require new skills and new data collection and monitoring regimes by the environment portfolio, and the Victorian Government more broadly.

Early analysis for SoE 2018 found that Victorian Government agencies in the environment portfolio do not collect sufficient socio-economic data for many of the relevant SDG targets to be assessed. To report effectively on the SDG targets in future, data-acquisition processes will need to be broadened to include individuals (some of whom

will identify as citizen scientists) and agencies that have not traditionally contributed to SoE reporting.

This expanded reporting regime will require:

- broadening of the definition of conventional data inputs
- innovative and creative data-acquisition methods and supporting investment
- relationships with new data partners (both organisations and individuals)
- augmentation of current indicators and metrics, and corresponding data requirements, for each target (both quantitative and qualitative data) in consultation with experts in the respective disciplines.

However, transitioning to the SDGs as the operating framework for SoE reporting in Victoria will require more than data-collection reform. It will also require that government and community partners work together to maintain adaptive management principles, drive systemic change and support evidence-based decision-making at the state level.

Recommendation 20: That the Minister for Environment include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to adopt the SDGs as an operating framework for SoE reporting in Victoria from 2023. This will require that DELWP support the Commissioner by leading a portfolio review of the data requirements to assess Victoria's progress against the selected SDG targets, which will include a complementary analysis of current legislation, policy and programs against the SDG targets, and the development of a plan to improve data-acquisition processes for socio-economic indicators by 2021.

For further detail, see the Sustainable Development Goals section of Part II.

Table 6. Summary of Recommendations, Challenges and SDG targets for future reporting by theme

Lead themes	Recommendations	Challenges the recommendation addresses	UN SDG targets for future reporting
Cultural Landscape Health and Management	1. That the Victorian Government, in consultation with Traditional Owners and relevant agencies, develop contemporary cultural indicators to inform future environmental reporting. These indicators must reflect the priorities of Traditional Owners, have practical and cost-effective data-collection methods, be meaningful, and demonstrate change within a five-year reporting period.	Transitioning from a singular focus on Aboriginal cultural heritage reporting to a new approach which incorporates the social, economic, spiritual, cultural, environmental, and health and wellbeing values of Victorian Traditional Owners, Registered Aboriginal Parties and Aboriginal Victorians.	1.5 4.7 11.4
Climate Change Impacts	2.That DELWP, in coordination with research partners, conduct further analysis to improve localised climate projections (particularly in agricultural regions). These projections would aim to reduce the uncertainties associated with rainfall projections as a minimum.	Regional climate projections at a finer spatial resolution and more accurate rainfall projections are required to improve management outcomes. Rainfall projections are currently associated with reasonably large uncertainties (relative to other climate variables such as temperature).	2.4 6.5 9.5 13.2, 13.3
Air	3. That EPA Victoria prioritise the implementation of the EPA Inquiry Recommendations 6.3 and 7.2 to develop a publicly accessible, real-time assessment of air quality across Victoria that incorporates air-quality monitoring data, citizen science observations, air-quality modelling and an up-to-date air-pollution inventory. Future monitoring and assessments would also be expanded to include ultrafine particles and data on indoor air quality.	Victoria's current air monitoring network does not cover regional Victoria and the growth areas of Melbourne adequately. It needs to target hot spots such as major roadsides and industrial areas. EPA Victoria's air pollution inventory has limitations. The immediacy of data access is an issue, with data generally not available until at least two years after the base year of the pollution inventory. There is a limited knowledge of the concentrations and health effects associated with ultrafine particles and indoor air pollutants.	3.9 9.5 11.6

Lead themes	Recommendations	Challenges the recommendation addresses	UN SDG targets for future reporting
Air	4. That Victoria's Chief Environmental Scientist, supported by relevant government agencies and research partners, lead the establishment of a contemporary pollen-monitoring network to enable community access to information on pollen levels in the air in a timely manner, through actions including increasing the number of locations monitored, the frequency of the monitoring, and automating the monitoring process.	Up to 50% of the population have the potential to suffer from the allergy conditions of hay fever and seasonal asthma, with 25% of the population suffering regularly. Pollen is monitored at eight locations across Victoria, with a single measurement recorded and reported every 24 hours at each location through a process reliant on significant manual work.	3.9 9.5 11.6
Biodiversity	5. That DELWP streamline the governance and coordination of investment in the science and data capability of all government biodiversity programs and improve the coherence and impact of the publicly-funded, scientific endeavour. Further, that DELWP establish the position of the Chief Biodiversity Scientist to oversee this coordinated effort and provide esteemed counsel to the DELWP Secretary and the Minister for Environment to improve the impact of investment in biodiversity research across the Victorian environment portfolio. That DELWP improve biodiversity outcomes on public land by streamlining and coordinating governance arrangements.	Various investment programs across multiple land management units have created different, inconsistent data sources and terminologies for reporting on the state of biodiversity, land and forest assets in Victoria. Data is inadequate to answer many of the critical questions about biodiversity science in Victoria. Victoria's biodiversity science and data capability are undermined by a lack of coordination and a strategic approach to investing in the critical research that will enable an ecosystems approach to decision making and policy interventions.	2.4 6.5 9.5 13.2, 13.3

Lead themes	Recommendations	Challenges the recommendation addresses	UN SDG targets for future reporting
Biodiversity	6. That DELWP improve biodiversity outcomes on private land by accelerating private land conservation. This will require resourcing permanent protection measures that focus on high-priority ecosystems and landscapes, and investing in local government capability to enforce the existing *Guidelines for the Removal, Destruction or Lopping of Native Vegetation and the Invasive Plants and Animals Policy Framework*.	The accelerated rate of biodiversity loss on private land.	4.7 6.6 12.2, 12.8 15.1, 15.3, 15.4, 15.5, 15.8
Land	7. That Agriculture Victoria lead the design and delivery of a state soil and land condition monitoring program, that includes analysis of the threats and impacts of land use and land-use change, to improve decision-making across a variety of sectors including agriculture, planning and water management.	There is no coordinated or systems approach to the collection, consolidation, reporting and assessment of land data across the state. There is only a basic understanding of the effect of land use and land-use change on soil and land in Victoria.	2.4 6.5 9.5 12.2 15.3
Forests	8: That DELWP maintain their commitment to resourcing and maintaining the VFMP and enhance it to (i) improve statewide understanding of the impacts of forest fragmentation on forest-dependent species (including the development of an authoritative list of Victorian forest-dependent species), and (ii) improve assessment of protected areas by conducting detailed research to identify the benefits of various types of IUCN-protected areas for target species. Any amendments to the VFMP must not disrupt future trend analyses.	The state-scale assessment of forest fragmentation does not provide a complete assessment and its impact on biodiversity in native forests. There is little evidence of the level of long-term species protection provided by the classification of IUCN protected areas. Inconsistency in methodologies has been disrupting comparative analysis between existing datasets and may disrupt future trend analyses.	15.1, 15.5

Lead themes	Recommendations	Challenges the recommendation addresses	UN SDG targets for future reporting
Fire	9. That the Victorian Government establish a structured framework based on the findings of the dual-scale ecosystem-resilience monitoring program, piloted by DELWP in 2017–18, and undertake a detailed analysis of the persistence of key fire-response species to increased fire frequency in Victoria, particularly in areas where below-minimum Tolerable Fire Interval exists.	Biodiversity impacts from planned fires and bushfires at regional and statewide scales are currently unclear. An approach to monitor biodiversity responses (flora and fauna) to fire at multiple scales (regional and statewide) is missing.	1.5, 13.1
Marine and Coastal Environments	10. That DELWP expand the Marine Knowledge Framework to include all state marine and coastal environments.	Expanding ecosystem monitoring programs beyond Port Phillip Bay, Western Port, Gippsland Lakes and Victoria's system of Marine National Parks and Marine Sanctuaries. Aligning the research priorities of agencies, academic institutions and citizen scientists with the needs of marine and coastal management.	6.3, 6.5 11.3, 11.4, 11.7 12.2, 12.5, 12.8 13.1, 13.3 14.1, 14.2, 14.3, 14.4, 14.5, 14.b 15.5, 15.6, 15.7, 15.8, 15.9 16.6 17.7
Water Resources	11. That DELWP use the current long-term water resource assessment (LTWRA) to identify metrics for monitoring the condition of, and risks to, Victoria's water resources and waterway health for reasons related to flow, and commit to long-term monitoring. Complementary thresholds would also be established for these metrics, and actions determined for circumstances when thresholds are crossed. Further, in a changing climate, it is recommended that DELWP review the 15-year period between LTWRAs, as more frequent assessments may be required to maintain ecosystem health and function.	Given the significant water resource, water quality, climate and population changes that can occur during a 15-year period, more frequent LTWRAs are highly likely to be required to ensure environmental values and the health of water ecosystems are being preserved. Metrics and thresholds currently do not exist to promptly determine when the condition of Victoria's water resources and waterway health for reasons related to flow has deteriorated to such an extent that urgent action is required.	6.4, 6.5 9.5 13.2

Lead themes	Recommendations	Challenges the recommendation addresses	UN SDG targets for future reporting
Water Quality	12. That DELWP, working with its portfolio agencies, implement an agile water-quality monitoring framework that (i) clarifies the roles and responsibilities of all agencies and the community, (ii) improves monitoring of pollution hotspots, and (iii) builds on EPA Victoria's implementation of EPA Inquiry recommendations 6.3 and 7.2.	The identification of water quality monitoring sites and needs is not currently well coordinated between agencies across the state.	6.3, 6.6 9.5
Waste and Resource Recovery	13: That Sustainability Victoria, in 2019, develop indicators and implement a comprehensive monitoring and reporting framework to measure delivery of the current SWRRIP and WRRIPs against their circular-economy design principles. From July 2020, that Sustainability Victoria expand that monitoring and reporting framework to track the progress of the implementation of the strategy and publicly report, at least annually, on Victoria's transition to a circular economy.	The Victorian government has acknowledged that there is a need to transition Victoria to a circular economy to improve Victoria's waste management and resource recovery. There is currently no regular public reporting on the delivery of the SWRRIP. Metrics need to be developed and reported on for the delivery of the SWRRIP. These indicators should be consistent with the circular economy strategy currently in preparation.	12.3, 12.4, 12.5

Lead themes	Recommendations	Challenges the recommendation addresses	UN SDG targets for future reporting
Waste and Resource Recovery	14. That the Victorian Government, commencing within the metropolitan region as a minimum, align the institutional planning and procurement processes (including leveraging Victorian Government procurement) to support the delivery of the circular economy strategy from July 2020. Ultimately, this alignment would be adopted statewide and enable an orderly transition to a circular economy in Victoria by 2030. In developing the action plan to deliver the circular-economy strategy, the roles and responsibilities of all agencies should be clarified to nominate those agencies responsible for delivering policy, procurement, program, reporting and regulatory roles. Further, that the Victorian Government commit to long-term, systemic, statewide community education to support this transition and assist the change in behaviours that will be required to improve long-term system outcomes. Reducing consumption and contamination levels in kerbside recycling would be the initial focus.	The Victorian government has acknowledged that there is a need to transition Victoria to a circular economy to improve Victoria's waste management and resource recovery. Victoria's recycling system has recently been impacted by major disruptions and restrictions in global commodity markets. Victoria has committed to delivering a circular economy strategy. This will require a comprehensive review of all of the levers of Government (including procurement) to deliver the strategy. There has been no ongoing community education to support the effective operation of Victoria's current waste and resource recovery system. The current system often responds to crises and has a reactive approach to issues more broadly. The transition to a circular economy presents a real opportunity to smooth out system operation and deliver better outcomes for Victorians.	12.4, 12.5, 12.7
Energy	15. That DELWP establish a set of indicators, and implement measures to collect appropriate data, to track the impact of energy emissions reduction to meet interim targets set under the Climate Change Act 2017. The reporting should also track the transition of Victoria's grid, transport and industry infrastructure to support a low-carbon future.	Reducing greenhouse gas emissions from energy is Victoria's principal challenge to meet its greenhouse gas emissions reduction goals.	13.2, 13.3

Lead themes	Recommendations	Challenges the recommendation addresses	UN SDG targets for future reporting
Energy	16. That DELWP implement measures to collect data and track the impact of the transition to a low-emissions electricity system on (i) consumer sentiment and behaviour, (ii) investment in distributed, low and zero-emissions electricity generation, and (iii) the associated markets, governance and business models.	Victorian consumers will drive Victoria's transition to its net-zero emissions target. It is critical to collect data and build an evidence base to support Victorians and understand their needs and choices and develop appropriate markets and business models to serve them.	7.2 13.3
Transport	17. That EPA Victoria, in coordination with other Victorian Government agencies, improve transport-related air and noise monitoring, including: developing a real-time noise-monitoring network across Melbourne (with a view to expansion across larger cities in regional Victoria), focusing on monitoring near major transport hotspots that include busy roads, flight paths and along public transport routes, increasing the number of roadside air-monitoring stations and publishing the noise and air data on the internet in real-time.	Additional research must be undertaken to acquire data and understand the impacts of transport noise on Victorians. EPA Victoria currently monitors air quality alongside only one major roadway in Victoria (in Melbourne's CBD), which is insufficient to understand the impact of air pollution in Victoria associated with motor vehicles.	3.9 9.5 11.3, 11.6
Megatrends	18. That DELWP develop its spatial information capability and database, and ensure it is regularly and routinely updated, to inform decision-making across the environment portfolio.	Technological advances in spatial information has led to significant increases in accuracy. However, legislative and regulatory reform is not keeping pace with this technological advance. This inconsistency generates several risks, including: • outdated and unreliable data sources • a reliance on physical maps that can be lost or degraded in the field • confusion across and within government agencies as there is no single and accepted source of truth, resulting in each group developing their own spatial information database with varying levels of accuracy.	6.6 9.4 12.2, 12.8 15.1, 15.2, 15.5

Lead themes	Recommendations	Challenges the recommendation addresses	UN SDG targets for future reporting
International Frameworks: UN SEEA	19. That DELWP establishes environmental–economic accounting as a core capability and delivers a set of environmental-economic accounts for Victoria by 2022, consistent with the SEEA guidelines, DELWP *Valuing and Accounting for Victoria's Environment strategy* and aligned with the agreed common national approach. Further, that the Minister for Environment include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to incorporate reporting against Victoria's environmental-economic accounts in State of the Environment reporting for Victoria from 2023.	Environmental–economic accounting capability addresses a gap in traditional SoE reporting which presents accurate and relevant environmental information on the state of Victoria's natural capital but not the direct and indirect benefits that all Victorians derive from healthy and sustainable ecosystems.	15.9
International Frameworks: UN SDGs	20. That the Minister for Environment include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to adopt the SDGs as an operating framework for SoE reporting in Victoria from 2023. This will require that DELWP support the Commissioner by leading a portfolio review of the data requirements to assess Victoria's progress against the selected SDG targets, which will include a complementary analysis of current legislation, policy and programs against the SDG targets, and the development of a plan to improve data-acquisition processes for socio-economic indicators by 2021.	The Commissioner for Environmental Sustainability Act 2003 provides objectives and definition for ecologically sustainable development (ESD). However, there has been ambiguity in delivering on the guiding ESD principles. The SDGs are the missing link that provide an operating framework that bring the ESD objectives and guiding principles in the Act to life.	16.6 17.14, 17.17

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VICTORIAN STATE OF THE ENVIRONMENT 2018 REPORT

SUMMARY REPORT Part II Global Context

Commissioner *for* Environmental Sustainability Victoria

VICTORIA State Government

Megatrends

The *Megatrends and the Victorian Environment 2018* report was prepared by Deloitte Access Economics and will be published at www.ces.vic.gov.au/Publications.[56] The report analyses the anticipated key trends that will influence and impact natural capital, and our management of it, in Victoria to 2030 and beyond. In this section, an abridged version of the Deloitte report is presented with a focus on the key insights.

These 'megatrends' have informed the Future Focus priorities and recommendations arising from each of the scientific assessments chapters in Part III of this report. The megatrends have enabled a top-down analysis, while the scientific assessments have provided a foundational, bottom-up evidence-base. Combined, these analyses have identified the most important priorities for Victoria's environment over the next decade and beyond.

The five megatrends identified are:

1. the physical impacts of climate change
2. reducing our carbon footprint
3. clued-up citizens shaping business and government practices
4. disruptive technologies
5. natural resource constraints.

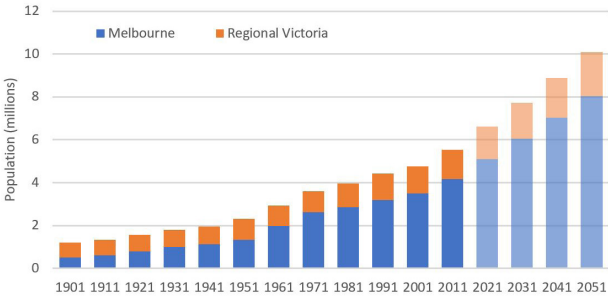


Figure 6 Victorian historical and forecast population growth, 1901 to 2051

(Source: DELWP[57], ABS[58])

Victorian context

Population

At the end of 2017, Victoria had a population of 6.4 million.

Latest Victorian Government projections indicate that Victoria's population will grow at an average rate of approximately 1.5% per annum to almost 8 million by 2031, and to 10 million by 2051. Victoria's population growth has outpaced projections for much of the past decade, and with actual observed population growth of 2.3% in 2017, these projections appear relatively modest.

Regardless of projection accuracy, what is clear is that Victoria's population is likely to continue to grow, and as it does, so too will its ecological footprint.

Economy

With a Gross State Product (GSP) of almost $399 billion in 2016–17, Victoria accounts for almost one-quarter of Australia's Gross Domestic Product (GDP), making it the second-largest state economy.

Whereas various other Australian states are rich in natural mineral resources, the Victorian economy has a greater reliance on knowledge-intensive industries. As such, the major sectors contributing to Victoria' GSP are services-based. Meanwhile, the state's strong population growth has underpinned a strong construction sector.

Victoria has shifted, and in some ways is continuing to shift, towards a services-based and more environmentally sustainable economy. Relative to 30 years ago, there are fewer major heavy industry and manufacturing sites. Recent years have seen the closure of sites such as the Ford and Toyota factories in Geelong and Altona, the Point Henry aluminium smelter and the Hazelwood coal-fired power plant.

Looking forward, Deloitte Access Economics forecasts show that Victoria's services sector is likely to continue to be the engine room for growth.

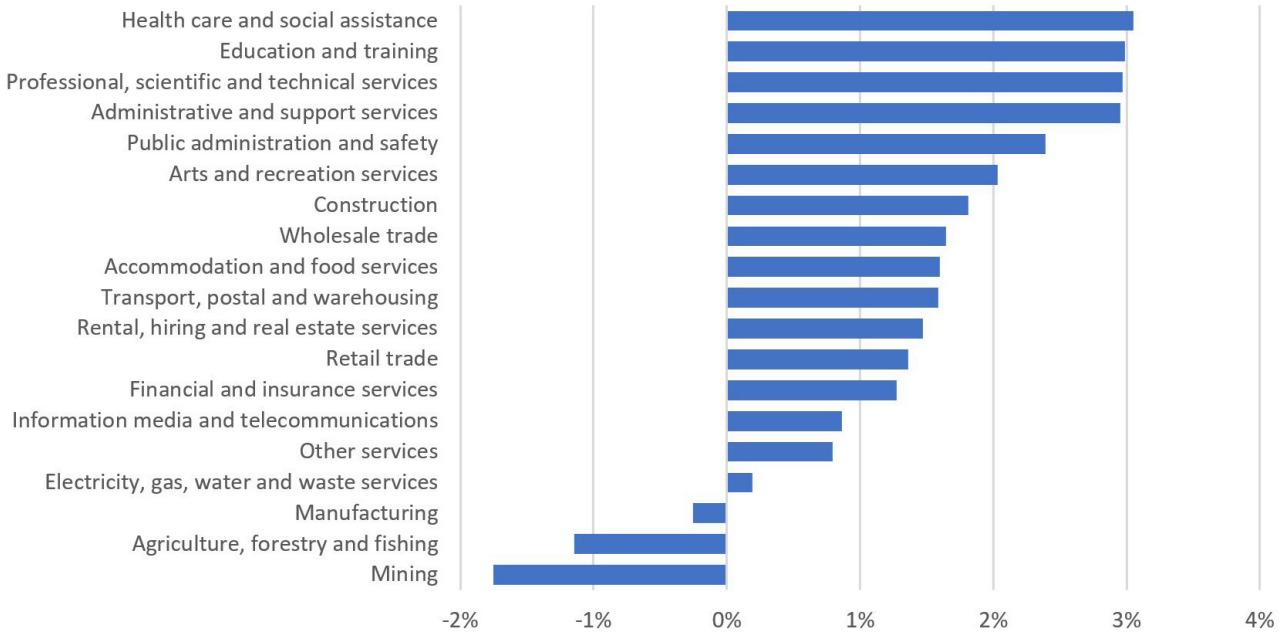


Figure 7 Forecast annual average employment change, Victoria, 2018–30

(Source: Deloitte Access Economics modelling)

Global economic and political conditions are also shaping Victoria

Victoria's population and economy are not growing in a vacuum. Global economic and political forces have and will continue to influence Victoria's growth trajectory.

The balance of global economic power is shifting with many reports noting that the coming decades will likely see a shift in global leadership, typically from traditional western economic powers to emerging economies across Asia, South America and Africa.[59] Meanwhile, political sentiment in traditional economic powers is also shifting – seeing a return to trade protectionism and reduced multilateral collaboration on global issues such as climate change, poverty and terrorism. Among some economies, there is currently a backlash against globalisation which may disrupt the alliances and trade partners that traditionally defined Australia's place in the global economy.

The growth in Asian economies, particularly China, should continue to have a powerful influence on the Victorian economy. China's growth has seen incomes and purchasing power increase for hundreds of millions of its citizens, resulting in stronger demand for goods and services. This trend should eventually see up to two-thirds of the global middle class residing in Asia by 2030.[60] This presents a significant opportunity for the Victorian economy to grow further. It is also likely to continue to underpin strong tourism and population growth in Victoria, placing growing demand on the environment and our natural resources.

Megatrend 1: The physical effects of climate change

Climate change is one of humanity's greatest challenges. Globally, temperatures are rising, and extreme weather events are becoming more frequent and severe.

Climate change poses a significant threat to both natural and built environments. Research indicates that impacts will be widespread, with coastlines shifting as sea levels rise and volatile weather patterns that will result in drought and floods. Extreme weather events will occur with increased incidence and severity. Rising temperatures could place strain on the biodiversity of our native flora, fauna and marine life. By 2030, the ocean will rise 7 to 18 cm across most of the state's coastline.[61] The combination of increased temperatures, wind, and longer stretches between rains will provide dangerous conditions across Victoria, with the potential for more bushfires.

These factors could have profound impacts on the way Victorians organise and operate in day-to-day life. Where, when and how Victorians work might change, with corresponding costs. Victorians' expectations of government will increase. It is likely that Victorians' health will be affected – both directly (such as deaths and injury caused by serious weather events), and indirectly (floods affecting water quality).[62]

Although Victoria has a role to play in reducing anthropogenic emissions and enabling technologies that support global transition, the biophysical changes Victoria experiences will be determined by the world's ability to reduce greenhouse gas concentration. Globally there is a push to limit global warming to 1.5°C above pre-industrial levels, as the consequences of higher global warming will be dire, particularly for vulnerable regions and ecosystems.[63] On the current trajectory, global warming levels are expected to reach 1.5°C by 2030–52.[64]

International cooperation will need to play a strong role in enabling the world to limit warming to 1.5°C by the end of the century, with global climate models relying on effective policy, such as a global price on carbon, to incentivise transition.[65] International relations may be strongly impacted by countries who fall out of step of the trajectory.[66]

Victoria will need to respond to the global challenges posed by climate change. Within South-East Asia alone, 40 million people are projected to be displaced by climate change by 2050.[67] The poorest and most vulnerable nations, including the Pacific island nations with low elevation, will see the greatest direct impact.[68] An influx of climate refugees is not currently included in Victoria's population forecast,[69] leading to the potential to disrupt Victoria's urban planning.

Megatrend 2: Reducing our carbon footprint

As the human-induced drivers of climate change become more apparent, industries and governments are changing existing practices and policies to reduce their carbon footprint.

In recent years, climate change mitigation and the reduction of greenhouse gas emissions, has emerged as a major international policy issue. In 2015, parties to the UN Framework Convention on Climate Change reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low-carbon future. The Paris Agreement set in place a durable and dynamic framework for all countries to take climate action from 2020, building on existing international efforts in the period up to 2020.

Victoria is well positioned to prosper as the world transitions to a net-zero-carbon economy, primarily through abundant wind and solar potential. New industries are expected to emerge, as Victoria gets smarter with diversification of energy sources and the production, usage and storage of clean fuels.

Over the next 30 years, our methods of transport are also likely to change. Although timelines remain uncertain, automated and/or zero-emissions vehicles are expected to move from the concept/design phase, into mainstream adoption. This could give rise to a raft of new policy and infrastructure challenges for government.

Megatrend 3: Clued-up citizens shaping business and government practices

As economies grow and its citizens become wealthier, more people have access to education. Concurrently, in the digital age, information is more accessible, allowing citizens to understand how their decisions are impacting on the world around them.

The ecological and social implications of consumer purchase decisions are becoming more broadly understood – whether those implications are environmental (such as reducing food wastage or disposable plastic) or ethical (such as animal welfare standards or worker conditions). Consumers are becoming increasingly 'clued-up'.

All levels of government and industry, as well as households, are introducing initiatives that collectively attempt to reduce the carbon footprint of the Victorian economy, recover a greater share of our growing waste, conserve habitats that support biodiversity and improve air and water quality.

The role of government will continue to evolve

Government policy can continue to play a key role in steering engaged consumers and business towards sustainable decisions, by providing signals, information and resources to support a more sustainable lifestyle. Governments' ability to monitor and manage impacts on the environment will only improve with technological innovations.[70]

Government organisations are embracing technology by disseminating research targeted at educating and persuading businesses and individuals to make environmentally conscious decisions. Some policies at the forefront of shifting Victoria's consumption patterns towards more sustainable decisions include the Sustainability Victoria 'TAKE2' pledge, 'Go5' and the 'Love Food Hate Waste' campaign.

Citizen science

Globally, clued-up citizens are increasingly participating in citizen science projects. Citizen science involves 'public participation and collaboration in scientific research, with the aim to increase scientific knowledge'.[71] While citizen science is not a new phenomenon – the first citizen-run bird census occurred on Christmas day in 1900 – it has gained increased popularity globally over the past two decades.[72]

Citizen science endeavours are becoming more common, due to the following:

- People are living longer, meaning that there is a large and often skilled cohort of retired people looking to put their skills and knowledge to use, and who have time to participate.
- Scientists and governments are realising the benefits of engaging volunteers, particularly where the geographic or temporal scale of the project is large.
- Technological advancement, most notably the widespread adoption of personal computers and, more recently smartphones and tablets, has unlocked the potential of citizen science and sped up the collection of data from citizen scientists.[73]

Our tourism footprint is growing

Relative to population and income growth, advanced economies around the world are experiencing a fall in material consumption. Wealthier, more educated, societies where basic material needs are met, demonstrate a preferential shift towards experiential services, meaning they allocate more of their income towards activities such as tourism, education and entertainment.[74]

Megatrend 4: Disruptive technologies

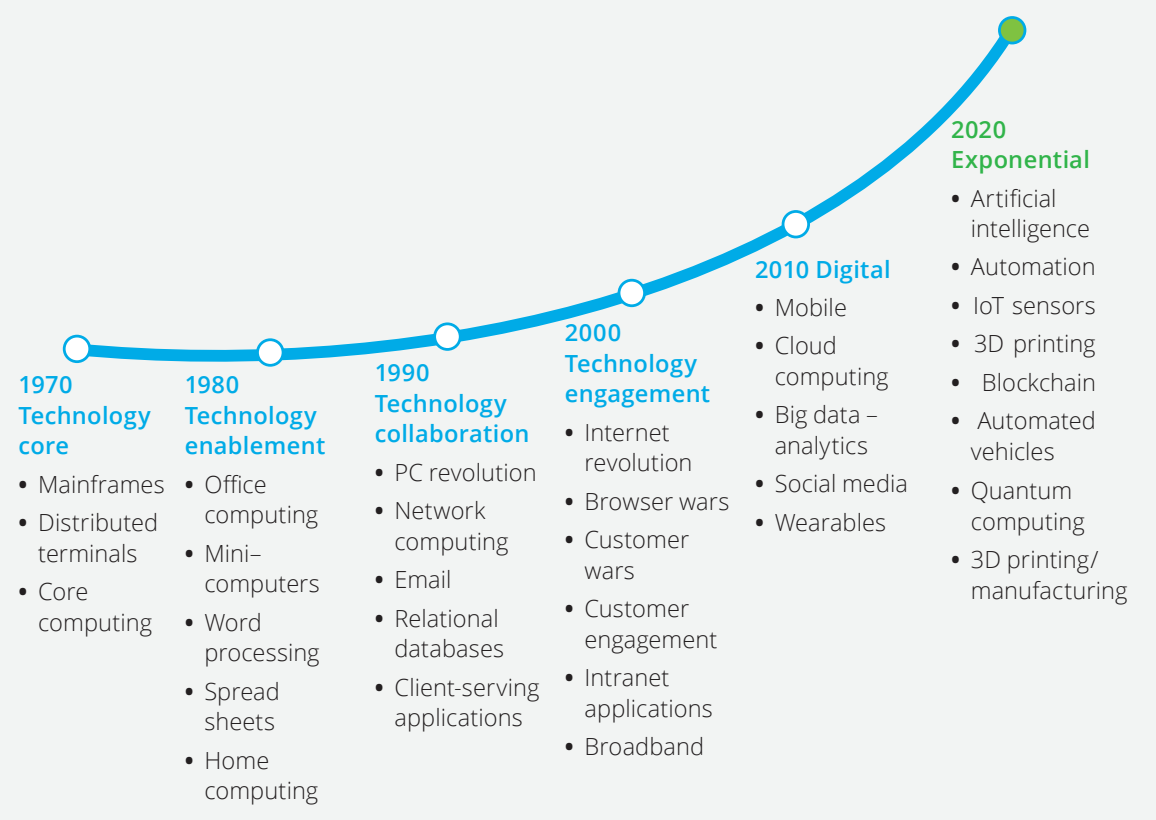
Over the past 50 years, technological advances have brought about exponential change in society and the economy. Global computing power is doubling every two-and-a-half-years. Technology is rapidly changing the way Victorians work, interact and move. The figure below summarises the disruptors that have characterised the last 50 years of technological change.

New, emerging and maturing technologies may not just influence – they could continue to revolutionise the future of Victoria's economy, the nature of work that Victorians do, and the way that they interact, travel and do business, all which impact on environmental outcomes. The exponential trajectory of technology suggests that the revolution in digital technologies has much further to run. Technologies such as mobile internet, big data and data analytics, the internet of things (IoT), and cloud technology are already seeing increased penetration with the potential for much more to come. There are also exponential technologies on the medium-to-longer term horizon that have the potential to have far reaching, transformative impacts.

The role of technology in improving environmental monitoring

In future, businesses and government agencies will use IoT-enabled sensors to monitor the environment. Sensors will monitor environmental factors – such as noise, air, temperature, water quality and CO_2. Current technology allows sensors to collect data on these variables and provide businesses with automated alerts and data visualisations.

Spatial technology already plays a role in environmental monitoring – for example, through the tracking of wildlife using GPS systems. Satellite technology will continue to improve environmental monitoring in other ways. For example, CSIRO scientists have developed a satellite-based blue-green algae alert system, while satellite technology is already in use to monitor the health of the Great Barrier Reef.[75] Long-term and large-scale satellite



(Source: Deloitte)

Figure 7 Exponential technological growth

monitoring can enable rapid detection in changes to the environment, such as land clearing, and can be used to efficiently identify suitable areas for biodiversity offsets.[76]

Low-cost, user-friendly and very compact air pollution monitoring platforms enable observations at high spatial resolution, in near-real-time. These platforms provide new opportunities to simultaneously enhance existing monitoring systems and enable citizen science. While there are concerns over the quality of data that these platforms can generate, as with all technology, improvement is likely to occur over time.[77]

Megatrend 5: Natural resource constraints

The rising global population is escalating the pressure placed on finite natural resources used to satisfy basic human needs. As we grow, our fixed quota of natural resources including water, non-renewable energy, minerals, land, fish and timber will come under more strain.

As the population expands, demands placed on the environment will increase. Demand for food, water, waste management and land for household, agricultural and industrial use will continue to grow, resulting in a reduction in fresh water supplies and impairments to biodiversity. Sustaining the projected population of 8.3 billion people in 2030 will see a 35% increase in food demand and a 40% rise in water demand globally from 2012 levels.

Future Focus

The following recommendation was included in the Future Focus section in Part I. However, it is repeated here for context as it draws from all five megatrends but principally from the drivers of, and impacts from, Megatrend 3: Clued-up citizens shaping business and government practices, and Megatrend 4: Disruptive technologies.

Develop spatial information capability

Spatial information provides fundamental and essential information that informs Victorian Government planning and decision-making across the environment portfolio. It can also be applied to assess regulatory compliance. Technological advances in spatial information has led to significant increases in accuracy. However, legislative and regulatory reform is not keeping pace with this technological advance.

This inconsistency generates several risks, including:

- outdated and unreliable data sources
- a reliance on physical maps that can be lost or degraded in the field
- confusion across and within government agencies as there is no single and accepted source of truth, resulting in each group developing their own spatial information database with varying levels of accuracy.

A spatial information resource that can be used as a single source of truth, that is regularly and routinely updated and can be accessed on a shared database across and within government agencies, and be publicly available, will help mitigate the above risks and reduce misinformation in the media and the public domain.

The government has committed to providing more detailed spatial information maps for any future allocation orders[79] in response to an ABC investigation regarding timber harvesting activity by VicForests).[80 81]

Recommendation 18: That DELWP develop its spatial information capability and database, and ensure it is regularly and routinely updated, to inform decision-making across the environment portfolio.

Applying International Frameworks

UN System of Environmental-Economic Accounting

The reforms undertaken in this SoE reporting cycle and outlined in the State and Benefit framework, aim to drive improved monitoring regimes leading to better environmental outcomes. This will require reporting that not only details the condition and trends in the health of the environment, but also reports on the benefits of the ecosystem services provided – services that society relies on. By showing the nexus between environmental, economic and social outcomes, State of the Environment reporting will help identify integrated policy solutions and responses.

A key feature of SoE 2018 is showcasing the potential of the United Nations SEEA by including information in each theme of Part III (provided by DELWP) on the development of a set of environmental-economic accounts.

The SEEA is a multipurpose conceptual framework for understanding the interactions between the environment and the economy. It provides internationally agreed standards on concepts, definitions and classifications for the organisation of relevant environmental, social and economic statistics that are then used for deriving coherent and comparable indicators and measuring progress towards policy goals and evaluating return-on-investment from investing in the environment.

An overview of the connections between the environment and the economy in the SEEA is provided in Figure 8. Recording the connection between the environment and the economy in the form of natural inputs and ecosystem services (and hence capturing the contribution of the environment to benefits arising from economic and other human activity) is at the centre of the SEEA approach. The SEEA extends the traditional production boundary used in the economy (that is, goods and services produced by economic units) to include the unpriced inputs provided by environmental assets, including ecosystems and biodiversity.

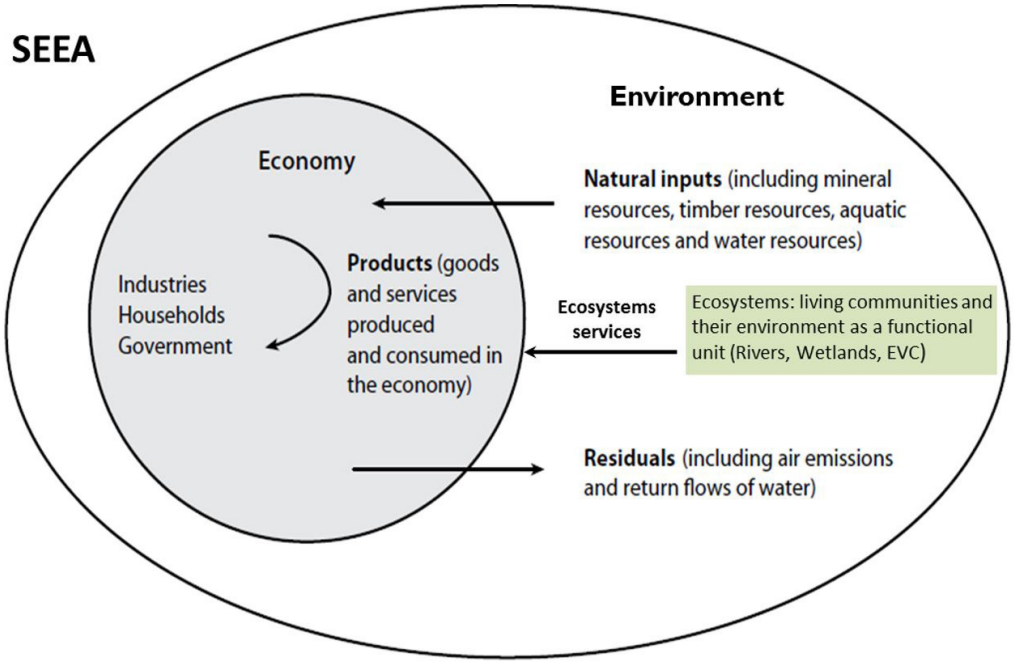


Figure 8 Overview of the United Nations SEEA expansion to cover ecosystems

(Source: Adapted by DELWP from United Nations 2014, System of Environmental-Economic Accounting 2012: Central Framework)

The extension of the boundary means that ecosystem accounting considers, in an integrated way, those ecosystem services used to produce tradable goods and services (such as the use of timber from forests, abstraction of water for household use) and ecosystem services that affect people but are unrecognised in market transactions, such as air filtration, flood protection and amenity services. Environmental-economic accounting can be used to integrate the measurement of environmental assets and value the benefits they provide in a coherent and consistent manner across many domains of the environment (such as water, land, soil, biodiversity and forests) using internationally agreed accounting concepts (see Figure 9).

Reflecting the logic of environmental-economic accounting, the aim of the State and Benefit framework for this SoE report is to present objective, accurate and relevant environmental information on both the state of Victoria's natural capital, and to emphasise the direct and indirect benefits that all Victorians derive from healthy and sustainable ecosystems.

In the past, the measurement of environmental assets and the benefits they provide has occurred separately and the results could not be combined easily for policy and decision-making. Using the SEEA guidelines and standards to integrate the state and benefit components provides a robust approach to assessing multiple benefits and trade-offs among alternative policy or management options.

Future Focus

The following recommendation was included in the Future Focus section in Part I. However, it is repeated here for context as it is in response to the rationale for establishing a set of environmental-economic accounts for Victoria presented above.

Establish a system of environmental–economic accounts for Victoria

In 2015, DELWP produced a plan to deliver a set of environmental–economic accounts by 2020: *Valuing and Accounting for Victoria's Environment: Strategic Plan 2015–2020*.[83] Although it is unclear if DELWP will be able to meet the 2020 deadline, commitment to the vision of the plan remains important. Subsequent to the release of the plan, the Victorian Government has been a leader in the interjurisdictional effort of environment ministers to release *A Common National Approach to Environmental-Economic Accounting: Strategy and Action Plan* (2017).[84]

Recommendation 19: That DELWP establishes environmental–economic accounting as a core capability and delivers a set of environmental-economic accounts for Victoria by 2022, consistent with the SEEA guidelines, the DELWP Valuing and Accounting for Victoria's Environment strategy and aligned with the agreed common national approach. Further, that the Minister for Environment include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to incorporate reporting against Victoria's environmental-economic accounts in State of the Environment reporting for Victoria from 2023.

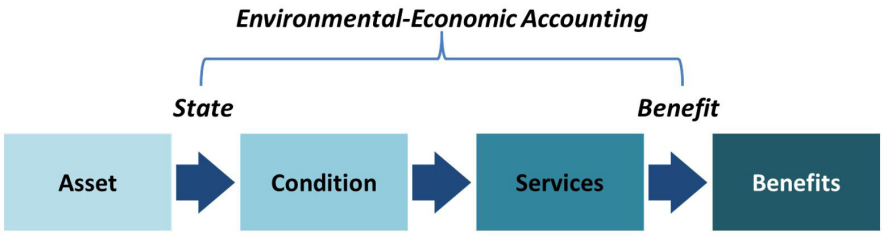


Figure 9 Integrating the measurement of environmental assets and valuation of their benefits

(Source: Adapted from *Valuing and accounting for Victoria's environment: Strategic plan 2015–2020*[82])

UN Sustainable Development Goals

The State and Benefit framework for SoE 2018 was tabled in Parliament in December 2015 and committed to aligning SoE 2018 with the United Nations SDGs.

The SDGs took effect on 1 January 2016[85] and recognise that the extent and condition of our ecosystem assets provide many social, cultural and economic benefits. The 17 SDGs provide a comprehensive and integrated framework of 169 targets and 230 indicators to support planning and reporting through to 2030. They provide business, government and civil society with a compelling framework for future growth that aims to be socially fair, environmentally sustainable and economically prosperous.

There are four critical aspects of the SDG framework that are relevant to SoE reporting. The SDGs provide:

1. a pre-prosecuted framework for reporting across complex and disparate areas of social, economic and environmental policy
2. a framework that is internationally agreed and widely supported
3. a common language for measuring progress against goals and targets
4. broad support from across business, government and community.

Many countries, businesses and stakeholder organisations are taking up the challenge of the SDGs, with initial efforts including a range of evidence-based assessments.[86, 87, 88]

Commissioner for Environmental Sustainability Act 2003

Prior to the establishment of this Act, ecologically sustainable development had been referred to in numerous state acts and policies without clear definition. The Act defines it as 'development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends'.

The Act outlines these objectives for ecologically sustainable development (ESD):

(a) to enhance individual and community wellbeing and welfare by following a path of economic development that safeguards the welfare of future generations

(b) to provide for equity within and between generations

(c) to protect biological diversity and maintain essential ecological processes and life-support systems.[89]

The Act also provides 'guiding principles of ecologically sustainable development' (s. 4(3)). Furthermore, the Objectives and Functions of the Commissioner (s. 8–9) clarifies that SoE reporting is a key function assisting the Commissioner in achieving the ESD objectives and delivering on the guiding principles.

The international adoption of the SDGs in 2016 enables the Commissioner for Environmental Sustainability to (i) analyse the SDGs through the authorisation of the Act, and (ii) identify which SDG goals and targets correspond with the ESD definition in the Act and will require reporting by the Commissioner. From this perspective, the SDGs are the missing link that bring the ESD objectives and guiding principles in the Act to life. The realisation of this link has been a significant insight. It is now clear that the United Nations SDG framework is intrinsic to fulfilling the commitments of the Commissioner for Environmental Sustainability under the Act.

National and Sub-National Reporting on SDGs Progress

Despite the growing interest in the utility and benefits of the SDGs, the reporting disciplines of national and sub-national governments is mixed. While many national governments have now reported on national progress against the SDGs in their Voluntary National Reviews submitted to the High Level Political Forum (HLPF) on Sustainable Development, very few have provided an evidence-based assessment of national progress against the SDG targets and indicators.[91]

Australia's Voluntary National Review

Australia's first Voluntary National Review (VNR) on implementation of the SDGs was launched by The Hon Julie Bishop MP, Minister for Foreign Affairs, on 15 June 2018 and was delivered to the United Nations HLPF on Sustainable Development on 17 July 2018.

The Australian Government took a narrative approach to the VNR, addressing each of the SDGs with case studies and other analyses. Australia's VNR does not attempt to systematically assess Australia's progress towards the SDG targets and indicators. The Australian Government also released an online SDG data platform that houses Australian datasets. Each SDG indicator has been assessed for potential reporting and provided with a colour code to indicate the availability of a dataset.[92]

Sustainable Development Solutions Network's 2018 SDG Index

At the global level, Australia was one of 156 countries assessed in the 2018 SDG Index on SDGs progress undertaken by the Sustainable Development Solutions Network (SDSN). Australia was ranked 37 with an overall index score of 72.9.[93] Australia ranks below the Western European and Others Group (WEOG) members average score for OECD countries of 76.9 in 2018.

National Sustainable Development Council's Transforming Australia Project

A national assessment of Australia's progress on the SDGs was also undertaken by the SDG Transforming Australia Project produced by the National Sustainable Development Council (NSDC). The NSDC includes senior representatives from business, civil society and academia in Australia. The assessment responded to the outcome from the Australian SDG Summit held in 2016, which identified the need for a national baseline assessment of Australia's progress on the SDGs as a top-priority action.[94] SDG Transforming Australia's website provides a 'dashboard' assessment of national data with analysis and reports on progress. Broader Australian themes (for example, 'Australia's changing economy' and 'Society and environment') draw the SDGs together, exploring interlinkages across the goals.[95]

Victorian Sub-National Reporting

The Victorian SoE 2018 report is the first attempt at the sub-national scale in Australia to apply the SDGs as an operating framework for reporting. What differentiates this approach from Australia's VNR, the SDG Index and SDG Transforming Australia is that the Victorian SoE is led by an independent Commissioner who has the authority, in Victorian legislation, to drive reform of data collection to improve assessment and reporting.

Many agencies and individuals collect information about the state of Victoria's environmental assets (land and biodiversity, forests, water, marine and coasts, air and climate). The SDGs provide an international reporting framework to bring uniformity and a common language to reporting across the state, while still maintaining local independence to report on indicators of importance at a regional scale. The introduction of statewide indicators, nested in an international reporting framework, will ensure linkages between relevant statutory environmental reporting in Victorian legislation. Ultimately, as alignment of SDG assessments and SoE reporting is refined in the 2019–2023 and subsequent reporting cycles, this consolidation will produce a state-level reporting regime of statutory environmental reports that 'talk to each other'.

The State and Benefit co-creation model (a commitment to working with community, academia and government agencies as partners in the data cycle) has also fostered a spirit of partnership in the development of this SDGs reporting approach. It enables the goals, targets and indicators to be assessed in terms of current legislation, policies and programs within Victoria – to inform continuous improvement of management settings. This 'sense-checking of policy coherence' with government and community partners provides an opportunity to examine interlinkages and management gaps with the intention of driving systemic change and supporting decision-making at the state level.

The Method

An Approach Framed by Targets

Another important distinction between the Victorian SoE reporting approach and Australia's VNR, the SDG Index and SDG Transforming Australia, is that it focuses on the SDG targets, rather than the goals or SDG indicators.

Although useful as a framing and communication device, working at the goal level proved too broad: it reinforced silos, and did not convey the 'indivisible whole' anticipated by the SDG framework.[96] The current suite of SDG indicators (230 across 169 targets) were also inadequate to drive alignment as the SoE reporting process in Victoria was already well-established and sophisticated for the biophysical sciences, with many potential indicators to draw on to inform assessment of the corresponding SDG targets. The SDG indicators, at least at their current stage of development, do not offer comprehensive measurement of the targets – and often the indicators are not nuanced for local knowledge or management priorities.

The targets were considered the best frame for aligning SDGs with SoE reporting because the targets are action-oriented and enable a direct assessment for achieving ESD outcomes through policy and management interventions. Priority SDG targets of relevance and importance for Victoria's long-term sustainable development were identified, and then potential indicator options explored, drawing from the established SDG indicators as well as other regional, state and national indicators.

The Seven Phases

The Commissioner's team of scientists devised a seven-phase process to explore the potential for the SDGs to provide an operating framework for environmental monitoring and reporting in Victoria. (The seven phases happened organically through an exploratory method, rather than being a linear process designed when the project was initiated.)

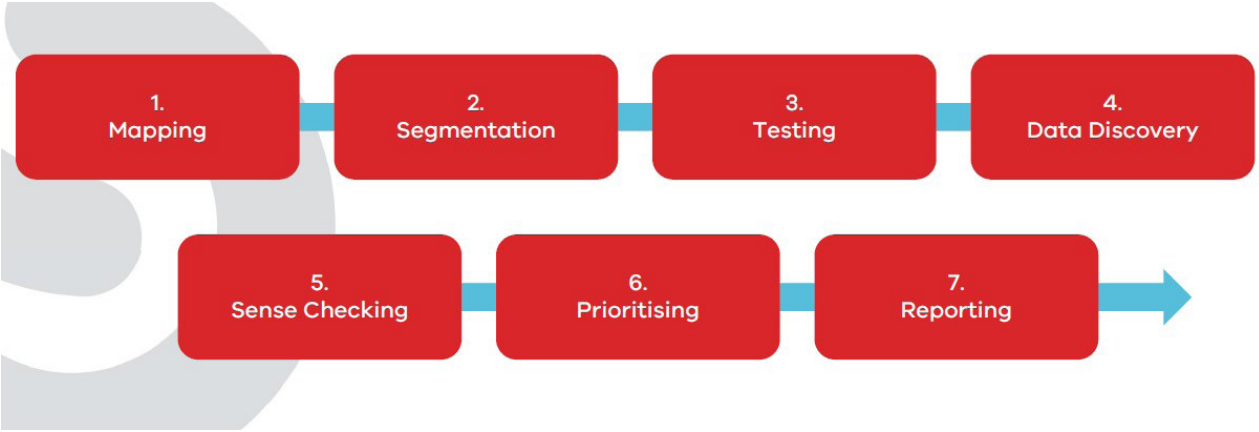


Figure 10 The seven-phase process to explore the potential for the SDGs to provide an operating framework for environmental monitoring and reporting in Victoria.

Engagement with decision-makers, academia, government, industry and community leaders (phases 3-6) prompted a broader understanding of the SDGs and their applications, introducing thinkers from outside the environmental disciplines to ESD principles and engaging environmental practitioners in a wider story of social and economic development. Working in this way encouraged a view of the whole and cut across bureaucratic silos. It became clear that a model of reporting was going to be required that went beyond the technical application of a measurement framework and embraced the importance of creating meaningful narratives. This was not easy. Developed in parallel with the national processes outlined earlier, the project provided a real opportunity for co-creation and co-design with community, government and data custodians.

PHASE 1: Desktop Mapping

The first phase of the process was a desktop exercise in which the draft SoE 2018 indicators were mapped against the SDG goals and targets. These were predominantly biophysical indicators associated with the environmental SDG goals (goals 6, 13, 14 and 15) and targets – although the draft list did include some well-established socio-economic SoE indicators, for example in the energy sector.

This phase demonstrated that there was strong alignment between the Victorian SoE and the SDGs. It also showed that while alignment was strongest against the four environmental SDG goals, there was also significant alignment with other SDG goals and targets.

PHASE 2: Segmentation

While Phase 1 mapped the SoE indicators to the SDG goals and targets, Phase 2 focused on the 169 SDG targets and assessing their appropriateness for SoE reporting in Victoria.

Criteria were established for assessing alignment between SDG targets and SoE reporting. The target must:

1. assess the benefits of, or impact on, natural capital
2. be relevant to Victoria
3. have available data to assess it (although this criterion did not disqualify a target – it only impacted on its categorisation; that is, it was assessed for inclusion in the SoE 2018 or as an aspirational target for future reporting).

This phase segmented the targets into three categories. The assessment identified where there was a strong alignment with existing SoE indicators, potential alignment for socio-economic SDGs targets with the SoE, and targets assessed to be out-of-scope for SoE reporting.

PHASE 3: Roundtable Discussion

The segmentation from Phase 2 was further interrogated in a roundtable discussion with a group of experts. The key objective of this phase was to 'stress test' the process undertaken in the initial phases to confirm the value to Victorian SoE

reporting. This objective was not only to improve the scope and comprehensiveness of the SoE but whether the method could improve a key outcome of environmental reporting – to support the evidence base for better decision-making.

The roundtable evaluated the process as purposeful and challenging and recognised the potential benefits of aligning SoE reporting with the SDG goals and targets. Following the roundtable, the mapping and segmentation was amended and prepared for presentation to a wider group of stakeholders, including data custodians.

PHASE 4: Discussions with Stakeholders and Data Custodians

The provisional list of SDG targets identified in the first three phases informed the engagement with stakeholders and data custodians in Phase 4. Interviews explored the 'opportunities' that exist for data collection for the socio-economic targets identified in Phase 2 – those targets not within the scope of conventional SoE reporting. This engagement also enabled a refining of the assessment of the third criterion (in Phase 2) of current data availability and whether a target could be meaningfully reported on in SoE 2018. Interviews also assessed the value proposition of the process and the enthusiasm of each stakeholder or data custodian.

Key questions included:

- what data exists?
- how is the current data being used?
- would they (or how would they) use the proposed data sets?

PHASE 5: Strategic Engagement with the Commissioner's Reference Group

Phase 5 involved stepping through the process so far with the Commissioner's Reference Group (CRG). The CRG is a statutory requirement of the Act.

It was agreed by the CRG that the ultimate purpose of the initiative to include SDG targets as part of SoE reporting should be to:

- ensure Victoria has the data that it needs to make the best decisions to protect and improve the environment
- influence decision-makers
- improve environmental outcomes.

The CRG noted that the Commissioner's method had the potential to improve environmental policy coherence across the state. The members also identified a limitation in the process. The first five phases had been focused on assessing the alignment of SDG targets rather than the relative value of the targets to Victoria's ESD. The CRG recommended a broader workshop to introduce 'thought leaders' to the process and rank the value of the candidate socio-economic SDG targets for potential inclusion in the Victorian SoE 2018 report.

PHASE 6: High-Level Workshop

The workshop had four key objectives:

1. increase awareness and understanding of the SDGs as practical and accessible at the state level
2. engage environmental leaders, decision-makers and stakeholders from across government, business, NGOs and the community
3. engage participants in the process of prioritising and selecting socio-economic SDG targets for inclusion in Victoria's SoE 2018
4. to ensure Victoria has the data that it needs to make the best decisions to protect and improve the environment.

The workshop, held in Melbourne on 27 February 2018, was opened by the Minister for Energy, Environment and Climate Change, the Hon. Lily D'Ambrosio MP.

"Putting the United Nations' Sustainable Development Goals under the microscope to determine which are the most relevant to environmental reporting in Victoria is a crucial step in achieving meaningful, high quality and transparent reporting."

Hon. Lily D'Ambrosio MP

The workshop shifted the focus from what can be reported, to what needs to be reported, with: (i) the prioritisation of the candidate targets for Victoria, and (ii) which targets the stakeholders want information on. The participants were introduced to each candidate target and were polled using an app on their mobile phones in real-time.

PHASE 7: Selection of Targets (and Corresponding Indicators)

Phase 7 consisted of collecting and collating data against the 52 selected SDG targets (see Table 8). It was important to include all selected SDG targets identified by phases 1-6 (and corresponding SoE indicators) and not limit the analysis to the targets with the most compelling data. The data can be improved over time. It is necessary to shine a light on the targets (and corresponding indicators) that are critical gaps in telling the complete ESD story for Victoria. Similarly, it is important to note that the current list of selected SDG targets may change over time, as the sophistication of the operating framework improves, and the narrative becomes more precise. This project is intended as the beginning, not the end, of the journey to apply the SDGs to SoE reporting in Victoria. Although unable to comprehensively report against all the selected SDG targets in SoE 2018, this project has gone further in this reporting cycle than initially envisaged.

Table 7 SDG Targets by category

SDG Targets	
Biophysical targets aligned with SoE	22
Socio-economic targets aligned with SoE	30
Out-of-scope	117
Total	169

First Results

The first indicative results are provided in the Dashboard (Table 8); however, data quality for the socio-economic targets is generally poor at this stage. Improving the evidence base for assessing the critical socio-economic targets will require innovative and creative data-acquisition methods, developing relationships with new data partners (both organisations and individuals) and a broadening of the definition of conventional data inputs. A critical next step for all the selected targets is to augment the indicators and metrics, and corresponding data requirements, for each target (both quantitative and qualitative data) in consultation with experts in the respective disciplines (see recommendation 20).

Significantly, the status and trend assessments in the Dashboard (Table 7) are indicative only – especially when the data quality is assessed as 'poor' or 'fair'. It is important to acknowledge that even for the SDG targets that have many corresponding SoE indicators (for example, in goal 14 and 15), that does not mean the indicators comprehensively assess the target: there could still be gaps, and that analysis will be undertaken in the 2019-23 SoE reporting cycle. Furthermore, some corresponding indicators are going to be more important than others when assessing an SDG target – indicators will require a 'weighting' – and this analysis will also be completed in the next reporting cycle.

Table 8 Established and Emerging SDG Targets

Within established (biophysical) SoE scope		New and emerging (socio-economic) SoE scope		
SDG Goal	**SDG Target**	**Status**	**Trend**	**Data quality**
	1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	Poor	Unclear	Poor
	2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	Fair	Stable	Good
	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Unknown	Unclear	Poor
	2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified se ed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilisation of genetic resources and associated traditional knowledge, as internationally agreed	Fair	Unclear	Poor
	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	Fair	Stable	Good
	4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	Fair	Stable	Good
	5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	Fair	Improving	Good

Within established (biophysical) SoE scope		New and emerging (socio-economic) SoE scope		
SDG Goal	**SDG Target**	**Status**	**Trend**	**Data quality**
6 CLEAN WATER AND SANITATION 	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Fair	Stable	Good
	6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	Fair	Stable	Good
	6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation, as appropriate	Fair	Stable	Good
	6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Poor	Stable	Good
	6.b Support and strengthen the participation of local communities in improving water and sanitation management	Fair	Stable	Good
7 AFFORDABLE AND CLEAN ENERGY 	7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	Fair	Improving	Good
	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	Poor	Improving	Fair
	7.3 By 2030, double the global rate of improvement in energy efficiency	Poor	Stable	Good
8 DECENT WORK AND ECONOMIC GROWTH 	8.4 Improve progressively, through to 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10 Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead	Poor	Stable	Good
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	Poor	Deteriorat-ing	Fair
11 SUSTAINABLE CITIES AND COMMUNITIES 	11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	Poor	Stable	Good
	11.3 By 2030, enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	Unknown	Unclear	Poor

Within established (biophysical) SoE scope		New and emerging (socio-economic) SoE scope		
SDG Goal	**SDG Target**	**Status**	**Trend**	**Data quality**
	11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	Fair	Stable	Fair
	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	Fair	Stable	Fair
	11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	Fair	Stable	Good
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	Fair	Stable	Good
	12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	Fair	Stable	Good
	12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their lifecycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimise their adverse impacts on human health and the environment	Fair	Stable	Fair
	12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	Fair	Stable	Fair
	12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	Poor	Stable	Good
	12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities	Fair	Improving	Good
	12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	Unknown	Unclear	Poor
	12.c Rationalise inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimising the possible adverse impacts on their development in a manner that protects the poor and the affected communities	Poor	Improving	Good
13 CLIMATE ACTION	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	Fair	Deteriorating	Good
	13.2 Integrate climate change measures into policies, strategies and planning	Fair	Improving	Good

Within established (biophysical) SoE scope		New and emerging (socio-economic) SoE scope		
SDG Goal	**SDG Target**	**Status**	**Trend**	**Data quality**
	13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	Unknown	Unclear	Fair
	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	Unknown	Unclear	Poor
	14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	Unknown	Unclear	Poor
	14.3 Minimise and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	Unknown	Unclear	Poor
	14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	Fair	Stable	Fair
	14.5 By 2020, conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information	Fair	Stable	Good
	14.b Provide access for small-scale artisanal fishers to marine resources and markets	Unknown	Unclear	Poor
	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	Poor	Deteriorat-ing	Good
	15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	Fair	Stable	Good
	15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	Fair	Deteriorat-ing	Good
	15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	Fair	Stable	Good
	15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	Fair	Deteriorat-ing	Fair
	15.6 Promote fair and equitable sharing of the benefits arising from the utilisation of genetic resources and promote appropriate access to such resources, as internationally agreed	Unknown	Unclear	Poor

Within established (biophysical) SoE scope		New and emerging (socio-economic) SoE scope		
SDG Goal	**SDG Target**	**Status**	**Trend**	**Data quality**
	15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	Good	Stable	Good
	15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	Poor	Deteriorat-ing	Fair
	15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	Fair	Improving	Fair
	16.6 Develop effective, accountable and transparent institutions at all levels	Poor	Unclear	Poor
	17.14 Enhance policy coherence for sustainable development	Poor	Unclear	Poor
	17.17 Encourage and promote effective public, public–private and civil-society partnerships, building on the experience and resourcing strategies of partnerships	Fair	Stable	Fair
	17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement GDP, and support statistical capacity-building in developing countries	Unknown	Unclear	Poor

Distribution of Selected SDG Targets

The selected SDG targets are distributed across all goals except for goal 10: Reduced Inequalities. However, there is the possibility that this goal will become relevant to SoE reporting in Victoria in the future.

The broad representation of SDG goals across the 52 selected SDG targets (Figure) is testament to the interconnectedness of the United Nations' design of the SDGs, as well as the systems approach adopted that interrogated each SDG target on its merit, rather than its presumed applicability to SoE reporting based on the goal to which it was assigned.

At this stage of development, there is a limited number of SoE indicators aligning with targets in goals 1, 3, 4, 5, 8, 9 and 16.

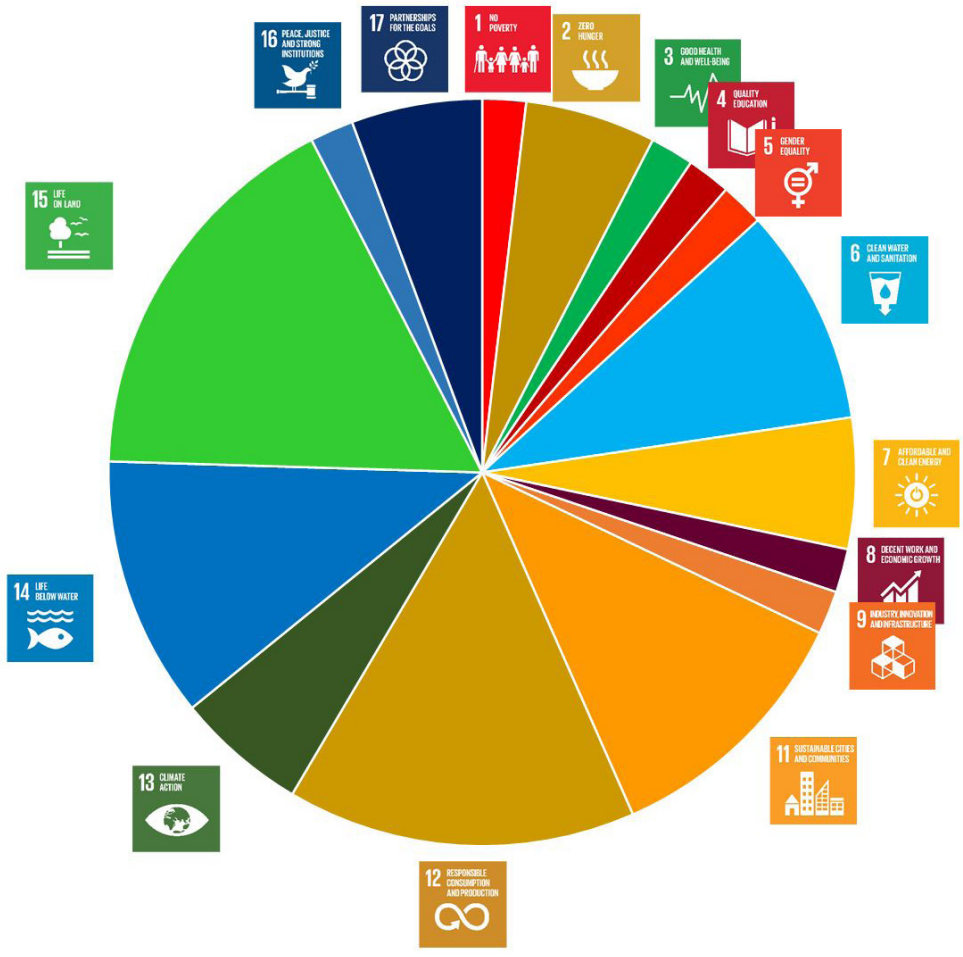


Figure 12 Distribution of the 52 selected SDG Targets by SDG Goals

The number of SoE indicators is not distributed across the 17 goals equally (Figure 12 and Table 9). As would be expected in an environmental report, more than half (53%) of the 'total' indicator count support assessments of targets in goals 14 (Life Under Water) and 15 (Life on Land).

Note: This figure includes the 170 indicators from SoE 2018 and 19 additional indicators from the State of the Bays (SoB) 2016. The SoB 2016 included a total of 36 indicators; 17 were updated and included in SoE 2018.

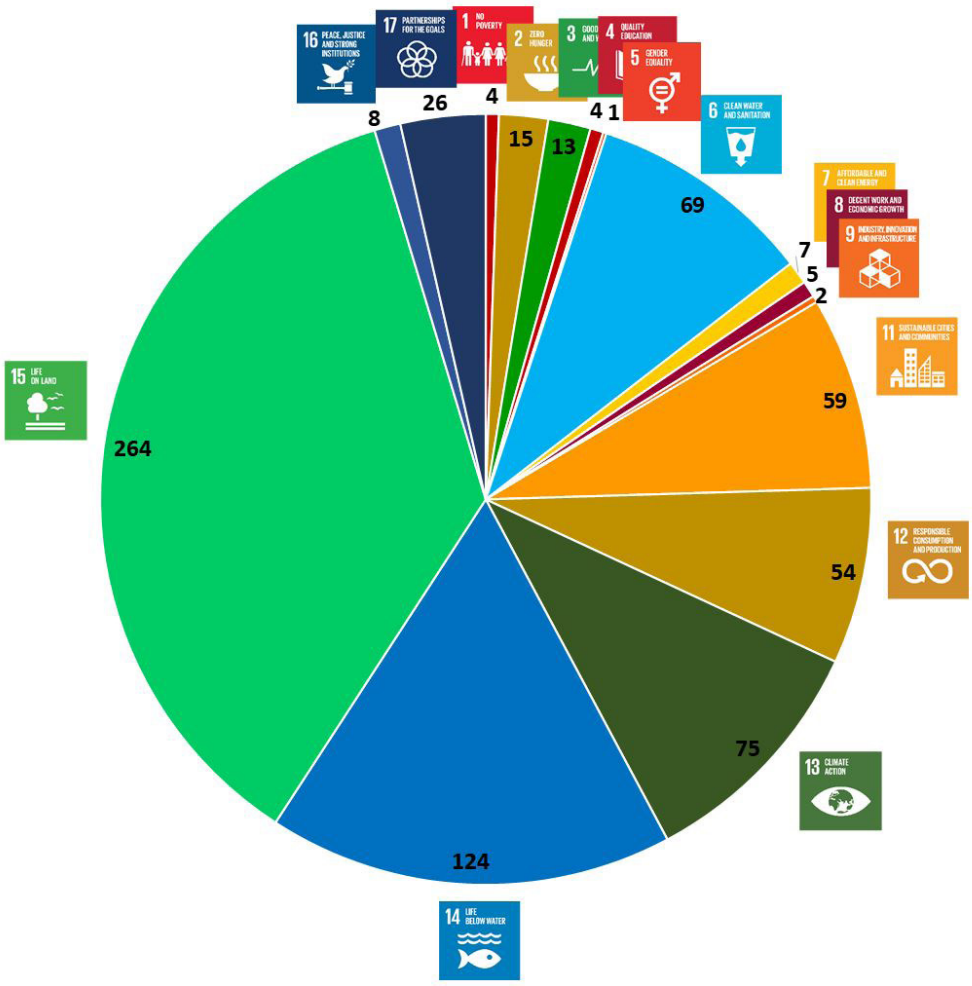


Figure 13 Distribution of the 189 SoE indicators across the SDGs

Table 9 Distribution of the 189 SoE indicators against SDG Goals and a list of relevant SDG Targets against SDG Goals

SDG goal	Selected SDG targets	Number of indicators in State of the Environment report	Proportional distribution of indicators
1: No Poverty	1	4	0.5%
2: Zero Hunger	3	15	2.1%
3: Good Health and Wellbeing	1	13	1.8%
4: Quality Education	1	4	0.5%
5: Gender Equality	1	1	0.1%
6: Clean Water and Sanitation	4	69	9.5%
7: Affordable and Clean Energy	3	7	1.0%
8: Decent Work and Economic Growth	1	5	0.7%
9: Industry, Innovation and Infrastructure	1	2	0.3%
11: Sustainable Cities and Communities	6	59	8.1%
12: Responsible Consumption and Production	8	54	7.4%
13: Climate Action	3	75	10.3%
14: Life Below Water	6	124	17.0%
15: Life on Land	9	264	36.2%
16: Peace, Justice and Strong Institutions	1	8	1.1%
17: Partnerships for The Goals	3	26	3.6%
Total		730[97]	100.0%

Data Quality Assessment

To enable meaningful assessment of the 52 selected SDG targets, significant improvements to the evidence base will need to be undertaken, particularly to inform the 30 socio-economic targets (see recommendation 20). The analysis concluded that there is 'good' data for 13 of the 22 established SoE biophysical targets (59%) but that the socio-economic targets have a dramatically higher proportion of 'poor' data quality (30%, 9 SDG targets) than the biophysical targets (14%, 3 SDG Targets).

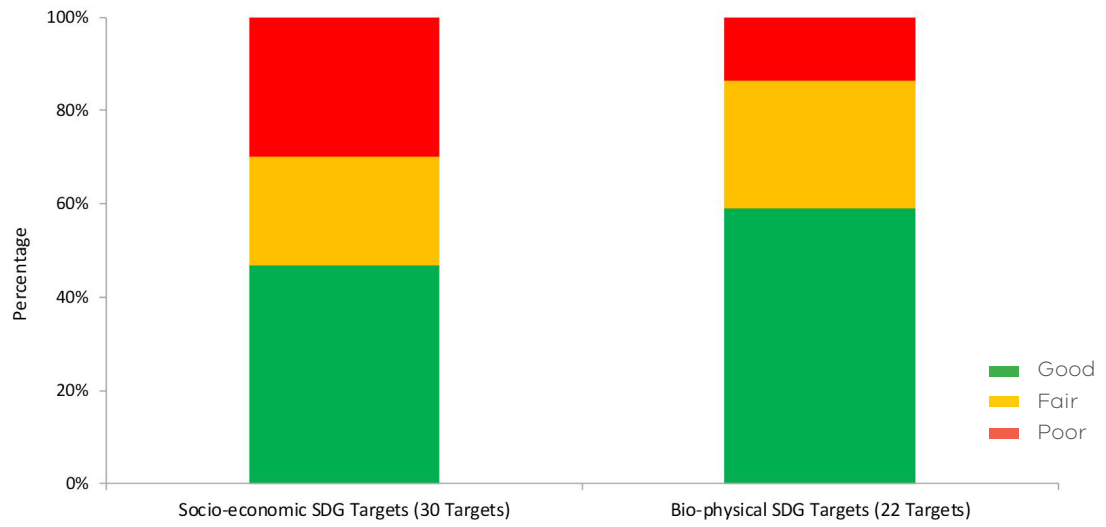


Figure 14 Proportional distribution of data-quality assessments for 52 SDG targets, as grouped into two categories: socio-economic (30 targets) and biophysical (22 targets)

Table 10 Number of SoE indicators that have 'good' and 'fair' data quality against each SDG Goal

SDG goal	Number of SDG targets	Number of SoE indicators	No. of 'good' and 'fair' data-quality assessments	Proportion
1	1	4	1	25%
2	3	15	9	60%
3	1	13	10	77%
4	1	4	3	75%
5	1	1	1	100%
6	5	69	54	78%
7	3	7	7	100%
8	1	5	5	100%
9	1	2	2	100%
10	0	0	0	
11	5	59	46	78%
12	8	54	38	70%
13	3	75	69	92%
14	6	124	89	72%
15	9	264	211	80%
16	1	8	4	50%
17	3	26	19	73%
Total	52	730	568	78%

Future Focus

The following recommendation was included in the Future Focus section in Part I. However, it is repeated here as it is the natural next step after the seven phases presented here. This recommendation is the eighth phase in the methodology for adopting SDGs as an operating framework for environmental reporting in Victoria.

Apply the SDGs to State of the Environment reporting

Comprehensive mapping of SoE indicators against SDG targets was undertaken to inform environmental reporting and information requirements. Ideally, the Victorian Government would complement this analysis by mapping current legislation, policy and programs against the targets so that future data reform and prioritisation is consistent with management priorities and an adaptive management cycle.

Developing the SDGs as an operating framework represents a fundamental shift for SoE, from reporting on what is occurring in the natural environment, to include additional analysis on how environmental change impacts society and how these impacts are managed. Assessing the SDG targets, and developing a set of environmental-economic accounts for Victoria (see recommendation 19), will require new skills and new data collection and monitoring regimes by the environment portfolio, and the Victorian Government more broadly.

Early analysis for SoE 2018 found that Victorian Government agencies in the environment portfolio do not collect sufficient socio-economic data for many of the relevant SDG targets to be assessed. To report effectively on the SDG targets in future, data-acquisition processes will need to be broadened to include individuals (some of whom will identify as citizen scientists) and agencies that have not traditionally contributed to SoE reporting.

This expanded reporting regime will require:

- broadening of the definition of conventional data inputs
- innovative and creative data-acquisition methods and supporting investment
- relationships with new data partners (both organisations and individuals)
- augmentation of current indicators and metrics, and corresponding data requirements, for each target (both quantitative and qualitative data) in consultation with experts in the respective disciplines.

However, transitioning to the SDGs as the operating framework for SoE reporting in Victoria will require more than data-collection reform. It will also require that government and community partners work together to maintain adaptive management principles, drive systemic change and support evidence-based decision-making at the state level.

Recommendation 20: That the Minister for Environment include in the Statement of Expectations to the Commissioner for Environmental Sustainability a requirement to adopt the SDGs as an operating framework for SoE reporting in Victoria from 2023. This will require that DELWP support the Commissioner by leading a portfolio review of the data requirements to assess Victoria's progress against the selected SDG targets, which will include a complementary analysis of current legislation, policy and programs against the SDG targets, and the development of a plan to improve data-acquisition processes for socio-economic indicators by 2021.

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Authorised by the Commissioner
for Environmental Sustainability

Level 36, 2 Lonsdale Street
Melbourne, Victoria 3000

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The Office of the Commissioner for Environmental Sustainability
Level 36, 2 Lonsdale Street
Melbourne Victoria 3000
T 03 9948 2829
www.ces.vic.gov.au

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