

GOAL **FIVE** UNDERSTANDING THE ENVIRONMENT



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GOAL FIVE UNDERSTANDING THE ENVIRONMENT

5.1 Monitoring and Data Collection

Proposition

Many of the recommendations in the 2008 State of the Environment Report in the Land and Biodiversity chapter related to the need for better monitoring (see for example LB1.7, LB2.8, LB3.3, LB3.6 and LB4.3).

Furthermore, Part A of this document illustrates that there is significant opportunities for improvement in monitoring. In some instances the methodologies for monitoring and reporting have changed, creating problems in comparing indicators over time.

It is imperative we review the state of environmental monitoring in Victoria and identify key gaps and priorities for funding.

It is also important that there be some formal recognition of the role of citizen science and the invaluable work the community does.

Mechanisms need to be established for guiding future monitoring and it is important that this is done on the basis of management targets (for example, the benchmark targets for the Index of Stream Condition, due to be established in 2018). These targets need to be established at state level by the government. Furthermore, we require formalisation of the following:

- agreed standards and protocols
- centralised accreditation for reporting, consistent with existing national and international programs.

Context

In a seminal article in 2007, multiple authors asked: – ‘Who needs environmental monitoring?’¹

The answer was: ‘... monitoring should be considered a **fundamental** component of environmental policy’ (emphasis added).

This view has been reiterated by policy advisers, biophysical and social scientists, and community commentators over many years.

Monitoring is fundamental to understanding environmental health and the state of ecosystems and therefore it is pivotal in understanding the benefits of ecosystem services. It is also crucial in determining the impact of human activities on the environment.^{2–23}

5.1.1 The importance of monitoring

Planning forwards²⁴ is fundamental to environmental management – however, looking backwards informs that process. Strong standards and protocols – and adequate resource allocation – for data collection provides the evidence base for review of our intervention and management of Victoria’s natural capital.

Appropriate environmental monitoring is an essential component of adaptive management. In this process, management actions are cyclically evaluated and adjusted based on progress towards clearly defined targets. This approach, which is being increasingly adopted by natural resource managers (for example, by Parks Victoria²⁵ and nationally for wetland habitats),²⁶ requires indicators that are appropriately chosen and properly monitored to demonstrate progress – or otherwise – towards desired environmental outcomes.

Monitoring and the collection of data enables environmental practitioners to:

- address barriers to change and good management
- undertake knowledge gap analysis
- support technology transfer and scientific and technological cooperation
- develop and review targets
- update biodiversity strategies, action plans and indicators.

Internationally, at the *2012 Conference of Parties (COP 11) to the Convention on Biological Diversity* (which Australia has ratified) delegates reiterated the imperative of monitoring.²⁷

5.1.2 Indicator formalisation and continuity

To ensure the importance of ongoing monitoring is elevated and that data collection is supported appropriately, the standards and protocols for monitoring need to be formalised to the extent that this is possible.

Continuity of indicator selection and funding of ongoing monitoring is fundamentally important. Data sets are of limited use if they lack continuity. Discontinuity in respect of monitoring and the production of data sets represents a waste of often limited resources. For this reason alone we need to be organised in our selection of indicators and consistent in our scrutiny of them.

Having made those observations, it is important to observe that a great deal of environmental monitoring work is being undertaken. High-quality environmental data is essential to monitor long-term changes in ecosystem function and quantify the effects of management decisions and environmental degradation on the provision of essential ecosystem services.²⁸

We require monitoring which:

- is historical and long-term
- operates across wide scales
- is locally specific, addressing variability
- provides an understanding of tipping points and the consequence of crossing them
- reflects upon the effectiveness and impacts of the environmental management which is actually being undertaken
- is guided by long-term goals for environmental outcomes.

5.1.3 Increased support for environmental monitoring programs is necessary

Effective environmental management needs to be supported by adequate monitoring of the state of ecosystems that can demonstrate progress towards clearly defined environmental objectives and targets that guide and inform adaptive management decisions. Numerous independent assessments have concluded that such monitoring has not been achieved in Victoria. It is critical that baseline monitoring is improved and a stable, long-term source of funding to support this monitoring is ensured.

Commensurate to this, it will be critical to review and consolidate current and historical environmental knowledge. This would include an analysis of crucial areas that have been under-represented in monitoring (e.g. biodiversity). Where practical, this would be entered into modern databases to allow inclusion in future analyses.

5.1.4 Monitoring and reporting in Australia

A range of large-scale data collection is undertaken in Australia. Nationally the Australian Bureau of Statistics (ABS) and the Bureau of Meteorology (BoM) report on environmental data. The ABS is constantly updating its data sets and publishing information online for the public.²⁹ Biophysical data and satellite imagery is provided by Geoscience Australia (GA).³⁰

5.1.4.1 ABS monitoring

Nationally, the ABS collects data on a number of environmental themes:

- Climate and natural resources
- Energy
- Environmental management
- Greenhouse gas emissions
- Land use and management
- Sustainability
- Waste.

The most recent ABS publication on environmental trends (released in 2010) reported on:

- population and urban issues
- human activities (including trends on energy and waste)
- atmosphere
- water (including trends on consumption, conservation and management)
- marine and coastal waters
- landscape (including trends on land, forests and biodiversity).³¹

As well as biophysical data, in 2012, the ABS reported on Australian's environmental attitudes, noting a drop in concern about the environment – whereas eight out of 10 people were not confident about environmental condition in the previous survey, the 2012 survey suggested only six out of 10 people were so concerned.³²

See below for a discussion of the ABS's experimental land account for Victoria.

5.1.4.2 Bureau of Meteorology (BoM)

The BoM provides public access to a range of data products and services including:

- Weather forecasts, including information designed for use by farmers
- Climate and weather observation data
- Marine data (e.g. tides, currents and sea temperature)
- Ultraviolet levels

The BoM is also a lead agency in the Nation Plan for Environmental Information, which brings together data from multiple sources (see further discussion in 5.2).

5.1.4.3 Geoscience Australia (GA)

GA is principally concerned with large-scale earth observation and satellite imagery.

Publically available environmental data sets include:

- earth observation and satellite imagery (including aerial photography)
- groundwater
- environmental hazards – sentinel bushfire mapping application, Australian earthquakes database
- marine and coastal – Australian Marine Spatial Information System (AMSYS) and Australian Maritime Boundaries (AMB).

The national *State of the Environment Report, 2011*³³ used the data from the above agencies extensively to report on environmental trends. The most recent NSW,³⁴ ACT³⁵ and South Australia³⁶ state of the environment reports also rely upon this data, as does Victoria.

5.1.5 Monitoring and reporting in Victoria

In addition to the national monitoring initiatives there are a number of state-based programs.

In Victoria, monitoring of natural resources status and function is primarily undertaken by DEPI, which operates a range of programs. Important, collaborative and stand-alone contributions are made by the EPA, Melbourne Water and CMAs.

Part A provides a comprehensive analysis of environmental data in Victoria and its analysis. The following information is only provided as an overview to contextualise the accompanying recommendations.

Statewide Natural Resource Management (NRM) Monitoring and Reporting Program³⁷

DEPI has committed to a more formal and uniform system of NRM monitoring, reporting and investment.

CMAs, Regional Coastal Boards^{38, 39, 40} and Parks Victoria⁴¹ are the key organisations to implement improvement and create effective protocols and standards to generate clearer and more consistent statewide monitoring and reporting on the management and condition of our natural environment.

This project is using a range of tools, including aerial photography – available online⁴² – and remote sensing information.

Victorian Forest Monitoring Program⁴³

Public forests and parks are also subject to monitoring by DEPI. Collectively these programs are described as the Victorian Forest Monitoring Program (VFMP).

VFMP is Australia's most comprehensive statewide public forest monitoring system. The data and information generated through VFMP can be used to improve land management policy and decision making. The data can also support state and national reporting of sustainable forest management through the Victorian State of the Forests Report. Data can also be accessed online. This data could be among the data sets reflected in the proposed Environmental Data Portal.

River health⁴⁴

A range of river health monitoring and surface-water monitoring programs provide baseline river health data. This work includes the River Health Report Card⁴⁵ and the Index of Stream Condition.⁴⁶ However, this information is updated at relatively long intervals (Index of Stream Condition has been released in 1999, 2004 and 2013; River Health Report Card was published in 2009).

The government has made a commitment to streamline the index development process by using remote sensing and aerial photography and improve on the coverage of the last index, which only sampled a number of actual sites along the 26,000 km of stream frontages across the state.

Groundwater

Thirty-four Groundwater Management Areas and 19 Water Supply Protection Areas are monitored across the state quarterly via the State Observation Bore Network.⁴⁷ This Observation Network is being refurbished.⁴⁸ This work may go some way to assisting us to answer the question raised by VAGO in 2010 when it reported that DEPI 'did not know whether the use of groundwater in Victoria was sustainable'.⁴⁹

The first regional groundwater report ever compiled – *South West Victoria Groundwater Atlas*⁵⁰ – attests to the:

- dearth of collated information about this issue
- extent of the available uncollated information
- range of parties holding information
- need for monitoring and reporting to enable understanding of this utterly essential ecosystem service and environmental resource.

It was remarked in the atlas:

'... groundwater is a valuable resource but its great potential is hidden.

It is complex, often described in unfamiliar technical language and hard to visualise. This atlas provides information in words and graphics that readers can understand – to help them develop their knowledge of this vital water resource. The atlas describes the groundwater resources in South West Victoria: how much there is, where it is, how deep and thick it is, what it could be used for and how it is used now.'

Water resources

The *Monthly Water Report*⁵¹ is published online providing an updated summary of the current state of Victoria's water resources.

The *Victorian Water Accounts*⁵² provides an annual overview of water availability and use across Victoria in terms of bulk supply, including a detailed water account for each of Victoria's 29 river basins.

5.1.5.6 Victorian Catchment Condition Report

The Victorian Catchment Management Council (VCMC) compiles data collected by DEPI and the catchment management authorities (CMAs) in the Victorian Catchment Condition and Management Report, published every five years.⁵³ This monitoring also attempts to identify the effects of management interventions.

The 2012 report includes recommendations that:

- robust processes be established to determine the condition of Victoria's land and water resources and the effectiveness of land-protection measures
- this crucial function be assigned to an independent and appropriately resourced entity, with the task of reporting annually on progress towards the implementation of these processes, and every six years on overall condition
- a state *Integrated Catchment Management Plan* be developed to define, explicitly, the quality of the land and water resources that will maintain and enhance long-term land productivity while also conserving the environment.

The Commissioner for Environmental Sustainability endorses the recommendations of the Victorian Catchment Management Council in its Catchment Condition and Management Report of 2012 and calls for the Victorian Government to adopt them in their entirety.

Environment Protection Authority, Victoria

EPA Victoria measures a range of environment indicators as defined in State Environment Protection Policies (SEPPs).⁵⁴ This may include where pollution affects (i) human health and wellbeing, (ii) ecosystem health or (iii) other beneficial uses of the environment.⁵⁵

The EPA's powers, duties and functions outlined in the *Environment Protection Act 1970* reflect the extent of the organisation's work (see section 13 (e), (i) and (l)).

The EPA routinely makes data available on its website on air and water quality.⁵⁶

Monitoring Victoria's air quality

As at 2013, EPA Victoria monitors air quality at 15 sites across Victoria, with:

- 13 in metropolitan Melbourne (11 long-term and 2 short-term)
- 1 in Geelong
- 1 in the Latrobe Valley.

The EPA also receives data from industry operated stations such as Alcoa's site at Point Henry.

The EPA prepares an *Ambient Air Quality Annual Report*⁵⁷ based on this monitoring that assesses compliance with the air quality policy outlined in the state Environment Protection Policy (Ambient Air Quality). Additional air quality reports are made available on the EPA's website.⁵⁸

Monitoring Port Phillip Bay⁵⁹ and water and beach quality.

The Beach Report program provides information on water quality at 36 beaches in Port Phillip Bay in summer.

A Cleaner Yarra River and Port Phillip Bay – A plan of Action.⁶⁰

Yarra Watch⁶¹ is a project funded and managed by Melbourne Water which is implemented in partnership with the EPA and DEPI. The EPA is the custodian of the data.

RECOMMENDATION 30

It is recommended that the Victorian Government audit the scope, quality and accessibility of environmental monitoring in Victoria.

ATTRIBUTES

This work could be undertaken by an existing monitoring agency such as VAGO.

The role of this audit would be to define standards and terms that can be used by multiple agencies to produce datasets that can be meaningfully compared.

It can also provide guidance to government on a range of issues including:

- accreditation of monitoring methods
- allocation of funding
- developing programs for public access to data
- setting management targets
- enforcement processes.

5.1.6 Problems with monitoring: gaps

In recent years there have been a number of investigations by the Victorian Auditor-General's Office (VAGO) into the effectiveness of state environmental management agencies. These have covered topics such as the administration of the *Flora and Fauna Guarantee Act 1988*,⁶² groundwater management,⁴⁹ (also see above in groundwater discussion) soil health⁶³ and marine protected areas.⁶⁴

Typically, these audits have concluded that even when robust management frameworks exist they have been undermined by inadequate data collection. Assessing the success, or otherwise, of management interventions becomes difficult, if not impossible, in these circumstances. This results in a lack of accountability – a fundamental governance issue.

Predominant reasons for gaps in monitoring are that:

- the indicator has never been monitored
- monitoring was undertaken but has ceased
- limited research has been conducted.

5.1.6.1 The indicator has never been monitored

There are numerous indicators of both biophysical trends and environmental impacts on people that are not – and have never been – monitored. The reasons for this vary. In some cases, the indicator in question is not broadly relevant. Often, however, the failure to monitor an important indicator hinges on the absence of a consistent method of data collection. This is particularly so in the case of social indicators, such as adaptive capacity.

5.1.6.2 Monitoring was undertaken but has ceased

There is a set of indicators where data can be obtained but the data will not reflect changes in recent times. The relevance of biodiversity and ecosystem structure and function indicators are adversely effected by this sort of hiatus. The benefits of long-term continuous monitoring have been clearly demonstrated in the case of the Leadbeater's possum (see Case Study).

However, collecting information on biodiversity indicators is often labour-intensive and time consuming – discontinuing monitoring programs diminishes and adversely affects our ability to recognise long-term changes in the environment.

The cessation of indicator monitoring in biodiversity is also deeply frustrating to the public involved in such monitoring and frequently keenly interested in the outcomes and tracking changes over time. We had this reported to us across Victoria at the Winton Wetlands and by members of Project Platypus in western Victoria.⁶⁵ In particular, people commented on the frustration associated with 'episodic funding' and the 'disappointment which attended the commencement and then cessation of pilot programs'.⁶⁶



Kangaroos

Case Study: The Case for Ongoing Monitoring of the Leadbeater's Possum

In the mid-late 1990s, several records of the possum denning in Snow Gum indicated that Lake Mountain might support a significant population of this endangered species. In 2003, 30 nest boxes were installed to survey the distribution and abundance of Leadbeater's possum across the breadth of the Lake Mountain plateau. The results were particularly encouraging, with 28 of the 30 nest boxes colonised by the species. It confirmed that the Lake Mountain plateau supported a substantial population containing 200–300 individuals, one of the largest documented strongholds of the species.

The Lake Mountain plateau was burnt severely on Black Saturday (7 February 2009), with 95% of the sub-alpine woodland burnt at high severity. Surveys were expanded in an attempt to locate sites where Leadbeater's possums had survived the fires. The results were devastating.

Just two possum families, together containing just five individuals, survived on the plateau in one partially burnt gully system. Supplementary feeding trials were initiated by Parks Victoria, the Friends of Leadbeater's possum and Healesville Sanctuary during winter 2009 to assist the survival of these possums in fire-damaged habitat. The supplementary feeding program was maintained during the winters of 2010 and 2011. Early in 2012, following the disappearance of several of the surviving possums, the decision was made to bring the last three possums on the plateau into captivity at Healesville Sanctuary to ensure their welfare. The results from Lake Mountain highlight how vulnerable the Leadbeater's possum is to fire and habitat loss, and the major impact that catastrophic events can have on populations of threatened species.

In April 2013, four years after the devastating impacts of the 2009 Black Saturday fire, two Leadbeater's possum families, each containing two individuals, have returned to the plateau. It is anticipated that it will take at least 15–20 years for the recovery of foraging conditions for the possum at Lake Mountain, a necessary precursor for Leadbeater's possum population recovery to occur.

5.1.6.3 Limited research has been conducted

In these circumstances data or case studies may be available for individual sites but no systematic statewide monitoring is available to identify long-term trends. This is not necessarily problematic, as some indicators that have a high relevance to communities at a local scale will not be useful at the statewide level. However, limiting indicator consideration to specific carefully circumscribed sites is potentially problematic as it produces a narrow reporting scope.

This also includes indicators that combine data from multiple sources to provide high-level summaries of our environmental performance. The ecological footprint of Victoria, commissioned by the EPA and presented in the State of Environment 2008 provides a good example of this.

Such indices, produced for particular research projects or individual reports, provide valuable snapshots of the current state of particular impacts or assets. If they are not systematically repeated, however, they have limited use in demonstrating progress towards long-term environmental goals and guiding management decisions and policy formation.

5.1.6.4 Critical authoritative commentary about monitoring shortcomings

The implications of these gaps are the subject of commentary in the 2012 Victorian Catchment Management Council *Catchment Condition and Management Report*.⁵³ The council observed that its assessment was 'incomplete' due to a lack of clarity about targets and measurement processes (lack of consistency, fragmentation) for the natural environment.

This absence has contributed to a situation where data regarding the Victorian catchments of 2011–12 cannot usefully be contrasted with the 2007 data. This in turn limits the ability of the VCMC to identify changes in the state of the catchments over time and constricts the council's capacity to provide guidance for management strategies.

5.1.7 Frameworks for environmental monitoring and accounting

The need for an integrated approach to environmental monitoring has been recognised nationally and internationally. This has led to the development of strategies that seek to provide framework for multiple forms of environmental information and allow managing agencies to compile accounts of changing states.

There are attributes consistent across the strategies, each:

- works across a range of sectors
- involves the development of cross-jurisdictional partnerships
- seeks to provide consistent and comparable metrics for ecosystem condition.

5.1.7.1 System of Economic and Environmental Accounting: United Nations Environment Program⁶⁷

As suggested above, if and when monitoring frameworks are maintained over decades they will provide invaluable long-term information on management intervention and changes in ecosystem function and ecological processes.

However, to be truly effective, monitoring programs need to be properly integrated to provide data that is comparable over both time and space. Because of the diverse range of collection agencies, it is critical that special attention is paid to standardising methods and metrics.

The pressing need for an aligned and integrated monitoring framework for collecting environmental data has been recognised as critical in improving our environmental outcomes. At a national level, steps have been taken to establish common standards beyond jurisdictional boundaries.

The *System of Economic and Environmental Accounting* (SEEA) is an international experiment that is being trialled in Australia by the ABS and BoM. SEEA has developed a set of metrics that can be used:

- to monitor natural resource assets in Australia
- to compare areas within the country and against overseas territories.

Initially, this system concentrates on monitoring the economic value of tradable assets such as timber and water, but the next stage of the project will expand the system to include the economic and non-economic value of ecosystem services.

SEEA has been used by the ABS as the basis for producing experimental accounts that report on:

- energy
- waste
- water
- land (see 5.1.7.2 for further discussion).

It is not proposed that the ABS manage any monitoring directly. This work provides a common framework for agencies. The ambition is for this system to form the basis for an internationally agreed set of environmental accounting metrics. This work is being supported by the Wentworth Group of Concerned Scientists, CMAs in Australia, and by the TEEB internationally.⁶⁸

Consistent standards and metrics will arguably promote the credible and authoritative combination of data sets and provide for comparative study with comparatively less effort than is currently the case. This would greatly enhance the accessibility of information across geographies, sectors and with the general public and interested stakeholders (see 5.2 Public Access to Data).

For example, Waste Accounts in 2012 detailed an increase in the national population of 22% between 1997 and 2012, an increase in waste from all sources (including, for instance, construction and residential facilities) of 145%, and observed that nearly 50% of all waste from households was organic.⁶⁹

This data is of enormous importance – continuity in collecting provides us with indications of worsening problems and the standardisation of the indicators used means the data is reliable and that conclusions can be formed as a result.

Environmental monitoring that achieves coverage across the state will involve multiple collectors, collators and custodians even when managed by central environmental agencies such as DEPI.

Consistent and coherent standards, a mutual language and normative measurement mechanisms supported by robust quality assurance by all monitoring agencies will be necessary. Only by achieving some level of mutuality will data sets be comparable in a straightforward and transparent manner across organisational cultures and other scales and settings. A super structure such as that provided by SEEA will assist this process immeasurably.

5.1.7.2 Experimental Land Accounts (ABS and DEPI)⁷⁰

Scope exists for innovative partnerships to develop new monitoring regimes and reporting partnerships. One recent study from the ABS and the Department of Environment and Primary Industries (DEPI) involved generating new and experimental land accounts to assist in the valuation of ecosystem services.

The first of these experimental land accounts for Victoria – assessing the value of land for 10 NRM regions – was released in 2012. Key findings included:

- The total rateable value of land in Victoria covering approximately 23 million hectares as at June 2012 was \$1,047 billion. While the area of land is shared relatively evenly between the 10 CMAs in Victoria – Port Phillip and Westernport CMA dominate land value contributing a total of \$874 billion (83%).
- Land classified as ‘residential’ represents \$878 billion or 83% of Victoria’s total rateable value but only 5% of the state’s total land mass.
- More than half of all land in Victoria is classified ‘primary production’ (56%).
- The CMA with the highest value of land used for primary production is Port Phillip and Westernport (\$17 billion) despite representing the second smallest area of land used for primary production in the state.
- The total rateable value of land used for livestock grazing on irrigated pasture in Victoria is \$626 million.

Land, the soil from which produces the food we eat, and the water systems that impact it, is of considerable financial value. Understanding this assists in a whole range of other standard accounting exercises. Internationally, *The Economics of Ecosystems and Biodiversity* (TEEB), is exploring the value of ecosystem services for a range of reasons and in a number of settings and across sectors.⁷¹

5.1.7.3 Regional Environmental Accounts trial led by the Wentworth Group of Concerned Scientists⁷²

The Wentworth Group of Concerned Scientists has developed a framework that could apply SEEA at a regional level, thereby informing national environmental accounts; initially in *Accounting for Nature* (2008) and subsequently refined in *Accounting Metrics for Building Regionally Based National Environmental Accounts* (2009).^{73, 74}

This work aims to create a ‘common currency’ for determining the value of environmental assets while maintaining monitoring that is specific to, and relevant at, the regional scale. This is a means of standardising measurement of environmental assets, both in terms of rate of change and benchmark states. This model will allow:

- the state of comparable assets to be compared across Australia
- the rate of change to be compared between asset classes
- regional reporting to be combined to form a consistent national account.

This system has been trialled nationally across 10 CMAs. Victoria is represented by Corangamite⁷⁵ and North Central⁷⁶ CMAs.

In a paper to the UN Statistics Division in 2012, Professor Peter Cosier observed of these trials that they have two tests:

‘1. Is it possible to construct asset condition accounts using a common unit of measure?’

2. Is it feasible to do so?

The Australian trials are built on five design principles:

- 1. Environmental accounts should enable people to understand and track the status and direction of changes to their environmental assets.**
- 2. Indicators may vary from region to region according to agreed standards.**
- 3. Existing data sets should be used wherever possible.**
- 4. Measurements of condition are based on specified reference condition benchmarks against which change in indicators can be measured and compared.**
- 5. Measurements to be generated at a regional scale should be capable of aggregation to the national scale.⁷⁷**

Final outcomes of this trial will be reported by the Wentworth Group in late 2013. When this occurs, Victoria will be well placed to capitalise on the potential to improve examination of environmental outcomes in a formal and systematic way as the state has played an important role in developing and trialling the model.

5.1.7.4 National Plan for Environmental Information (NPEI)⁷⁸

The NPEI is a framework, established in 2010, and led jointly by the Bureau of Meteorology and Department of Sustainability, Environment, Water, Population and Communities. The ultimate aim of the project is to create a network to support the collection, access, and reuse of environmental information. The infrastructure will be designed to enable environmental information to be widely provided and shared by working alongside existing data management systems.

This framework will be closely linked to SEEA and there is an opportunity for Victorian agencies to make major contributions to its development. These contributions will build on initial work carried out with the Regional Environmental Accounts trial (see above) and experimental land accounts (see below) that have been produced in Victoria.

Other accounting systems (and the agencies that administrate them) that will inform the creation of an integrated national environmental accounting framework include:

Water Account Australia (ABS)⁷⁹

This is based on the SEEA framework and reports physical and monetary uses of water. These describe who uses water, how much, and for what purpose.

National Water Account (BoM)⁸⁰

This is complementary to the Water Account Australia and aims to report on the total national water resource. It reports on the volume of water assets and liabilities (e.g. water allocations and rainfall) and actual water flows (e.g. the delivery of water against water allocation and rainfall).

National Greenhouse gas inventory (DCCEE)⁸¹

Australian greenhouse gas emissions are compiled to meet reporting commitments under the United Nations Framework Convention on Climate Change.

5.1.7.5 National Data Grid⁸²

Separate to establishing management outcomes and environmental indicators, monitoring needs to be supported by data frameworks that allow the flexible analyses of data from numerous agencies.

To this end, the National Data Grid, developed by the CRC for Spatial Information, is currently being developed to provide a common technical infrastructure which is based on a set of standard grids and projections that allows spatial data from multiple sources to be combined, analysed in decision making systems and also used for modelling.

Once established, this platform will be able to support spatial analyses by land management professionals – even if they have limited technical knowledge.

Spatial decision making will arguably be capable of being built into decision making processes as a result of this technology being adopted.

5.1.7.6 Monitoring, Evaluation, Reporting and Improvement (MERI) Framework

The Commonwealth, in recognition of the importance of high-quality monitoring in natural resource management has produced the Monitoring, Evaluation, Reporting and Improvement (MERI) Framework.⁸³ The purpose of the MERI framework is to provide a generic framework for monitoring, evaluating, reporting on and improving Australia's management of 'key' natural assets.⁸⁴

The MERI framework is being applied by the Commonwealth Environmental Water Holder (CEHW)⁸⁵ to the Murray–Darling Basin (MDB). It is highly relevant to Victoria.

The application of MERI in this context has the long-term goal of protecting and restoring the environmental assets of the MDB.

As well as establishing the monitoring required to ensure operational compliance, MERI will establish monitoring to report on immediate and long-term ecosystem responses to management. This is a very important development in river system management at the national scale.

Targeted monitoring to inform intervention and decision making will be prioritised to address the need to understand short-term outcomes and demonstrate the effectiveness of water deliveries. In turn, this will inform annual planning and guide and enhance long-term intensive monitoring.

MERI will assess basin-wide, long-term changes in baseline conditions in response to environmental monitoring. This will be achieved through:

- low-intensity, broad-scale monitoring of key ecological indicators at randomly selected sites that will be used to validate more intensive monitoring
- monitoring of larger-scale responses from environmental watering including wide-ranging, longitudinal and lateral biodiversity-connectivity studies and the wide-ranging vegetative-response monitoring of mobile species such as birds.

RECOMMENDATION 31

It is recommended that the Victorian Government establish a systematic, environmental data collection plan.

ATTRIBUTES

Elements of a data collection plan would include:

- clearly defined outcomes and targets
- a range of core indicators that are:
 - examined consistently
 - accompanied by a public explanation if discontinued
 - regularly reported against indicator type, and any failure, or delay in reporting, to be publicly explained
- a range of data sources at multiple spatial scales
- consistent protocols
- maintained and shared standards
- quality assurance procedures
- a register of monitoring programs past and present.



Hindmarsh Landcare, 2010

5.1.8 Broad-scale monitoring systems

Monitoring programs need to be achievable within resource constraints. This means they also require methods that deliver, within the available funding, information that is scientifically valid while still covering the greatest possible area. One method of achieving this is to create a broad network of coarse-scale, low-cost monitoring that is refined and validated at selected locations by higher-quality instrumentation (for a detailed description see BLANKET Case Study).

Gaps in spatial temporal resolution in data sets can also be improved by adopting autonomous instrumentation and incorporating remote sensed imagery and data assimilation models into the monitoring toolbox. The Integrated Marine Observing System provides a good example of how information from multiple sources can be integrated (see Case Study).

Case Study: Broad-Scale Monitoring Systems

The Base Line Air Network of EPA Tasmania (BLANKET)

This is a network of 19 small air quality stations reporting near real-time indicative particle concentration data (i.e. from smoke or dust) to the EPA division's public web pages. The stations will also collect and report meteorological data (air temperature, wind speed, etc.).

This network uses low-cost, low-maintenance instruments to provide indicative air quality data. This is regularly cross-checked against reference instruments. This allows a wider coverage with many more instruments able to be deployed.⁸⁶

Integrated Marine Observing System (IMOS)

IMOS is designed to be a fully integrated national array of observing equipment to monitor the open oceans and coastal marine environment around Australia, covering physical, chemical and biological variables. All IMOS data is freely and openly available through the IMOS Ocean portal for the benefit of Australian marine and climate science as a whole.

IMOS observations are guided by societal needs for improved ocean information, and focused through science planning undertaken collaboratively across the Australian marine and climate science community.

The system has been operational since 2006 and is in a mature phase. It promotes standardised infrastructure that is strategically placed in Australia's coastal and offshore waters. Deakin University and CSIRO are currently in discussion for the development of a Bass Strait node for the next iteration of IMOS. To date, all other states have engaged with, and benefited from, this initiative.

The United States is running a program called BISON (Biodiversity Serving Our Nation) coordinated by the US Geological Survey, which also seeks to cover multiple focal points.^{66, 87}

5.1.9 The role of citizen science^{88, 89}

There is a critical role for citizen science in monitoring, information dissemination and gathering, and knowledge creation. While formal, organised and institutionally embedded monitoring is fundamental, valuable supplementary and foundational information can be gathered using citizen science programs.⁹⁰

There are many great examples of citizen science that were brought to our attention during public consultation across the state. One example is the Yarra Riverkeeper Association.⁹¹ The association also works on monitoring the Yarra's health, advocating for its care and providing input into relevant inquiries.

The association was established in 2004 and is a not-for-profit community organisation affiliated with international organisations that also care for waterways. This association's activities are a great example of citizen involvement in environmental issues.

Waterway monitoring has also provided a good model for community data collection in the Waterwatch program (see above and Case Study below). More broadly, waterway management is also a matter of concern for landholders when they consider the value of stream frontages. Organisations such as Landcare have plainly encouraged better practice and community monitoring of waterways.^{92, 93, 94}

We have shown the real benefits of highly localised community monitoring in Foundation Paper One, *Climate Change Victoria: The Science, Our People and Our State of Play*, where we cited the work of the *Friends of Beware Reef*.^{95, 96}

The work done by the public in bird audits both here – for example, the Bird Atlas Data collected by volunteers and coordinated by BirdLife Australia program Birdata⁹⁷ – and internationally⁹⁸ is indicative of the capacity of the public to provide meaningful, continuous, cost-effective and efficient local assistance in this work.

We have reported the work of the community at Kings Billabong, south of Mildura, where George Kerridge, a retired scientist, and a band of active and committed local people have been studying bird populations for years. Just before the Millennium Drought broke, this group:

‘... recorded 136 species and 6,577 individual birds within 40 km of Mildura [and after the drought broke in December 2010] 173 species and 19,293 individual birds [concluding that] adding water [to the system] does make a difference ...’^{95, 99}

It was the efforts of local people that resulted in the establishment of bird tourism along stock routes in NSW, giving effect to environmental and economic co-benefits by promoting local economies and conservation at the same time.^{100, 101, 102}

Members of the public – sometimes guided by professionals, sometimes receiving formal training, but often simply engaging in participant observation – monitor environments and consistently collect large amounts of environmental data over wide geographical ranges.

In one research study of community forestry monitoring collaborations it was concluded that:

‘... collaborative monitoring can lead to shared ecological understanding among diverse participants, build trust internally and credibility externally, foster social learning and community-building, and advance adaptive management.’¹⁰³



Sealake charrette VCCAR and CfES

Although concerns have been expressed about the quality of data gathered in this way, and there are issues of custodianship, much will depend on how we define success,¹⁰⁴ and the electronic age increases the possibilities of collaborations and partnerships.¹⁰⁵ Citizen science can provide valuable long-term data on environmental issues if programs are designed to be well-integrated into broader monitoring and have the resources to ensure good quality control.

We have given substantial consideration to the formal place for Aboriginal people's concerns about monitoring and their role in this work – native title connections reinforce their long-held cultural connections to waterways.

MLDRIN provides some insights into how this work is done and coordinated through Indigenous organisations, both formal and informal.¹⁰⁶ This work requires formal acknowledgement as an illustration of cultural commitment to – and deriving benefits from – monitoring which reflects community needs. A recent example of this in Parks Victoria's release of Ngootyoong Gunditj Ngootyoong Mara South West: Draft Management Plan, August 2013.¹⁰⁷

WaterWatch and EstuaryWatch (see notes above about these two programs)

The Waterwatch and EstuaryWatch community monitoring programs are key components to the Victorian approach for monitoring waterway health. These programs are part of the broader monitoring framework and provide credible data to assist in waterway management.

WaterWatch and EstuaryWatch act as trusted conduits of information to waterway frontage landholders. In these programs it has been shown that community involvement in resource monitoring has multiple benefits:

- enhancing community knowledge regarding waterway health and related issues
- increasing the spatial coverage and sampling frequency of formal data collection as the data is generally collected outside the Victorian Water Quality Monitoring Network (VWQMN)^{108, 109}
- providing an 'early warning system' for impacts as a direct function of frequent surveillance and local knowledge of local waterways.

5.2 Public Access to Data

Proposition

The Victorian public has an active interest in data that:

- reflect current issues
- government collects and uses in the formation of public policy
- is used to inform decision making generally.

Metropolitan and regional views were canvassed by the DBI in 2007 and again in 2011.¹¹⁰ The survey concluded that Victorians' public interest in accessing scientific information had increased from 50% to 60%, and that seven out of 10 people said they made a science information search at least once a week.

Information on environmental issues forms a key part of this interest. If communities are to be able to make informed decisions about their future, they need to have access to up-to-date research, high-quality data products and the means to analyse that data according to local interests.

Educators seek information to fulfil the requirements of various school and post-school education curriculums. Community members wishing to plan for personal environmental outcomes desire this data to assist them in making choices about housing and other infrastructure proposals – particularly in bushfire and flood-prone areas. Those interested in biodiversity, pollution, health, and water issues wish to explore the current state of knowledge.

Context

The advances of the information age will make us increasingly subject to 'data deluge'. Although this will create its own difficulties regarding quality control and equity, it also promotes 'unprecedented data access [that] will enable world class research ... focussed towards addressing the key policy issues [of the future].'¹¹¹

Internationally, instruments such as the 2001 Aarhus Convention¹¹² and the 2011 Draft Chisinau Declaration¹¹³ stipulate the international commitment to provision of information to the public and the public's right to both access and involvement in decision making processes.

Institutions as diverse as the World Bank, Canadian International Development Agency, and USAID support the widely available and comprehensible provision of data sets. Further, as learning is a two-way process – both bottom up and top down.

5.2.1 Environmental data in the information age

It is apparent that access to information is necessary to ensure meaningful contributions to change our management of environmental issues.¹¹⁴

Science as an Open Enterprise, a 2012 report from the Royal Society,¹¹⁵ provides case studies of good practice and the range of possibilities in broadening the public's access to data and information. The Royal Society suggests:

- better communication with the public and the media is a role for scientists
- common standards are necessary for usability
- publication in useable form should be mandatory
- more experts are needed to manage the growth of data
- new software tools will be necessary.

While scientists and academic institutions have a role in this, it is increasingly apparent that governments do as well. Governments are responsible for publication in useable form and for the continued funding for public accessibility to useable data sets.

5.2.2 Access to current research

The first step in allowing the public to make informed decisions about the future of their communities is to facilitate access to the most up-to-date research and reporting. Some scientific reports will not be appropriate for informing the broad public – due to their dense and technical nature. However, it is critical that the community are the judge of this as open-access publishing models are developed to make environmental and other scientific data collections and analysis easily available to the public and not financially prohibitive.

For example, the UK Government has recently promoted public access by ensuring that all scientific articles that are based on publically funded research are available without subscription costs (see Case Study: Free Public Access to Academic Journals in the UK).¹¹⁶

Case Study: Free Public Access to Academic Journals in the UK¹¹⁷

The UK Government has introduced a scheme to make publicly funded scientific research immediately available for anyone to read for free by 2014.¹¹⁶ The UK has adopted the 'gold' model of open access. This model allows journal publishers to charge 'article processing charges' to authors for papers that will be made freely available once published. This approach places the burden of cost on research funding, and early estimates predict that approximately 1% of the £4.6 billion annual research budget will have to be used to pay for open access.

The transition to open access is currently being guided by the UK Open Access Implementation Group, which is comprised of funding bodies, higher education umbrella groups and some publishers who support open access.

This group aims to:

- increase the proportion of UK research output that is available as open access
- ensure that adequate funding is available to support gold-model open access
- and limit the cost of processing charges set by publishers (currently around £2,000 per article).

5.2.3 Data products

Numerous high-quality environmental data sets are already available as downloads. It is significant that most data sets that provide information at a large spatial scale report on biophysical attributes such as land-cover types or weather and climate. Information on biodiversity and ecosystem health is often more nuanced and it is also very labour-intensive to collect. These data sets are less complete over time and it is a much more complex undertaking to make this data meaningful and accurate.

Large-scale earth observation data can be obtained directly from the Geoscience Australia website, even though analysis requires technical expertise and specialist software making the material more useful to researchers than the general public.¹¹⁸

By way of contrast – and as an example of public accessibility best practice – the Bureau of Meteorology (BoM) has made high-quality weather and climate data available for free that can be visualised online through its own web interface.¹¹⁹ Anyone in the community can conduct in-depth interrogation of data to inform local interests.

5.2.4 Government repositories of environmental data in Victoria

In Victoria there has long been a recognition that information provision is fundamental to good governance in organisations. Victoria has embarked upon an effort to be effective in managing data for government, researchers, the general public and business.

It is critical to ensure that data is managed in effective and efficient ways. This will necessitate the establishment of portals and it will require a level of maturity about standardising data sets – an issue which we have struggled with in environmental management, both statewide and nationally, for decades.

This work needs to be informed by a recognition that funding for public data accessibility requires continuity, for when programs such as this are not maintained the initial investment is wasted. The Victorian Water Resources Data Warehouse is an example of a project that started well, but data has not been updated. This, coupled with inconsistent funding and an ageing data infrastructure, have limited its usability, although a planned ‘refresh’ of the site may address some of these issues.

The EPA¹²⁰ provides information through its Beach Report, partnership arrangements in Yarra Watch, air quality reports, and specific interest studies – such as the 2007 Noise Survey. These initiatives are also underpinned and guided by monitoring of public awareness of environmental information.

Melbourne Water provides guides for the public on the 8,400 km of waterways in Port Phillip Bay and Western Port. The ‘Know Your River’ series is an example of accessible and relevant information provision. Melbourne Water also provides data on water storage, a weekly water report, water levels and restrictions. An interactive Water Supply map is also found on the website together with water education materials.¹²¹

Engagement with, and access to, water information is also advanced by the Office of Living Victoria’s efforts to both involve the public in its decision making processes by calling for public comment on proposed policy matters.

Information on biodiversity issues is sought as actively as information about pollution and water, and efforts are being made to address this interest despite the difficulties inherent in making this often highly complex material both physically accessible and meaningful to the broader public.

5.2.4.1 Victorian Resources Online (VRO)

Despite challenges in collating and presenting biodiversity data, some of the environmental information that is held by DEPI is made available to the public through the coordinated portal VRO.¹²² This portal brings together a range of resources such as:

- maps
- digital files
- searchable directories
- management plans
- links to relevant external information including BoM weather and climate data.

Information is grouped by themes and at the catchment scale (enabling regional information compilation). This resource includes the *Biodiversity Interactive Map* (see below), which allows the public to view existing biodiversity information at a fine scale.



Alpine high country

5.2.4.2 DEPI Biodiversity Interactive Map 3.2

The primary focus of the *Biodiversity Interactive Map* is to provide information on Victoria's biodiversity by displaying the latest natural resources data including:

- threatened flora and fauna distribution
- native vegetation extent and quality
- significant wetlands
- critical marine habitat
- landscape disturbances.

Two levels of access are available – General Users and Authenticated Users.

General Users can view publicly available information, including:

- threatened flora and fauna
- vegetation classes
- wetland categories
- marine habitat
- fire history
- timber harvesting
- cadastral boundaries.

They can also access data sets held by:

- CMAs
- Parks Victoria
- Victorian Environmental Assessment Council
- Victorian Government administrative regions.

Authenticated Users have access to data such as:

- restricted flora and fauna
- biosites
- land for wildlife
- historic places
- Catchment Activity Management System (CAMS)
- pest plant and animal infestation sites
- Indigenous cultural heritage places
- the latest as well as historic satellite imagery and aerial photography.

At this time the interactivity function does not extend to comparisons of data sets. For example, it is not possible to overlay biodiversity data with data sets maintained by other agencies, such as climate.

Case Study: Biodiversity Data Centre

One example of the provision of public access to environmental data sets is found in Europe. The European Environment Agency established a Biodiversity Data Centre which provides access to data and information on species, habitat types and sites of interest in Europe and to related products for biodiversity indicators and assessments.

Priority is given to policy-relevant data and information for European and national institutions, professionals, researchers and the public.¹²³

RECOMMENDATION 32

It is recommended that the Victorian Government develop and maintain a public-access Environmental Data Portal.

ATTRIBUTES

The portal would be a single point access for environmental information, such as:

- **all state-funded research**
- **common technical standards consistent with national and international practice**
- **the library of publications from government reporting agencies – VEAC, VCMC, VCC and the Commissioner for Environmental Sustainability**
- **all government publications and submissions to policy reviews**
- **links to all relevant authorities and agencies (including parliamentary committees)**
- **all Flora and Fauna Guarantee Act 1988 action statements and the current DEPI Advisory Species List, and**
- **reports on prosecutions conducted pursuant to the powers of the various departments.**

It is advisable that a Users' Guide to the portal is developed to make it accessible to all Victorians regardless of their level of disciplinary engagement with the issues they are examining.

5.2.4.3 DataVic Portal – Victorian Department of Treasury and Finance

In Victoria, the Department of Treasury and Finance (DTF) has led a process to develop better public access to data sets, encouraging the use and reuse by the community and business of data made available through practical tools. This is being achieved through the DataVic portal and guided by the DataVic Access Policy (see below).

The proposed Environmental Data Portal could be aligned – and possibly supported – by the existing DataVic portal, although the two portals are for different purposes and have clear distinctions. For instance, DataVic does not publish reports but makes data available in machine readable (raw) form for further innovation and development.

The DataVic portal provides access to a number of categories of data. Environmental data is one category. While there is a lack of specificity with current data sets, there are in excess of 900 raw data sets attached to the portal which inform each of the categories.

Examples of the environmental data sets available through DataVic include:

- 2001–02 to 2007–08 Local Government Waste and Recycling Service Survey (Sustainability Victoria)
- 2009 Green Light Report (environmental attitudes survey)
- ByteBack Dropoff Points (free computer recycling service – trial only)
- CFA locations
- Detox Your Home disposal points
- Melbourne water use by postcode
- recreational fishing spots
- ResourceSmart retailers (300 retailers' environmental performance and running costs)
- Solar Report (% cost and GHG emissions)
- Streamflow water gauging
- urban water restrictions
- Victorian Energy Efficiency Target (register of participants)
- Victorian Energy Efficiency Target (register of VEET certificates)
- current water storage levels
- spatial data on flood extent.

See www.data.vic.gov.au for a comprehensive list of data available.

Each of these data sets makes provision for public commentary, which will not be posted on the website, providing anonymity for members of the public.

Other data portal categories which have environmental content include Transport and Communication.

Transport currently includes data sets on arterial-road traffic volumes, bicycle volumes, car-pooling data, the government executive fleet, and Parks Victoria's initial strategy for the Metropolitan Trail Network.

DataVic encourages the public to provide views on what other categories should be included for the purposes of data retrieval and display.

On the basis of this brief outline some conclusions can be drawn. The DataVic portal:

- carries the authority of a central agency of government
- is guided by a policy statement which is open to public scrutiny
- represents a commitment to better information transparency
- reflects a commitment to improved science communication
- seeks to engage the public not just with present content but with proposed content which is of importance to the public
- is a good start to the vast task of digitising data for public digestion.

5.2.5 Intellectual property and limits to data access

The DataVic web portal is supported by the DataVic Access Policy Standards and Guidelines.

The explicit purpose of the policy is:

- to enable public access to government data to support research and education, promote innovation, support improvements in productivity and stimulate growth in the Victorian economy
- to enhance sharing of, and access to information-rich resources to support evidence-based decision making in the public sector.

This policy has to be read in conjunction with the Victorian Government Intellectual Property Policy (March 2013), which accepts that the state's intellectual property is a public asset and access rights should be granted 'in a manner that maximises its impact, value, accessibility and benefit consistent with the public interest', ensuring 'the fewest possible restrictions' within legal constraints and avoiding infringing the rights of others.

The policy undertakes that only data that is owned or sufficiently licensed to the Victorian Government will be released. Strictures on release of data through the portal are explained in this way:

Not all government data will be suitable for release. Access to data may need to be restricted for reasons of privacy, public safety, security and law enforcement, public health, pre-existing contractual arrangements and compliance with the law.

In respect of environmental data sets this policy is consistent with international initiatives.

It is clear that a freely available Victorian Environmental Data Portal replete with environmental data would assist in the public contribution to investigation of improved local environmental outcomes and policy options.

The data provided through this proposed portal will be freely available unless there is an express statutory function to commercialise or unless there is explicit Ministerial authorisation.

Further restrictions may also be imposed as a function of a number of legal constraints.

These may include:

- privacy concerns
- public health issues
- public safety
- security and law enforcement issues
- the existence of pre-existing contractual arrangements, including commercial-in-confidence arrangements put in place by government and other parties pertaining to data-collection arrangements.

5.2.6 How will we interrogate data products?

According to the *2011 Strategic Roadmap for Australian Research Infrastructure*:¹²⁴

It is recognised that improving the integration of data relating to Australia's terrestrial systems is a big task. The degree of difficulty derives firstly from the complexities of the systems being studied and secondly from the range of researchers, organisations and jurisdictions involved in environmental research and management. Linkages should continue to be strengthened. For instance, collaborative development of integrated observing and information systems for the coastal zone will be important. eResearch infrastructure provides enabling platforms for data-intensive capabilities.

In spite of continuing issues with consistency and coverage of environmental monitoring, developments in remote sensing, digitisation of data sets, and increasing access to the web and social media have created the potential for locally specific environmental data to be used by the communities.

RECOMMENDATION 33

It is recommended that the Victorian Government establish an interactive, scenario-based state environmental data tool.

ATTRIBUTES

Information for the tool would be generated through the environmental data collection framework.

The tool outputs will be based on needs identified in engagement with regional communities - such as the condition of locally-valued ecosystems.

The tool will:

- **allow access by the public to interrogate state-wide datasets at a local scale for a selected set of scenarios**
- **be aligned with the work and organisational structures which are evolving at the national level, including AURIN, TERN, and the National Data Grid.**



Narrawong Primary School students walking through sand dunes

5.2.7 Existing tools: Victorian Government

Large, high-quality datasets are being assembled, and services that allow these data products to be examined and compared in new ways provide increasingly powerful tools for managers and policy makers. Examples of these efforts can be found in the Victorian Biodiversity Atlas¹²⁵ and the Federal Government's Atlas of Living Australia.¹²⁶

The State Government department that manages our ecosystems and natural resources (DEPI) has developed several tools that aid environmental managers in strategic decision making and represent a wealth of environmental data.

A more detailed discussion of these tools can be found in Foundation Paper Two, *Land and Biodiversity Victoria: The Science, Our Private Landholders, Incentives and Connectivity*.¹²⁷

Examples of these tools include NaturePrint, Ensym, Soil Management Information System, Victorian Land Use Information System and the Victorian Biodiversity Atlas.

NaturePrint¹²⁸

NaturePrint provides simple-to-use outputs for biodiversity decision making. The information is publicly accessible via a web portal. Information on biodiversity values, ecosystem functioning and threatening processes, species distribution (based on modelling) for over 500 native mammals, birds, frogs, and reptiles is collated for public access.

Native vegetation is included as groups of co-located species. This information is used for strategic land management decisions by DEPI (see Part B: 1.2 Native Vegetation Management).

EnSym (Environmental Systems Modelling)¹²⁹

EnSym uses scientific models to illustrate the impact that revegetation, weed control and riparian management actions have on the landscape. Users can visualise, test and interpret results of changes in climate, land use and land management practices through a single user-friendly interface.

Soil Management Information System¹³⁰

Public users of this program are able to generate soil maps based on geographic areas. The public can also interrogate and extract data.

Victorian Land Use Information System (VLUIS)¹³¹

VLUIS is a dynamic information tool that describes what and where land tenure, land use and land cover is present. It does so at a fine scale. Accredited users and stakeholders can access this information – for example, planning and policy groups and those who model, report and monitor.

The Victorian Biodiversity Atlas (currently under development)¹²⁵

The VBA, when completed, will be a web-based information system designed to manage information about native and naturalised species occurring in Victoria. The system will include species attributes, including origin, conservation status, vital attributes and life-form. It will also give access to records of species distribution and abundance, including systematic survey data, herbarium and museum records, and general observations.

5.2.8 Existing tools: National tools and portals

ANDS – Australian National Data Service

ANDS recognises that ongoing research is producing increasingly large volumes of data and it is necessary to find ways to store this data and make it available as widely as possible.

AURIN – Australian Urban Research Infrastructure Network

AURIN is a science initiative with a commitment to sharing and integrating systems of knowledge and data.

This work is demonstrating that partnerships between governments and researchers to provide information to research communities and the broader public are increasingly possible once the legal, contractual and intellectual property issues are managed.

AURIN has been working for three years to resolve highly complex information-sharing issues that have confounded integrated and collaborative research efforts.

It is increasingly recognised that integrated approaches are required to answer complex questions. This is detailed in the *2011 Strategic Roadmap for Australian Research Infrastructure: National Collaborative Research Infrastructure Strategy*¹²⁴ with its 19 priority research areas ranging from population and health to sustainable energy and terrestrial systems. The strategy also includes associated enabling areas of interest such as e-Research Infrastructure. One of the singular issues that underscores the whole agenda is a commitment to an environmentally sustainable Australia.

In committing to this work, AURIN is working across a number of programs. From Victoria's point of view, the pivotal one is that involves the North West Metro Area studying walkability, employment, housing and health issues.¹¹¹

The partners in this work include the Victorian departments of Human Services, Health, Environment and Primary Industries, Transport, Planning and Local Infrastructure, and Justice, and the Valuer-General.

TERN – Terrestrial Ecosystems Research Network

TERN is changing the way we understand access to data, interdisciplinary partnerships and engaging the public with research reports and projects in ways which would have been inconceivable a decade ago.

The TERN Data Discovery portal is the outcome of ecosystem scientists sharing and storing their research and data.

The network also brings together the following projects as equal contributors:

- Ecoinformatics
- MultiScale Pilot Network
- AusCover
- OzFlux
- Soil and Landscape Grid of Australia
- Australian Coastal Ecosystems Facility
- Ecosystem Modelling and Scaling Infrastructure.

According to Professor Colin Prentice, Macquarie University eMAST Director, the ambition of the network is to produce 'truly practical tools' and have strong links with the Australian National Data Services (ANDS), the National Computational Infrastructure (NCI) and CSIRO.

Knowledge-sharing is a fundamental component of this work.

Australian Ocean Data Network (AODN) Portal

AODN uses data primarily provided by the Integrated Marine Observation System (see Part B: 5.1 Monitoring and Data Collection), and provides another example of the role of networks in providing insights about environmental issues to the broad public, and of engagement across jurisdictions and sectors.

5.2.9 Constraints of the current suite of tools

Despite continuing efforts to improve access to raw environmental data and analysis tools, public criticisms include:

- questions as to scale and a lack of local specificity
- a failure to ground truth data
- concerns about what data is actually collated and who makes the decisions about what data to collect and collate – including data about threatened species and threatened vegetation communities
- how zonings are selected
- how ‘estimates’ are determined and how they are revised, if they are revised
- complacency about climate change’s cascading impacts and feedback loops and concerns about tipping points being ignored
- the actual/real extent of access to information for the broadest possible public – that is, information without limitations.⁶⁵



Apollo Bay Community Gardens

5.2.10 Towards public analysis of environmental data

As government and other agencies continue to develop high-quality data products for specific purposes, there is scope for the government to act as a coordinating agency to expand the use of existing data by working with stakeholder groups to identify data needs. Different communities have different priorities and assets they wish to protect.

Combined or used separately these data-reproduction tools bring together large amounts of high-quality data. Relatively sophisticated investigation of the current state of environmental assets can be achieved by their use.

Not only do these reproduction tools provide raw information they can also be used:

- to determine potential outcomes of management regimes
- to determine the costs and benefits of implementing particular policies, and
- by local decision makers (such as local government and CMAs) who are working in partnership with the State Government.

Work that has already been carried out to identify priority ecosystem services (see Part B: 1.1 Managing the Landscape for Ecosystem Services) and core environmental indicators (see Part B: 5.1 Monitoring and Data Collection). can be extended by working with local governments to map local assets. This would entail a period of concerted effort to engage with regional councils.

In each case, when local priorities have been identified, the datasets available can be used as the basis for investigating the outcomes of policies and management actions at the local scale. For example: town planning, natural resource management or climate change adaptation.

It is critical that government continues to develop and improve tools that will allow environmental data to be used to evaluate management interventions, prioritise resource use and assess the costs and benefits of future actions.

It is also possible that environmental data products could be combined with geographical data from external sources using methods similar to those employed in AURIN (see above) to form the basis of a state environmental data service.

Ultimately, a state environmental data service could provide access to numerous environmental datasets that are collected and maintained by expert custodians.

The public tools for overlaying and interrogating datasets would:

- be straightforward to use
- allow varying levels of access according to user need
- be made available with sufficient information resources for outputs to genuinely inform the public
- include agreements with data providers to ensure security of data ownership and quality assurance.

5.3 Ecosystem Services: Public Awareness and Engagement

Proposition

Part B: 1.1 Managing the Landscape for Ecosystem Services includes Recommendation 1 for the Victorian Government to develop a Ecological Processes Management (EPM) Plan. A key prerequisite of this proposed EPM Plan will be to conduct broad-based community consultation to identify relative values and priorities for use of ecosystem services and constituents of wellbeing – avoiding absolute valuation and monetisation where not appropriate.

Below we discuss the plethora of great work which is undertaken by community groups and government agencies to engage the broader community in environmental practice. Many of the examples and principles referenced below were discussed in detail in our publication *Many Publics: Participation, Inventiveness and Change*.

This work and the strong networks formed across Victoria by community groups, landowners, businesses, educators, government agencies, Indigenous communities and culturally diverse Victorians creates a powerful foundation to expand upon and conduct the broad-based community consultation required to understand community values and priorities for use of ecosystem services and input them into the proposed EPM Plan.

Context

The Commissioner for *Environmental Sustainability Act 2003* (section 8) provides for the audit of ‘public education’ programs across Victoria.

In 2012, the Office produced a wide-ranging report on public awareness and engagement in multiple environmental protection issues called *Many Publics: Participation, Inventiveness and Change*.⁶⁵ This report reflected our rounds of consultation with the community across the state.

Since publishing that report the Office has continued to actively engage with the community about environmental issues. A great deal of this engagement has been localised and it is clear that there is a deeply organic movement to protect the environment which crosses sectors, generations and cultures.

5.3.1 Promotion of ecosystem services

Lessons for us and observations to be made about the success of community engagement in environmental issues include:

- projects with the greatest likelihood of success are not traditional top-down 'education' programs
- there is no universal model but continuity of support and consistency in messaging is extremely important
- the information flow is not only one way
- highly localised efforts receive better support¹³²
- the level of government funding is not always an indicator of success
- co-benefits are important
- people are not waiting for direction from authoritative knowledge brokers
- recruitment of participants is influenced by many factors and can be affected by leadership, pertinence of campaigns and trust alliances
- people value being included in decision making in meaningful and respectful ways
- the involvement of the community in decision making improves outcomes for a range of reasons and is highly useful to institutional decision makers.

The experience of community engagement that led to the publication of *Many Publics* demonstrated that a diverse range of people are seeking better environmental, economic and social outcomes and they bring with them multiple methodologies. We have concluded that the community, across ages, cultures and sectors, is actively committed to exploring the issues which underpin ecosystem health and ecosystem services.

The unifying thread in all these efforts and in all our conversations was a commitment to improved environmental practice and 'change'. We heard this message, for example, from dairy farmers in Gippsland, rural women in the Wimmera, friends of creeks and rivers in metropolitan Melbourne, Aboriginal people, homes where English was a second language, health workers, energy-efficiency campaigners, school children and senior Victorians.

Naturally, this message about the need for change was echoed by biophysical scientists, social scientists and agency staff involved in environmental issues and those involved in non-government organisations across the state.

Having made that observation, however, research demonstrates that much more needs to be done to protect and restore ecosystem services and processes, particularly as we confront the challenges of climate change and population growth.

The following discusses how we might increase the level of knowledge and commitment, even as we recognise the significant work already underway.



Beechworth Banksia Community Walk

5.3.2 Policy formulation based on community values of ecosystem services

5.3.2.1 Indicators and surveys about public awareness

One of the difficulties in driving public policy in support of decision making-models directed at ecosystem services outcomes, has been generating an evidence base to formulate inclusive policy instruments that reflect community concerns and awareness.

Recommendation 1 includes a prerequisite to undertake this work. How do we determine useful 'indicators' to reflect community values on ecosystem services? Having done so, how do we deal with an apparent lack of nuance in determining the links between ecosystem services, environmental awareness, policy development and action? Whatever indicators we select they may be too narrow, too wide or amorphous. What local lessons can be drawn from the work of community groups and landowners? Can we only forge policy at the local level and are these indicators only then specific to that scale and region?

Our valuing of ecosystem services extends beyond the services in reserve held in our natural assets. For example, our valuing of ecosystem services emerges in our attitudes towards:

- consumer purchasing preferences
- residential water storage and electricity generation (water tanks and solar panels)
- interest in environmental certification
- commitment to recycling and 'upcycling'.^{133, 134}

An indicator about the uptake of solar panels in Victoria may tell us a great deal about environmental awareness and concern, but it may also tell us about people's specific economic interests and their interest in co-benefits, which may be either environmental or economic, depending on preference hierarchy and personal circumstances.

Beyond developing indicators to illustrate levels of interest in environmental issues, we are often persuaded to rely upon survey data. The vast scholarship on surveys – techniques, methods, participant selection – suggest this mechanism may not be the most useful indicia of interest or commitment because of disparate motivations, 'value-flux' and a difficulty in separating or understanding the interconnectedness of environmental, social and economic issues.

Some valuable surveys on environmental awareness are undertaken in Victoria¹³⁵ and elsewhere in Australia.¹³⁶

EPA Victoria's 5 year plan social research program¹⁶⁵ monitors performance in key outcome targets for stakeholders identified in the 5 year plan 2011-2016. The General Public survey results indicate that providing information that has direct relevance to valued activities and assets by Victorians leads to more awareness and beneficial flow on effects than providing information about condition alone. For example, Victorians aware of living near environmental assets (waterways, beaches), or potential sources of harms (landfills, ports, airports), were more likely to perceive EPA as an evidence-based decision maker and authority on condition.

Similarly, Victorians aware of the Beach Report, Yarra Watch and Air Quality Report services, providing information aimed at helping Victorians make informed decisions for their use of waterways and beaches, or decisions about activities during poor air quality days, were also more likely to rate EPA's performance in this area higher. General awareness of non-specific EPA information is associated with slightly lower scores, but still positive perceptions, while people with no exposure to information were also lower but still positive.

Surveys of public opinion across Australia demonstrate that environmental issues rank below housing affordability, health care, local crime and education.¹³⁷

However, ranking issues presents a highly simplified picture of the actual position of the environment in our quality-of-life concerns and does not incorporate the ‘anonymous’ role that ecosystem services plays in many people’s lives – in fact, these surveys may well highlight the need for a concerted campaign to demonstrate these connections.

There is, for instance, no ‘health’ without a healthy environment. There is no sustainable housing without recourse to a continuing source of building material provided by the environment – the ecosystem service of timber. The work of *The Economics of Ecosystems and Biodiversity* (TEEB) makes these interconnections indelibly.¹³⁸

Scrutiny of community values and understanding of ecosystem services would generate a more measured, nuanced and grounded discussion, picking up on the systemic connections of environment and economics and, it is argued, it would promote better environmental outcomes.¹³⁹

The US Nature Conservancy undertakes surveys and studies into the US community’s valuing of ecosystem services. This work is recognised as international best practice and is often undertaken in collaboration with regional or state universities.¹⁴⁰ It provides a benchmark and useful guidance for the Victorian Government’s undertaking of similar foundation work for Recommendation 1.

5.3.2.2 Local matters matter

If we ask a different question, ‘What Matters to Australians?’, we find that we are primarily concerned about issues that relate to us and our local community.¹³⁷

Accepting the pivotal importance of localism, and recognising that environmental learning occurs when married to improving personal outcomes – including the attainment of co-benefits^{141, 142, 143} – it seems that we have the capacity to improve the way we both distil and instil environmental information.

Many people, many communities, numerous sectors and all tiers of government have legitimate and often keen interest in attaining better environmental outcomes. There are presently hundreds of programs, initiatives, formal and informal groups operating to protect and enhance environmental quality in Victoria. Many groups are composed exclusively of volunteers, while some are supported by paid coordinators and facilitators. Some of these groups have been active for generations.

Among them, Friends of the Merri Creek have spent countless weekends across generations – in partnership with local government, local businesses and schools and with representation from many cultures and age-groups – enhancing ecosystem services. They have built a biodiversity corridor, provided habitat for fauna, and improved the area for recreational activities.¹²⁷

Landcare has been operating for 25 years. The Friends of the Helmeted Honeyeater have been active for even longer. The Lake Bolac Eel Festival committee maintained its commitment to an annual festival, celebrating the local environment, even as the Millennium Drought left the lake dry.

There are also many newer groups – concerned about issues like energy, urban water and climate change and its impacts – like the Heyfield Flags Group and the Wangaratta and Portland Sustainability Groups.

Whole towns have committed to improved environmental outcomes – Newstead with the launch of its Community Plan in the Mount Alexander Shire is an example of this. The Newstead Community Plan is a typical example of the blending of environmental, social and economic issues and interests. Bike paths promote health and also have environmental benefits. The tree survey provides a benchmark, establishes need and provides a buttress against climate change impacts. The fire plan is concerned with human safety and also with protection of biodiversity. Hundreds of local people, across generations, have committed thousands of hours to developing this plan to deal with highly local issues.

Social media is playing an increasingly important role in this movement.

5.3.2.3 Crisis driven: fire, drought and flood (2009–2013)

Some of this localised environmental work has been in direct response to particular crises. Much crisis response starts with local social and economic concerns, but it illustrates the embedded nature of environmental considerations and the power and importance of partnerships with others – with NGOs and government.

The work done in the aftermath of the 2009 bushfires presents us with a good example of a carefully designed program informing the Victorian community about bushfire recovery (and preparation) and focused on local engagement, maintaining continuities, ingraining public consultation and promoting lasting active and interactive learning.¹⁴⁴

This work is built on Moser and Dilling's impressive collection of essays, which helps us to understand the importance of encouraging public outreach and action learning as the risks and consequences of climate change impact.

Farming communities and individuals, responding to the Millennium Drought, worked to improve their farming practices (see the Case Study on the Victorian no-till farmers in *Many Publics*)⁶⁵ and triple-bottom-line co-benefits flowed.

For instance, DEPI research has demonstrated that sheltered pastures lost 12 mm less water than open pastures in the spring growing season. In one study, shelter belts demonstrably reduced the cold stress and live weight-reduction in cattle by as much as 31%. The straw-necked Ibis, attracted to insect-rich pastures, consumes up to 25,000 insects per day; while sugar gliders can eat up to 3.5 kilograms of insects per year. The gross value of pasture output is at its highest level when the proportion of tree area on a farm is 34%.¹²⁷

In some cases soils improved, communities and farming practices developed resilience, and for the long term, climate change adaptation was normalised, mainstreamed and maladaptation avoided. This sort of environmental work has occurred even as the surrounding prevailing ethic may have been to deplete natural capital.⁶⁵ It is predicated on sharing relevant knowledge, learning by doing, and the availability of sectoral professional development.

In the aftermath of the 2010–11 floods, localised public engagement was actively sought and underpinned the work of the flood inquiry.¹⁴⁵ The inquiry was itself a catalyst for meaningful discussion at the local level with a view to informing the 'centre'. For example, the MAV, representing local government across the state, consulted widely and promoted both community environmental programs and engineering solutions on the basis of that consultation.¹⁴⁶

Crises – and the community consultation and public enquiries that ensue – provide the engine room for promoting environmental awareness about the role of ecosystem services in local communities, provided methodologies are relevant and accessible.

5.3.2.4 Co-benefits

Economic or health concerns may present as the initial driver for change, and then positive environmental outcomes may emerge as ‘co-benefits’ of action.

Regional people in the little town of Merino were invited to join an energy-efficiency program through a local primary-care partnership (the Pass-The-Parcel program).¹⁴⁷ Participants enjoyed immediate economic benefits but also reduced their greenhouse gas emissions. Similar programs with multiple outcomes have been repeated in Brunswick and Coburg.¹⁴⁸

Processes which were not top-down ‘environmental education’ programs improve environmental awareness of ecosystem services and produce environment outcomes. Environmental awareness grows by osmosis and learning by doing, not necessarily by didactic strictures. Purposeful interventions by individuals and organisations with expertise and access to community networks is, however, an essential part of the process (see below for a discussion of the importance of trusted organisations) as is evaluation.¹⁴⁹

Evaluation of community environmental programs provides government with critical information to not only ensure the ongoing viability of community groups but also how to promote the values and understanding of ecosystem services. Key government action would include:

- persistently support and reinvigorate programs that have worked
- consistently assist in meaningful evaluation of the environmental work that is already underway
- promote community leaders
- celebrate successes and value best-practice groups
- routinely fund local initiatives
- maintain continuity of programs and funding streams.

The corollary of this is the need to ensure that the institutional and regulatory environment are clear and that government supports open access to data and monitoring (including citizen science).

5.3.3 Community engagement across the spectrum – trusted organisations building collaborations

Trusted organisations will always play an important role in supporting better outcomes, and in guiding and consolidating efforts. These may include people-centred organisations like Landcare, or institutions like museums and zoos, which have long understood the need to provide accessible information in engaging ways.¹⁵⁰ Museum Victoria featured in our Strategic Audit 2011 for its award-winning recycling of its exhibition space building materials and drawing the public into the discussion of this.¹⁵¹ Zoos Victoria is probably the best example of a public communicator of environmental messages in the state.

In places where there is interest, but often conflict, it can be harder to engage and build environmental awareness, even for trusted organisations. The EPA, with its focus on pollution, environmental quality and the sanctioning of breaches, has very recently made a number of recommendations indicating the value of an engaged community and promoting the involvement of the public in developing environmental protection policies.¹⁵²

5.3.3.1 EPA review of state environment planning policies

For the government to lead a process to promote, understand and prioritise community values in relation to ecosystem services, much can be learnt from government institutions and agencies such as Museum Victoria, Zoos Victoria and the EPA.

EPA led a consultation process where Environment Victoria, the Environment Defender's Office, environment group representatives and community stakeholders attended a roundtable discussion to discuss ways to enhance engagement and involve the community when state environment planning policies (SEPPs) are made, amended, or referenced.

Proposals included:

- asking children to educate decision makers on what they enjoy doing in the environment
- implementing a citizens' jury to give the community equal say in decision making⁶⁵
- including scientists and industry representation in decision making.

Overarching considerations included a commitment to increasing public accessibility to statutory policies and updates, the condensation and consolidation of content, and avoiding repetition and jargon – a persistent issue in environmental information contexts. A 'user's guide' was suggested as one mechanism for achieving better outcomes for a 'lay' audience and a hierarchy of importance was also suggested as a means of clarifying commitments.

The Commissioner for Environmental Sustainability endorses the recommendations in the EPA's Review of the State Environment Planning Policies.

In particular, Recommendations 13–15, which are concerned with wider community engagement, streamlining policies and the use of clear, simple language respectively.



Charlton Volunteer Centre, flood recovery

Case Study: ResourceSmart AuSSI Vic

The *ResourceSmart AuSSI Vic Initiative* is a government supported framework for schools-based sustainability education.

Its precursors, developed by the *Gould League* and *CERES* (Brunswick), started the Victorian commitment to this work. There are now nine consortia of service providers across Victoria including *CERES* delivering ResourceSmart AuSSI Vic. ResourceSmart AuSSI Vic is managed by Sustainability Victoria in partnership with the Department of Education and Early Childhood Development.

The framework provides a holistic approach to sustainability by integrating educational, environmental, social and economic outcomes for participating school communities.

The Initiative is funded through the Victorian *Sustainability Fund* a perpetual fund provided by the landfill levy.

Over the next few years the existing framework will unfold in the following ways. It will:

- engage with 400 new Victorian primary and secondary schools, bringing the number of participating schools to about 50% of the state's schools
- maintain the current participation of over 700 Victorian primary and secondary schools
- continue to reward and recognise schools' achievements through the ResourceSmart AuSSI Vic 5 Star Sustainability Certification (5 Star) process and the annual ResourceSmart School Awards event
- conduct a pilot environmental sustainability education program with the early childhood sector
- provide incentives by grants of up to \$10,000 to schools to undertake energy efficiency activities for the 400 new schools which are being encouraged to join the Initiative.

Localism is a key component of this initiative. It has adopted a place-based delivery model, in that local providers and networks support schools within a designated geographic region.

A great deal of volunteerism underpins the success of the program – from teachers and school communities.

Outcomes

There is a demonstrated minimisation of waste, savings are made in energy and water use and associated accounts, and greenhouse gas emissions are reduced. Benchmarks are set and used as indicators of progress. Management of school facilities and resources is often improved. External relationships are improved and also become more productive.

Sustainability is integrated into school planning and strategic process. Resource-use management is improved, sustainability practices are embedded into the school operations, and teaching, learning and community engagement is actively encouraged.

Leadership is cultivated in the community and in the school itself and students develop environmental awareness and gain skills in environmental management which will position them for environmental leadership roles in the future. The Initiative supports implementation of the Victorian Essential Learning Standards (VELS) and the Australian Curriculum (AUS VELS).

The 5Star Sustainability Certification is awarded when a school demonstrates continuous improvement against benchmarks set in the areas of planning, biodiversity, energy, waste and water.

5.3.3.2 Provision of materials and guides – tool kits and multi media

Tool kits, guides and brief fact sheets are extremely valuable as components of a suite of teaching or professional development aids in generating environmental awareness about the value of ecosystem services.

There is a long history of development of guides of this kind, across sectors and geographies. Tool kits no longer simply deal with isolated or discrete issues. They can be ambitious and use the range of electronic and social media available to expand their potential influence.

Case Study: Examples of the Range of Toolkits

The Australian *Natural Resources Information Management Toolkit*¹⁵³ addresses issues like capacity building, monitoring and evaluation. Its target audience is diverse – from technical managers to regional groups – and it provides guidance on general principles and detailed practices. Similarly, the Florabank species navigator¹⁵⁴ provides online species seed propagation and collection advice.

Internationally, the scientific community see the benefits of promoting understanding of ecosystem services through factsheets and toolkits. The Union of Concerned Scientists and the Ecological Society of America have joined forces to develop toolkits¹⁵⁵ for communicating ecosystem services. The resources include easy-to-understand fact sheets with descriptions of things individuals can do to help protect specific ecosystem services.

A *Water Purification Tool Kit* identifies the benefits of pure water and the risks associated with a lack of care for the waterways of New York City.¹⁵⁶ The Tool Kit provides information about a range of individual and other actions which will reduce adverse impacts on water quality including:

- at a farm-scale, avoiding the over-use of fertilisers and pesticides
- in housing developments, resisting the temptation to pour toxic chemicals down drains
- as a community, engaging in active conservation measures, such as getting involved in efforts to clean up waterways
- at all tiers of government, providing real and relevant support for the protection of natural areas and supporting planning regulations that limit the impact of development on ecosystem services.

Illustrating the importance of the water conservation and ecosystem services message, the *Australian Water Education Toolkit* supplies dozens of guides about water resource use and conservation.¹⁵⁷

Greening Australia has been explicitly advancing the use of toolkits in promoting an understanding of ecosystem services. This work includes the *Make an Impact Toolkit*, which was developed in partnership with Alcoa Australia to assist Alcoa employees to reduce their energy and water use.¹⁵⁸

Conventional information packages should only be the beginning of the use we make of the electronic aids we now have available to us. Webinars, YouTube, mimeos and the ever-expanding range of electronic aids need to be imported into the options deployed. This requires specific research and application. Teachers and agency staff could be exploring these possibilities and adopting a leadership role in facilitating a shift into the electronic age in education for environmental awareness and ecosystem services.

5.3.3.3 Exploring cultural complexity in raising awareness of ecosystem services

New e-tech ways of generating interest, building a constituency, encouraging people to be active, emphasise the importance of cross-disciplinary integration to engender change in environmental decision making.

Changing our understanding of the mediums in which we can effect improvements is only one of the cultural changes we should be exploring.

We have a wealth of cultural influences in the community of Victoria. It is clear that communities which are 'outsiders' to mainstream environmental discussions may provide us with insights and other, different, pathways. In promoting environmental best practice and understanding the values inherent in ecosystem services, it is important to remain open to the multiple ways of achieving this understanding.

Our Office has been engaged with the great work undertaken in cross-cultural environmental education and awareness by Moreland Energy Foundation Ltd (MEFL) and Environment Victoria in the northern suburbs of Melbourne with the Arabic, Alawi and Asian communities in energy-use abatement and greenhouse gas reduction programs.

We also know that in Nhill the community garden is shared with the active Karen community – who have a long-standing interest in sustainable food.

Aboriginal people, the first Australian nations, have also provided invaluable insights about climate change and cultural connectivity to a wide range of scientists – both biological and social – through the Yorta Yorta Climate Change Group (along the Murray River) and as a function of the Budj Bjim Gunditjmara Lake Condah relood program.

Climate Communities grants of \$50,000 (managed by the Victorian Government) are made available to interested communities. Ongoing reporting and evaluation in the form of videos, photo diaries and stories identifying significant change provide novel methods of evaluating programs.

'There is a lot to learn and there is a lot to share, in organisational cultures and elsewhere.'

Case Study: Melbourne Water organisational change

A new way forward

Melbourne Water is implementing a number of strategic initiatives with the aim of improving organisational efficiency, capability and business outcomes. These involve completely *new ways of approaching business* and will therefore require a *new way of thinking* to implement them.

The projects are enterprise-wide and require extensive cross-organisational collaboration for them to be taken up as the new thinking and way of working. This type of change cannot be forced from the top down. It requires a *cultural shift* and a *new change leadership* approach.

Sustaining Change was engaged by Melbourne Water to assist because we specialise in how organisations and systems think, grow and establish themselves. At Sustaining Change we understand that each organisation has a unique configuration of business, strategic and people levers, required to interact to improve internal capability and external sustainable competitiveness.

To help Melbourne Water implement their new strategies Sustaining Change conducted a series of facilitated, iterative interventions. This was to create dialogue and engagement between different parts of the business on topics that were different from the usual task-based, project management ones. This non-linear approach created space for a wider range of issues to surface than are normally found. It allowed sharing of data about:

- the deeper meaning of work for individuals
- attitudes to their roles.

It also allowed us to identify:

- levels of capability
- leadership and team working skills
- understanding and operation of organisational processes by employees
- employee ideas about solutions to problems.

This data also resulted in shared understanding of the meaning that employees attribute to their work environment, and how they attribute that meaning. This enabled us to work with them to develop solutions that address problems as they see them. It helped create shared visions of what the organisation would look like after the strategic initiatives were implemented; and it helped clear bottlenecks, reduced conflict and created shared processes and activities.

This has also flowed on to improvements in their planning, scheduling and other project management processes. In addition it has resulted in broader and more persuasive communications with stakeholders. These process-based interventions and thinking tools also create capability in the staff who participated in them, so that they in turn can run a similar approach to unblocking hurdles in their own areas of responsibility.



Melbourne Water working differently

We have also assisted Melbourne Water to look at their new initiatives and strategies through both the internal and external lens of how people manage, react to and implement change. This has identified synergistic linkages between the implementation of new strategies, the operation of them, and the customer experience. This ensures that they all align rather than compete or cancel each other out. This enables Melbourne Water to avoid developing business processes that may be efficient but which are difficult for customers to use; or developing improved customer interfaces that result in more costly business processes for the organisation or which the organisation does not have the capability to support.

Once we understand how people attribute meaning to their environment and what that meaning is, we then know how to influence and lead them, how to resolve problems and design solutions, and what changes need to be deployed for a strategy to be implemented, and achieve the intended results for its business.

Working with our approach has resulted in Melbourne Water being able to better identify its gaps, define solutions, plan its activities and begin to embed its new strategies to achieve the organisational efficiencies and outcomes it seeks.

5.3.3.4 Business opportunities

In reflecting on and raising environmental awareness, it is important to discuss the role played by business.

A range of businesses in Victoria have been working on attaining better environmental outcomes and generating environmental awareness in their organisational structures. There is a significant movement to improve corporate social awareness at the structural level. Shareholders are driving better outcomes. The public is interested in change and business is not immune from these drivers of change. Some of these initiatives have been discussed in the strategic audits that the Office has undertaken.

Many businesses, often as a commitment to corporate social responsibility, have programs in which they promote environmental volunteering.

In Ballarat the headquarters of Conservation Volunteers provides a lynch-pin for a number of programs which encourage business volunteerism in the environment.¹⁵⁹ The organisation has been operating since 1982, having been started by a Yandoit farmer. It now manages over 100,000 conservation volunteer days per year, and has received multiple accolades and awards, including the Prime Minister's Award for Excellence in Community Business Partnerships.

Conservation Volunteers has also developed the only online booking service for volunteers in Australia, in partnership with Toyota. It is noted that in the nine-year partnership between Conservation Volunteers and Toyota a total of \$4.3 million has been assessed as accruing in benefits to society and ecosystem services.¹⁶⁰

City West Water's Community Grants Support Program for the non-government and community business sector,¹⁶¹ South East Water's dual-flush toilet program,¹⁶² Yarra Valley Water's Choose Tap program¹⁶³ and Melbourne Water's *Know Your River* booklets¹⁶⁴ form a small part of a plethora of programs that deliver better environmental outcomes for their customers.

These programs reduce resource use, waste and greenhouse gas emissions and inform and enrich our knowledge of the ecosystem services provided by our local environments. They also produce co-benefits in cost savings and better social outcomes.