Valuing and accounting for Victoria's environment:

Strategic Plan 2015-2020

Department of Environment, Land, Water & Planning

State Government Victoria

Cover photograph credits

DELWP and ARI photos (Scientist Viv Turner and DSE cadet Sam Barron surveying plants in a Northern Plains grassland, photo from Michele Kohout)

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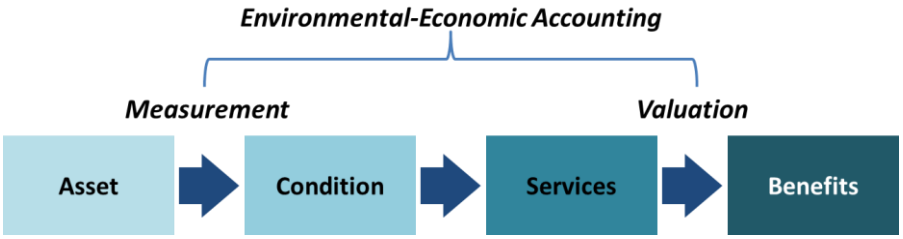
Executive Summary

Vision: Victorian Government policy and reporting is built on international environmental-economic accounting standards to better manage environmental assets for a sustainable, healthy and productive Victoria.

This document outlines a strategic plan to adopt the United Nations System of Environmental-Economic Accounting (SEEA) to improve reporting, decision-making and evaluation by DELWP, portfolio partners and the Victorian government. The SEEA is a multipurpose conceptual framework for understanding the interactions between the environment and the economy. It provides internationally agreed standards on concepts, definitions and classifications to compile environmental, social and economic statistics, deriving coherent and comparable indicators and measuring progress towards policy goals. It includes guidelines for ecosystems specifically, which build on recent initiatives for measuring and valuing ecosystems including the Millennium Ecosystem Assessment, The Economics of Ecosystems and Biodiversity (TEEB) and the Wealth Accounting and Valuation of Ecosystem Services Partnership (WAVES).

The SEEA is used to integrate the measurement of environmental assets and the valuation of benefits they provide together in a consistent manner across many domains of the environment (water, land, soil, biodiversity, forests, etc.) using internationally agreed accounting concepts (see Figure i below). A coherent approach to the measurement and valuation of environmental assets is the cornerstone for more integrated robust, evidence-based decision-making.

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



This Strategy addresses key challenges for DELWP including the need for better information on the degradation of environmental assets and the impact that may have on economic and social wellbeing. This information is used to demonstrate the value of investing in and protecting the environment. Environmental-economic accounts provide a robust framework to consider multiple benefits and tradeoffs among alternative policy and management options and support the ongoing monitoring, evaluation and reporting (MER) across the portfolio.

Having a common language and a consistent approach to frame information will help DELWP and portfolio partners to address environmental degradation and climate change risks affecting Victoria's environmental assets more effectively. Over the long term this capability will help to build a healthier and more resilient environment, and support more sustainable Victorian communities. The three objectives of the Strategy are:

- **Objective 1 – Apply best practice for consistent reporting on Victoria's environment:** tracking trends in the status of Victoria's environment and the services flowing to the Victorian community using internationally accepted standards.
- **Objective 2 – Integrate the benefits of a healthy environment in policy and planning**: valuing benefits from the environment and integrating them into policy development, planning and decision-making by Government.
- **Objective 3 – Improve evaluation of program investments in the environment**: assessing and improving our policies, programs and investments to protect or improve Victoria's environment using consistent performance measures.

DELWP has contributed to the development of the SEEA over a number of years and produced pilot experimental ecosystem accounts for the State in 2013 that report on the status and changes in environmental assets in Victoria. More recently, DELWP has produced pilot accounts for the Victorian parks network to show the status of environmental assets in parks and the contribution parks make to the prosperity and wellbeing of Victorians, and produced program level ecosystem accounts to evaluate the outcomes of conservation tenders to improve native vegetation and reduce risks to threatened species. The Victorian pilots have demonstrated that adopting a consistent framework makes it possible to compare changes in the extent and condition of environmental assets within and across environmental initiatives.

The benefits of implementing this Strategy include:

- DELWP will respond more effectively and in a timely fashion to emerging environmental issues that are critical to Victorian communities
- Being better able to describe value to the community of investing in the environment and linking this to economic decision-making
- Improved resource allocation across programs, demonstrating value-for-money and understanding tradeoffs
- Time and cost savings in accessing data that is readily available for public use in DELWP
- Stronger environmental partnerships with CMAs and other organisations on environmental management
- More informed and evidence based policy development within DELWP
- More efficient evaluation, monitoring and reporting of program outcomes within DELWP
- Improved accountability to the government and the public

The Strategy will be implemented by DELWP in collaboration with key stakeholders including Parks Victoria, Environment Protection Authority Victoria, Victorian Commissioner for Environmental Sustainability (CES) and Catchment Management Authorities. In addition, it will engage with central government agencies, including the Department of Treasury and Finance and Department of Premier and Cabinet, along with external collaborators, such as the Australian Bureau of Statistics and the United Nations Statistics Division.

The implementation of the Strategy will involve the delivery of a number of actions identified in consultation with relevant teams across DELWP in seven priority areas (outlined in Figure ii below). It will be undertaken in three stages:

- **In the short term** (over the first two years, 2015 and 2016), the work will focus mainly on reviewing and developing core capabilities, developing key relationships with external organisations, and producing pilot accounts and valuation applications to meet DELWP needs.
- **In the medium term** (2017 and 2018), moving from pilot into production for key accounts and valuation work and increased collaborative work with other government agencies and other organisations undertaking pilots at the regional or State scale.
- **In the long-term** (towards the last two years, 2019 and 2020), DELWP will focus on consolidating state-wide accounting and valuation work with partners and work towards a program for ongoing production of key accounts over time. A state-wide ecosystem assessment will also be pursued.

Figure ii. Overview of the Strategy

1. Vision

Victorian Government policy and reporting is built on international environmental-economic accounting standards to better manage environmental assets for a sustainable, healthy and productive Victoria.

Victoria's environmental assets are fundamental to the Victorian economy and society. A healthy environment has unique intrinsic values and is also the basis for many Victorian regional industries, such as agriculture and tourism. Environmental assets contribute to the State's liveability and sustainability by providing clean water and air, and habitats for species.

Often only piecemeal information is available on environmental benefits and costs to design and implement government policies and programs. As a result, many government decisions are taken without recognising fully the value of outcomes and tradeoffs affecting the environment, and the linkages between the environment and socioeconomic objectives for Victorian communities. A lack of consistent and coherent information also limits our ability to assess the performance and effectiveness of State investment programs aimed at protecting and improving environmental assets.

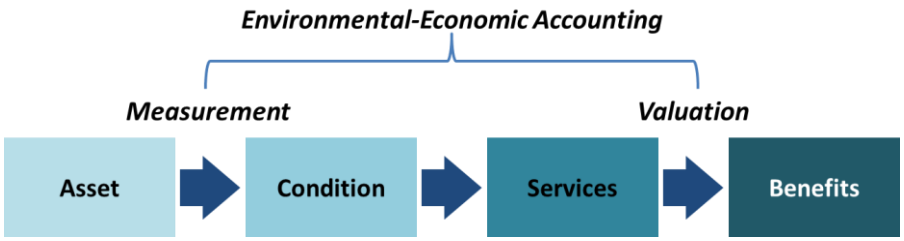
Purpose and outcomes sought

This Strategy proposes a fundamental shift in the organising frameworks for information to support and inform policy, planning and investment decisions affecting the environment. Specifically, the purpose of the Strategy is to use best practice environmental-accounting for integration into reporting, decision-making and evaluation by DELWP, portfolio partners and the Victorian government.

The Strategy will adopt the System of Environmental-Economic Accounting (SEEA). The SEEA is a multipurpose conceptual framework for understanding the interactions between the environment and the economy. It provides internationally agreed standards on concepts, definitions and classifications to compile environmental, social and economic statistics to derive coherent and comparable indicators and measures of progress for policy goals.

Environmental-economic accounting is used to integrate the measurement of environmental assets and value the benefits they provide in a coherent and consistent manner across many domains of the environment (water, land, soil, biodiversity, forests, etc.) using internationally agreed accounting concepts (see Figure 1 below).

Figure 1 Integrating the measurement of environmental assets and valuation of their benefits



Measurement refers to the knowledge available, along with information and related tools used to assess and monitor the status of Victoria's environment. Measurement is the cornerstone of robust evidence based decision-making and involves work to maintain and advance our capabilities to assess the state of environmental assets, their attributes and the impact of human interventions on them. Valuation refers to the assessment of benefits society derives from both market and non-market goods or services provided by the environment (or costs or welfare losses from environmental degradation or depreciation).

In the past the measurement of environmental assets and valuation occurred independently and could not be combined easily for policy and decision-making. Using the SEEA guidelines and standards to integrate these measurement and valuation components provides a robust approach to assessing multiple benefits and tradeoffs among alternative policy or management options.

Environmental-economic accounting will enable DELWP and portfolio partners to develop a more consistent inventory of environmental assets and the services they provide in our society and economy over time, along with transactions from investments in the environment. It provides links between management and changes in the quantity and quality of environmental assets and an understanding of how these changes generate value in terms of social, economic and environmental benefits to Victoria. The integration of environmental-economic accounting into DELWP's business operations and strategic planning can be used for multiple purposes including:

- raising awareness among stakeholders
- resource allocation across diverse programs,
- assessing tradeoffs under alternative scenarios
- improving transparency and accountability in reporting on investment outcomes, and
- providing base data for analysis to understand how DELWP can improve program outcomes over time.

The accounts will further provide significant opportunities for methodological development in each domain to value-add to the current information that is already collected and reported. For example, it will help to reduce information costs and achieve more effective communication across domains by applying the SEEA consistently.

The Strategy aims to achieve the following outcomes in five years:

- **Increased engagement and understanding** across the Victorian government, private sector and communities about needs to sustain Victoria's environment
- **Greater understanding about the role of a healthy environment** in Victoria's progress and growth
- **Stronger capability to assess benefits from a healthier environment** and hence better balance tradeoffs between competing uses of ecosystems across the community when making policy, planning (resource allocation) and investment decisions
- **Support government, businesses and communities to identify synergies** where more sustainable practices improve environmental health, while supporting economic activity and social outcomes
- **Improved transparency and accountability to the government and the public** in measuring outcomes and effectiveness of DELWP and portfolio partners' investments in the environment
- **Ability to undertake consistent analysis to improve programs and policy design** over time.

2. Information challenges addressed through this Strategy

The sustainability of our communities and our economy relies on interactions between our environmental assets, produced assets and human capital. Environmental assets include a diverse range of land, marine and fresh water ecosystems that support biodiversity and provide resources. However, only the extraction and harvest of resources are currently reflected in measures of economic performance, such as Gross Domestic Product (GDP).

The environmental impacts of unsustainable harvesting and damages from pollution are poorly reflected in the System of National Accounts (SNA). Further, benefits provided by ecosystems such as air filtration, flood protection and amenity services are not considered in the set of market exchanges among consumers, businesses, government and foreign nations (economic units) and are not included in the SNA. Thus, current national accounting presents a partial story of the sustainability of our economic activity.

In Victoria, there is currently no standard framework being used to organise information on environmental assets in a manner that can be directly integrated with standard economic information. The consequence is a lack of consistent information for environmental agencies and government generally to understand how

the environment is changing, its contribution to economic performance, welfare and societal wellbeing, and the impacts that economic or environmental programs or public policies are having on natural capital.

At the Federal level, the Hawke Review 2009 explicitly recommended that the Australian Government, in the interest of promoting ecologically sustainable development, develop a system of environmental-economic accounts to:

- Establish baseline national environmental information;
- Systematically monitor changes in the quality of the Australian environment;
- Provide an information basis for improved regional planning and decision-making; and,
- Strengthen the capacity of Local Government to incorporate land-use planning into decision-making.

A number of recent Victorian audits also have made similar recommendations:

- Develop a suite of consistent output efficiency and outcome effectiveness measures to monitor and assess conservation efforts (Victorian Auditor-General's Office (VAGO) 2009, Administration of the Flora and Fauna Guarantee Act 1988);
- Develop measures, monitoring and data to show progress towards desired outcomes in managing timber resources (VAGO 2013, Managing Victoria's Native Timber Resources); and
- Improve documentation of the information and processes used to select performance indicators and output measures (VAGO 2013, Environment and Sustainability Sector: Performance Reporting).

While there has been a number of targeted responses to the above recommendations and work is ongoing, this Strategy proposes the use of internationally agreed standards contained in the SEEA as an important next step response.

This Strategy addresses the following key challenges/opportunities for DELWP:

- The need for better information on the degradation/depreciation of ecosystems, and how this impacts on the economy and broader society;
- Limited ability to demonstrate the value of investing in and protecting the environment due to piecemeal information;
- Increasing demand for consistent monitoring, evaluation and reporting (MER) approaches across the portfolio that allow DELWP to compare and improve policy and program outcomes.

3. Progress in accounting for the environment

The development of environmental-economic accounting for national and state governments has been underway for more than 20 years, but significant advances have been made in the last few years. In 2012, the United Nations (UN) adopted the SEEA Central Framework as an international statistical standard and in 2013 it endorsed a complementary guidance document on ecosystem accounting. Together these documents provide an accounting framework for integrating environmental information with standard economic information. Subsystems of the SEEA framework have been developed for energy, water, fisheries, land, and agriculture.

In a parallel process there have been a number of discussions centring around 'natural capital' which are also linked to the development of environmental-economic accounting. Both processes reflect the increasing need to understand the multiple benefits societies derive from healthy environmental assets and their interdependencies. In broad terms natural capital refers to all of earth's natural resources, ecological systems providing vital life-supporting services to society and all living things, e.g. air, water, soil, habitats and biodiversity. The focus of this Strategy is on natural resources from ecosystems, their supporting landscapes and ecological underpinnings. The Strategy does not cover mineral resources and geological underpinnings.

Environmental-economic accounting has the specific purpose of articulating the link between environmental assets and the use of these assets in economic and social activity. The use of the term 'environmental-economic accounting' is aimed at making it clear that the focus of accounting is on measuring the relationship between the environment and the economy, going beyond only measuring and reporting on the environment alone. In this context, environmental reporting (the process of collecting, processing and presenting information and indicators on the environment) is important but not sufficient to understand how changes in the environment can affect our society.

Environmental reporting is a long-standing field of endeavour with many streams of work across the different aspects of the environment, for example water, soil, air quality, forests, biodiversity, carbon sequestration, etc. Generally, it has developed data collection definitions and techniques that are specific to a particular aspect of the environment. In some instances, this can limit the capacity of the information to be integrated to convey a coherent narrative about how environmental assets have changed over time. The focus of environmental reporting is on collecting biophysical data concerning specific environmental variables and generally, does not provide information on the connection between the environment and economic or social activity. The use of the SEEA provides a framework for better integration of current environmental reporting initiatives and guidance on how future environmental reporting can be enhanced.

The SEEA builds on expert knowledge from leading statistical agencies worldwide along with experience from a number of international initiatives aimed at advancing the measurement and valuation of ecosystems, biodiversity and ecosystem services. This has been achieved over the recent decades through research in environmental economics, along with initiatives integrating environmental performance into economic reporting, such as the Millennium Ecosystem Assessment[1], The Economics of Ecosystems and Biodiversity (TEEB)[2], Accounting for Nature (Wentworth Group of Concerned Scientists)[3], Natural Capital Declaration[4], the Wealth Accounting and Valuation of Ecosystem Services (WAVES) Partnership[5].

At an international level, the ambition is to implement the SEEA framework in all countries and a global implementation strategy is underway. Advancing this strategy is involving all key international agencies, including the UN, OECD, World Bank, FAO, IMF, UNEP and UNDP. In particular, the implementation of the SEEA is expected to improve coordination and coherence of national level data to underpin development initiatives including the recently adopted UN Sustainable Development Goals.

Within Australia, the Australian Bureau of Statistics (ABS) has been a leading contributor to the development of the SEEA standards, and it is also leading implementation with accounts developed for land, waste, greenhouse gases, water resources, energy use and ecosystem accounting for the Great Barrier Reef. Other countries leading the adoption of the SEEA include Canada, Netherlands, UK, Denmark and Norway, and significant momentum is building in non-OECD countries such as China, Brazil, South Africa, Indonesia and India.

Box 1. Trends from ABS environmental accounts

The ABS commenced compilation of environmental accounts in the early 1990s for assets within the SNA boundary, such as mineral resources, forests and land. A summary compiled in 2013 showed that over the period 2002/03 to 2010/11 greenhouse gas emissions and energy use increased steadily by 9% and 15% respectively, while waste rose by 68% (well above economic growth rates over the same period). By contrast, water consumption was shown as decoupling from economic growth, decreasing by 34% over this period. This was mainly driven by restrictions on domestic water use and a shift towards less water intensive crops as a result of drought conditions.

Source: Australian Bureau of Statistics 2013

Since environmental-economic accounting reflects a combination of integrated data, it can support the analysis of sustainable use of resources, the impact of economic activity on the environment and the effectiveness of program investments and related transactions (e.g. clean up costs, environmental taxes, environmental fines/penalties, cost of pollution abatement technologies and waste management costs) in achieving policy goals.

[1] Millennium Ecosystem Assessment, 2005. Available in: http://www.millenniumassessment.org/en/index.html
[2] TEEB: http://www.teebweb.org
[3] Wentworth Group of concerned Scientists: http://wentworthgroup.org/
[4] NCD: http://www.naturalcapitaldeclaration.org/
[5] WAVES: https://www.wavespartnership.org/en

Valuation techniques and guidelines have been increasingly applied in the assessment of benefits from market and non-market goods and services. Market valuation draws on transactions directly observed within the economy or can be inferred by analysing commercial transactions. By contrast, non-market valuation techniques have been developed over the last few decades to elicit the value of environmental benefits or damages that are not captured in market transactions as a result of production or consumption activities. While the intrinsic value of maintaining the health and integrity of ecosystems and species needs to be recognised, valuation aims to assess the relative importance of environmental impacts affecting human use and/or non-use values[6].

Non-market valuation is being used more widely across a number of sectors, including health, transport and the environment, noting that a high standard of rigour is required to deliver credible values. Its use in economic analysis helps providing a more complete picture of welfare outcomes.

Overall, market and non-market welfare values can be used to inform the development of policies, regulations or market-based instruments in capturing a broader range of externalities, as outlined in Table 1.

Table 1. Examples of market and non-market values relevant to environment policy

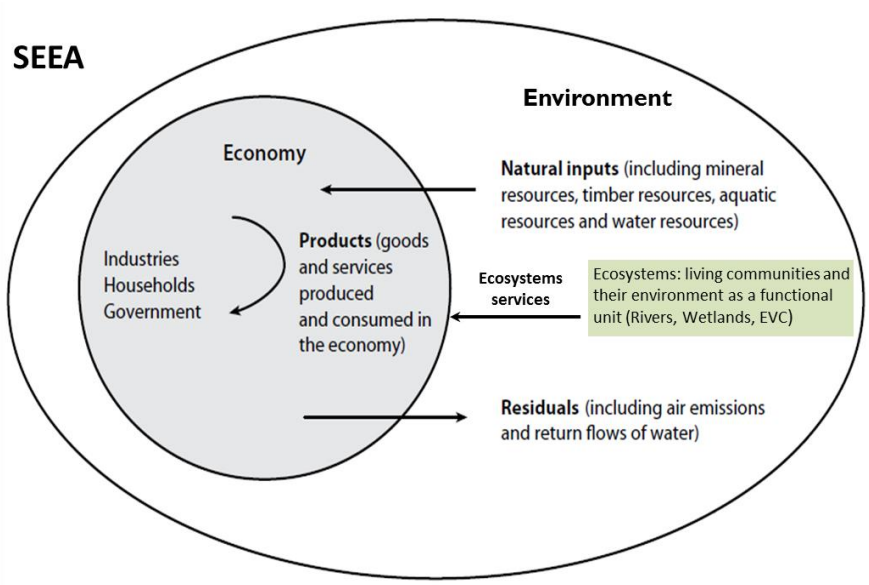
Policy areas	Market values directly relevant	Non-market values directly relevant
Air quality – air pollution	Air pollution taxes/levies, pollution abatement costs (e.g. costs of filters, upgrades to efficient plants)	Health impacts (e.g. illness, irritation) and loss of amenity
Water quality – stormwater and water discharged from factories	Abatement costs (e.g. cost of water filtration), government funding to improve water quality	Degradation of ecosystems and reduced recreational enjoyment
Water allocation – consumptive and environmental uses	Value of water entitlements (e.g. irrigation, residential/industrial use), distribution costs	Impacts on water filtration, groundwater recharge, health of wetlands, habitats
Mining – clearing native vegetation	Mining profits, incomes of mining workers, royalties, taxes, environmental licence fees	Impacts on wetlands from groundwater extraction, land subsidence and amenity
Native forest – logging	Profits from wood processing facilities accessing logs, market value of products	Loss of biodiversity and reduced recreational enjoyment
Waste management – improper disposal of waste	Costs of increase waste to landfills and recycling, costs of anti-litter programs	Impacts on human health, visual amenity and ecosystems

Source: Adapted by DELWP from Baker, R. and Ruting, B. 2014, 'Environmental Policy Analysis: A Guide to Non-Market Valuation', Productivity Commission Staff Working Paper, Canberra.

An overview of the connections between environmental assets and the economy in the SEEA is provided in Figure 2 below. Understanding the connection between the condition of an ecosystem (considered an asset in accounting terms) and the flows of ecosystem services (the contribution of ecosystems to benefits in economic and other human activity) is at the heart of the SEEA's approach. It extends the standard production boundary used in the economy (i.e. goods and services produced by economic units) to include non-market services provided by environmental assets, such as ecosystems. The extension of the boundary means that ecosystem accounting considers in an integrated way, those ecosystem services used to produce tradeable goods and services (e.g. the use of timber from forests, abstraction of water for household use) and ecosystem services that affect people but are unrecognised in market transactions, such as air filtration, flood protection and amenity services.

[6] Use and non-uses values are the basis to evaluate alternative policy options on human welfare. Intrinsic values describe the role of ecosystem components to support ecological functioning. Policies often consider implicitly a mix of both values.

Figure 2 Overview of the UN SEEA expansion to cover ecosystems



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

While ongoing research and testing is underway, the SEEA provides a comprehensive, internationally comparable framework for the organisation of information on the environment and its relationship with social and economic activity. Recent studies have discussed how information from accounting frameworks can feed into decision-making processes. Some examples are outlined in the Appendix I.

Current applications

Work at DELWP on land and ecosystem accounting and valuation is leading the way in Australia and internationally to report and measure changes in environmental assets and the relationships between the environment, our communities and the economy.

Over the past five years DELWP has contributed to the drafting of the SEEA using its experience in constructing information sets to support environmental markets. These developments included regional accounts for the Corangamite Catchment Management Authority (CMA) and appraisals of return on investments in the environment using market based approaches (branded by the Department as ecoMarkets, e.g. BushTender, EcoTender).

DELWP is committed to expanding its capability to implement environmental-economic accounting to provide Victoria with regular accounts that meet the international standards.

In March 2013, the first set of Victorian Experimental Ecosystem Accounts applying the SEEA framework was released. These accounts were instrumental in gaining an understanding of the nature of historical changes in native vegetation groups and land classifications in Victoria. In addition, DELWP worked with ABS on land accounts that show both economic and environmental values of land in Victoria.

Box 2. Accounting for ecoMarkets investments

Market based approaches have been used to address environmental degradation in Victorian landscapes, known in Victoria as ecoMarkets. Ecosystem accounts were developed to measure expected outcomes of the $2.5 million West Gippsland EcoTender across terrestrial, river and wetland ecosystems. In this tender area, terrestrial ecosystems supported about 70% of ecosystem services (measured through the Environmental Benefits Index). The ecosystem accounts reported an 11% increase in terrestrial ecosystem services, 17% increase in river ecosystem services and 10% in wetland ecosystem services as a result of management actions undertaken by landholders.

Source: United Nations 2013

More recently, DELWP and Parks Victoria produced pilot ecosystem accounts for the Victorian parks network to assess the contribution that parks make to the prosperity and wellbeing of Victorians, while providing a stronger evidence base to inform investment decisions in relation to park management.

In addition, DELWP is piloting ecosystem accounts to evaluate outcomes of conservation tenders for management actions to improve native vegetation and reduce risks for threatened species. The first set of program level accounts was developed for the native vegetation component and was instrumental in a program review. The accounts have improved efficiency, transparency and accountability to demonstrate the value provided by these conservation programs to the Victorian community.

Other recent work in DELWP included an engagement by West Gippsland CMA to support natural resource management through vulnerability assessment modelling of potential future climate scenarios, which used an environmental asset based conceptual framework.

Table 2 outlines the value of different types of accounts by governments at different scales.

Box 3. National accounts on pollution in the US economy

Recent research used environmental accounting to assess air pollution damages across the US economy. This work identified agriculture and utilities as the sectors with the highest value Gross External Damage (GED) per dollar of Gross Value Added (GVA). At the industry level, air pollution damages from seven industrial activities were found to be greater than their net contribution to output (e.g. sewage treatment plants, solid waste incineration, oil- and coal-fired power plants and petroleum-coal product manufacturing). The authors highlighted the need for reducing the regulated levels of emissions across these industries. The total value of GED in the US economy was estimated at $184 billion in 2000 US dollars (not including pollution from households transport or homes).

Source: Muller et al. 2011

Table 2. Value of different accounts

Scale and purpose	DELWP experience	Examples of other relevant initiatives
Program level – accountability, analysis to improve program settings • reporting past and expected changes in asset condition • reporting past and expected changes in ecosystem services • reporting on return on investment	Conservation tenders: • Native vegetation • Threatened species • Lapsing Program Review	None identified
Regional and State level – priority setting, resource allocation, planning, raising awareness • tracking the condition of natural assets and ecosystem services • measuring changes in condition and services resulting from government programs • measuring contribution of environment to economic and social measures of progress • helping to assess impacts of degradation	• Valuing Victoria's Parks • Victorian Experimental Ecosystem Accounts • Work with ABS on Land Account for Victoria	ABS – Land Account: Victoria, Experimental Estimates (2012) Wentworth Group – trial of environmental accounts in ten regions across Australia, including Corangamite and North Central CMAs in Victoria (2014) ABS – pilot ecosystem account for the Great Barrier Reef (2015) European Environment Agency, European Academies Science Advisory Council, CSIRO – various studies on biodiversity and ecosystem services (2009-2013) Queensland government – initiating discussion on state-wide environmental accounts (2015)
National – priority setting, measuring progress • reporting on natural inputs to the economy • reporting on impacts of economy on environment • identifying contribution of environment to human wellbeing • adjusting measures of national progress	• Liaising with ABS and ANU	Millennium Ecosystem Assessment (2005) New Zealand Treasury – Treasury's Living Standards Framework including natural capital (2011) ABS – Australian Environmental-Economic Accounts (2012) DEFRA – UK National Ecosystem Assessment (2013) Statistics NZ – New Zealand Environmental-Economic Accounts (as required to comply with the Environmental Reporting Bill 2014) Canadian environmental-economic accounts (2014) UNEP – Guide on valuation and accounting of ecosystem services for small island countries (2015) WAVES Partnership – case studies in eight developing countries (current)

Scope of ecosystem accounts of value to DELWP

Recent DELWP pilots at the program level have focused on specific aspects of the environment which are targeted or directly affected by program interventions. By contrast, the pilot for the Victorian parks network explored a range of metrics to describe the extent, condition, and significance of parks and provided a first snapshot assessment of diverse ecosystem services.

The appropriate scope for accounts will be influenced by their scale. For example, state-wide accounts would be whole of landscape and ideally capture and report on changes in the environment that are human-induced separately from natural changes. Program level accounts would be limited to reporting on the geographical area targeted by the program.

Box 4. Ecosystem services in the Victorian parks network

DELWP and Parks Victoria produced pilot ecosystem accounts and a first assessment of ecosystem services supported by Victorian parks network. For the service of water filtration, the study found that nine high yielding State and national (non-metropolitan) parks have annual sediment loads of 4,165 tonnes of solids entering regulated rivers, which is 8% of what would be released if these parks were not protected. Current annual nitrogen loads in metropolitan parks are around 31,425 tonnes or 15% of what would be released into metropolitan waterways if the parks were not protected. Water filtration services from non-metropolitan parks are valued at $50 million per annum (net of reduction in water yield) and from metropolitan parks these services are valued at $33 million per annum. These values are based on costs avoided.

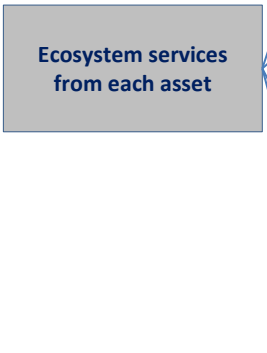
Source: Parks Victoria and DELWP 2015

Work under the Strategy will continue to adapt and apply internationally accepted accounting standards to inform the systematic collection and reporting of environmental-economic statistics. This will involve monitoring best practice and progress in other jurisdictions, along with foresighting and developing a critical view on potential adoption paths in Victoria. DELWP will build on its existing experience and capabilities to build a track record of pilot ecosystem accounts.

Information sought for environmental-economic accounting includes environmental and biophysical data, protection and natural resource management activities (e.g. expenditure, inputs, outputs and outcomes), and linkages to relevant social and economic activities. Measurement of linkages between environmental improvements/degradation and changes in ecosystem service outcomes is more critical for valuation.

The potential scope of ecosystem accounts is summarised in Figure 3 and includes examples of measures that can be reported. At a minimum, the accounts will include physical quantities of ecosystem assets, ecosystem service flows and environmental management activities (column 1). In addition, indicators can be used to measure the quality of ecosystem assets or outputs from ecosystem services (column 2). Relevant values in monetary terms include economic activity that can be linked to ecosystem assets and ecosystem services, and any government income and expenditure from program investments (column 3).

Figure 3 Overview of the structure of environmental-economic ecosystem accounts



	Physical quantities	*Quality, other indicators*	*Monetary values*
Extent	Area		Market value of land
Condition	Pollution loads to assets Species by conservation status	Condition (or health) Significance Biodiversity status	Linked to environmental management (e.g. observed damage or clean-up costs)
Use	Industry, residential, conservation		Market value of land
Asset management	Area of private/public ownership, managed with Traditional Owners	Participation of local stakeholder groups	• Operating costs and revenue • Corporate overheads
Provisioning	• Agriculture (food/fibre) • Unfarmed food/feed • Water flows • Biomass energy • Chemicals • Forestry products	• Genetic materials (bio-prospecting) • Water quality	• Market value of goods traded in markets • Operating costs • Relevant taxes and subsidies • Value added • Depreciation of assets
Regulating	• Water filtration • Soil stabilisation • Natural hazard mitigation (floods, fire, storm damage) • Pest/disease control • Local climate cooling • Carbon storage & sequestration	• Maintenance of soil fertility (regulation) • Coastal asset protection • Nursery populations	• Market value of services or relevant externalities • Non-market imputed values (outside of the SNA)
Cultural	• Recreation (enjoyment, tourism, health) • Amenity • Existence (non-use) values	• Scientific research • Indigenous cultural heritage • Social inclusion	• Economic activity & value added: tourism, research • Non-market imputed values (outside of the SNA)
Intermediary	• Native Vegetation Benefits Index • Habitat suitability • Maintenance of genetic diversity • Incidental pollination, seed dispersal		N/A (unless additional to the other services assessed and a link can be made to final uses)
Activities	Volunteering effort by activity		• Non-market imputed values (outside of the SNA)
Expenditure	• Labour or staff contracted • Amount of input materials and intermediate services used		• Management costs (wages, capital costs, costs of intermediate inputs) • In kind contributions • Environmental taxes, subsidies, other payments

Each set of ecosystem accounts is likely to cover different aspects depending on user needs and the information available. The selection of measures will need to be decided consistently across DELWP, recognising the availability of current monitoring or modelled data and update needs. DELWP currently has a good handle on data for native vegetation, terrestrial biodiversity, along with wetlands and rivers condition. Ecosystem services such as carbon and water can be modelled at larger scales, but many funded projects are relatively small and scattered across the State. Emerging areas that DELWP is still developing and are likely to progress through this Strategy include assessing interactions of management activities across land, water, carbon and biodiversity.

5. Objectives

The three key objectives of this Strategy focus on government reporting, decision-making and evaluation. Environmental reporting that includes consistent environmental-economic accounting information will directly support strategic planning. It will also provide critical information to feed into environmental valuation work to support forward looking analysis for decision-making. Using an accounting framework for program evaluation will improve accountability and produce program level information that can be aggregated back into State and regional level reporting.

Objective 1 – Apply best practice for consistent reporting on Victoria's environment

Tracking trends in the status of Victoria's environment and the services flowing to the Victorian community using internationally accepted standards.

A complete set of environmental-economic accounts provide the basis of key statistics about the environment, which need to be tracked or monitored over time (e.g. extent of land classification, flows of emissions/waste, water supply and use, biodiversity, condition and significance of ecosystems). This information can be used directly to indicate areas that require attention and raise awareness across the Victorian community.

A set of environmental-economic accounts aligned with the SEEA standards would also include linkages between the environment and the Victorian economy. This will improve the ability to report on 'the state of the environment', its drivers and impacts of degradation on the economy and society. Importantly, it can illustrate the ecosystem services we currently derive from ecosystems to promote further actions to protect the environment. In the longer-term, the accounts can also be linked to sectoral economic activity to indicate what sectors of the economy can influence environmental outcomes most effectively.

Box 5. Victorian experimental ecosystem accounts

Victoria's native vegetation in 2005 was about half of the extent under pre-European settlement with a mean condition of 0.57 compared to a benchmark of 1.0 in 1750. Vegetation types under pressure included Tussock Grasslands covering 10% of the 1750's extent with a mean condition of 0.35 per hectare.

Wetlands extent in 2004 was similar to pre-European settlement. It recorded a loss of 165,000 natural wetlands and a gain of 154,000 non-naturally occurring wetlands. The condition of wetlands was 0.7 per hectare in 2004 compared to 1.0 in 1750.

The mean condition of Victorian rivers in 2004 was 0.44 per km compared to the 1750 benchmark of 1.0. Areas under stress included the Hopkins river basin with a condition of 0.27 per km.

Victoria saw a net increase of 15,885 hectares in native vegetation over 1994 to 2004 – revegetation added 14,485 hectares, natural regeneration added 4,000 hectares, and 2,600 hectares were cleared. Over this period, around 14,270 hectares changed tenure from private to public.

Source: Eigenraam et al. 2013

This objective is critical to meet the Strategy's vision. It will ensure DELWP has a solid foundation to build a base of consistent and coherent information on Victoria's environment and DELWP is able to report progress at the State and regional levels over time. Environmental-economic accounting will help to highlight the nature and magnitude of ecosystem services from healthy ecosystems to Victorian communities and the economy. The performance indicator for this objective will be the number of accounts produced and user satisfaction from relevant policy owners and decision makers.

Objective 2 – Integrate the benefits of a healthy environment in policy and planning

Valuing benefits from the environment and integrating them into policy development, planning and decision-making by government.

Victorian communities receive a wide range of benefits from healthy ecosystems and the efficient use of natural resources. However, many of these benefits are not explicitly recognised or valued in our society, e.g. water filtration, flow regulation, nursery habitats, nature based recreation. As a result assessments of proposals with potentially significant impacts on the environment are often constrained by the limited coverage of environmental information available.

Economic valuation techniques can be used to assess the welfare gains from maintaining or protecting ecosystem services over time. These techniques can also be used to assess the damage or welfare losses that may result from degradation. Adopting an environmental-economic accounting framework will provide a more solid information base and enable a consistent definition of ecosystem services for the development of ongoing valuation work.

This objective will ensure environmental information and valuation of ecosystem services are used in a robust way, drawing from consistent sources to support economic analysis and policy advice across the whole of government. The performance indicator for this objective will be the number of policy and program owners that use the valuation work underpinned by the SEEA and their level of satisfaction with the information.

Box 6. The UK National Ecosystem Assessment

The assessment quantified the impacts of land-use change under policy scenarios for agricultural production, emissions, sequestration of greenhouse gases, open-access recreational visits, urban green space and biodiversity. The study used spatial models covering all of Great Britain and valuation methods to estimate economic values for ecosystem services, taking account of climate change impacts over 40 years.

This study found that planning decisions that focus on agricultural market values reduce overall ecosystem service values in many parts of the UK. In comparison, spatially targeted planning incorporating non-market ecosystem services yields net benefits in almost all areas and maintains biodiversity, particularly in areas of high population. The analyses suggest that a targeted approach to land-use planning that recognises both market goods and non-market ecosystem services would increase the net value of land to society by 20% on average, with higher increases arising in certain locations.

Source: Bateman et al. 2013

Objective 3 – Improve evaluation of program investments in the environment

Assessing and improving our policies, programs and investments to protect or improve Victoria's environment using consistent performance measures.

The development of consistent metrics to measure improvements in environmental policy and program outcomes over time is typically straightforward in areas of resource use or waste production by specific sectors of the economy. Outcomes from programs involving ecosystem assets are more difficult to assess. This is partly because the benefits attained from natural resources and conservation programs are often:

- assessed solely in terms of their ecological impact/objective (i.e. do not cover or take into account direct or flow-on benefits to society or economic activities); and
- based on evolving metrics developed around the scientific knowledge and resources available at a point in time.

Box 7. Accounting for investment in native vegetation

DELWP led conservation tenders to invest in management actions to improve native vegetation over 2014-2019. Management actions by private landholders across 10,642 hectares in Victoria are expected to increase native vegetation condition by 7% over 5 years. The expected outcomes of this program include: biodiversity benefits (about 89,000 Native Vegetation Benefit Index units per $1,000 dollars invested) and carbon sequestration assessed from revegetation projects only (50 tonnes of CO_2e over 100 years, valued at $560-$2,350 dollars per $1,000 dollars invested). The impacts of revegetation projects on water quality and flows for adjacent water uses were found to be negligible.

Source: DELWP 2015

The use of environmental-economic accounting will ensure outcome measures are comparable and can be consistently updated to assess the performance from Victoria's activities to improve the environment.

This objective is fundamental to demonstrate accountability in the delivery of DELWP's objectives. A consistent evaluation framework and performance measures can be used to communicate the benefits of

DELWP's investments. Moreover, it can support analysis and comparison of performance measures within DELWP to improve the efficiency in the delivery of policies and programs across the State over time. The performance indicator for this objective will be the level of adoption of accounts for reporting on DELWP and portfolio partner program investments.

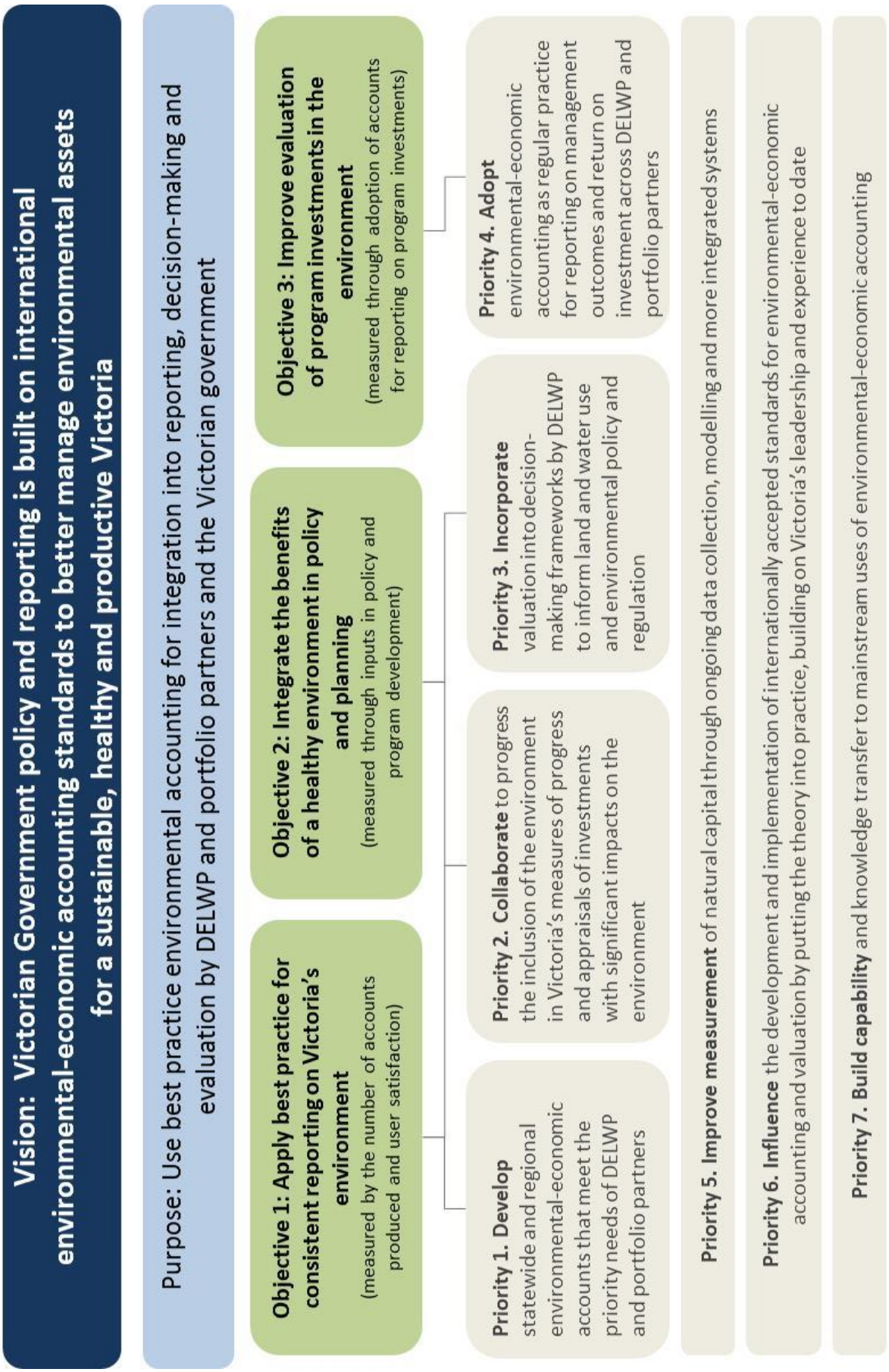
6. Priorities and actions

For environmental-economic accounting to be able to support resource allocation decisions and policy advice going forward, it is critical to ensure applications are tailored to DELWP's core areas, while maintaining ongoing collaboration with relevant government agencies in Victoria and Australia.

A detailed program of works will be built around the seven priorities outlined in Figure 4. The priorities are based on their alignment with Strategy objectives, and do not reflect relative importance or timing of implementation. Each priority includes a number of actions which have been discussed and agreed through a consultation process held during the development of this Strategy within DELWP.

Indicative timeframes are provided for priority actions in the short term (2015-2016), medium term (2017-2018) and long term (2019-2020). The scope of each priority action will be further refined during the implementation phase to facilitate the development of project plans.

Figure 4 Overview of the Strategy including objectives and priorities



Priority 1. Develop state-wide and regional environmental-economic accounts that meet the needs of DELWP and portfolio partners

This priority covers assessments of the status of Victoria's environmental assets and current linkages to support communities. This work will build towards producing a set of tailored state-wide accounts that will improve the ability of DELWP and portfolio partners to deliver their objectives.

Priority actions include:

Strategy timeframe	Priority actions
Short term	1a. Form partnership with Victoria's Commissioner for Environmental Sustainability (CES) to include environmental-economic accounting in the new reporting framework 1b. Biodiversity accounts as baseline for Victorian Biodiversity Strategy 1c. Accounts to support State of Bays reporting under Victorian Coastal Strategy 1d. Scoping study and conceptual models for accounts to support catchment condition and management reporting 1e. Engage with potential partners to develop collaborative projects e.g. CMAs, Parks Victoria, EPA, Melbourne Water, Trust For Nature, Wentworth Group
Medium term	1f. Victorian catchment accounts to support Victorian Catchment Management Council (VCMC) reporting and evaluation in 2017 1g. Advice to support the State of the Environment (SoE) 2018 as agreed in (1a) 1h. Victorian forest accounts to complement State of the Forests report in 2018
Long term	1i. Maintain collaboration with portfolio partners for ongoing accounts production 1j. Second Victorian ecosystem accounts (updating and expanding on 2013 accounts, analysis of trends and drivers) 1k. Victorian economy-wide or sectoral accounts of resource use and emissions (e.g. carbon, waste)

What it will deliver

The specific deliverables will depend on the extent to which environmental-economic accounting is embraced by key partners to support new approaches to State of the Environment Reporting and related applications. The Commissioner for Environmental Sustainability (CES) and DELWP will work together to develop State-wide environmental-economic accounts as part of the future State of the Environment Reporting framework.

State-wide and regional environmental-economic accounts will be progressively built through the actions listed above. In the long term the Strategy will deliver tailored environmental-economic accounts with a selection of key statistics and data reporting on Victoria's environment, comprising:

- *Ecosystem asset accounts* reporting on ecosystem coverage, resource stocks and key features of ecosystems, such as condition and biodiversity of the following types of ecosystems:
  - *Terrestrial ecosystems* – land uses, cover and extent and condition of terrestrial habitat (including wetlands) as reported through the 2013 Victorian experimental accounts.
  - *River ecosystems* – extent, features (including condition of aquatic habitat and biodiversity), water quality and emission levels in surface water or groundwater systems, landscape hydrology (e.g. stream flows, recharge from groundwater systems).
  - *Marine ecosystems* – as above, but focusing on features and condition of State-managed areas.
- *Ecosystem service accounts* reporting on physical flows or indicators of key ecosystem services at the State level, at the regional scale (e.g. CMA areas) or for specific landscapes or areas of high significance in the State (e.g. Alpine National Park).
- *Latest environmental-economic accounts from ABS* with focus on key environmental flows across sectors of the economy, including households (e.g. water, waste, energy and pollution).

The sets of accounts for DELWP will be tailored to meet user needs and reflect the ecosystem assets monitored and data available, particularly around condition, biodiversity and ecosystem service flows.

How we will do it

DELWP will build a stronger relationship with the Commissioner for Environmental Sustainability (CES) to develop an agreed approach or a joint statement of collaboration to shape Victoria's reporting on the environment. The agreement will cover the exchange of information, and commitment of resources and capabilities to develop or input into the development of accounts.

The accounts will be developed through projects within DELWP or in collaboration with other stakeholders active in the Natural Resources Management (NRM) sector, such as Parks Victoria and Catchment Management Authorities (CMAs). Once projects are completed, transition activities will include consultations to facilitate the use of the accounts as a core policy decision-making tool.

Each project will review available data, identify needs for additional data or systems capabilities to be developed or sourced, identify suitable metrics and an accounting structure to meet users' needs that is consistent with the desired set of state-wide accounts. A schedule will be established for updates over time.

Priority 2. Collaborate to progress the inclusion of the environment in Victoria's measures of progress and appraisals of investments with significant impacts on the environment

Strategic relationships will be developed with central government agencies and key external stakeholders to influence and inform new approaches to reporting on the environment and economic progress in Victoria. This new approach will communicate the critical linkages between the environment and society through an environmental-economic accounting framework.

This priority will also develop stronger engagement with central government agencies to support evidence-based decision-making across the Victorian government recognising the benefits of a healthy environment to Victorian communities and the State economy. In the longer term, the Strategy envisages reaching out to initiate some major projects to work productively with other areas of the government.

Priority actions include:

Strategy timeframe	Priority actions
Short term	2a. Initiate discussion with Victorian central government agencies on potential use and application of accounting and valuation work
Medium term	2b. Work with Department of Treasury and Finance (DTF) and ABS to explore role of environmental-economic accounting to inform measures of Victoria's progress 2c. Form productive partnerships with central government and other Victorian agencies for broader use of environmental-economic accounting
Long term	2d. Continue strategic work with Victorian central government agencies to influence uses of environmental accounting across the Victorian government 2e. Undertake integrated modelling and valuation work with other Departments, linking the environment to the primary industries sector, particularly agriculture

What it will deliver

New approaches to improve measures of State progress will be investigated and discussed with central agencies and ABS experts on environmental-economic accounting. The specific deliverables will be agreed upon inception of this work among key government partners.

Government departments and agencies will be encouraged to use environmental-economic accounting data to support reporting and valuation needs to feed into standard economic analysis to support public policy and project appraisals. This will be aimed at major policies, programs or infrastructure projects with significant impacts on the environment.

How we will do it

Strategic partnerships will be pursued with central government agencies and other Victorian departments to promote the use of relevant and consistent environmental-economic accounting information as part of regular policy development processes in the State.

Case studies will be used to illustrate practical applications of environmental-economic accounting to inform program or project development in other sectors of the economy. Support will be provided to encourage environmental impacts to be consistently defined, measured and considered in government submissions or their reviews of program design and funding.

Priority 3. Incorporate valuation into decision-making frameworks by DELWP to inform the use of land and water resources and environmental policy and regulation

This priority involves developing capabilities for consistent valuation using data from environmental-economic accounting to feed into standard economic analysis (such as cost-benefit analysis) to inform policy, program and investment decisions within DELWP.

The organising framework of environmental-economic accounts will provide a more consistent base of information for economists to value market and non-market benefits and assess tradeoffs.

Priority actions include:

Strategy timeframe	Priority actions
Short term	3a. Valuation of ecosystem services under different land uses to support the Industry Taskforce 3b. Valuation of ecosystem services to support development of the Environment Management Plan for Port Phillip Bay 3c. Scoping of valuation work to support assessment of risks/vulnerability to climate change and strategies for mitigation and adaptation
Medium term	3d. Valuation framework for climate change impacts on ecosystem services at both regional and State levels 3e. Scoping work on impact assessments, resilience and risk analysis for natural disasters 3f. Practical guidance for DELWP on valuing the benefits of ecosystem services
Long term	3g. State-wide ecosystem services assessment to support land use decisions and climate mitigation and adaptation strategies

What it will deliver

Valuation of the benefits of ecosystem services based on consistent environmental data and classifications of ecosystem assets/services will be delivered to support DELWP's key policies, investments and decisions.

Practical guidelines to support valuation work will be developed for internal use and produced either internally or through consultants. In addition, valuation estimates adopted for the projects and priority actions listed above will be compiled as practical notes and disseminated internally to support the development of future valuations.

How we will do it

Economists and policy makers across DELWP will be engaged to discuss economic valuation approaches and what environmental-economic accounting can offer in terms of ecosystem services classification, data and underlying metrics. Guidance on valuing ecosystem services will be developed collaboratively.

DELWP will incorporate an ecosystem service approach in relevant valuation work for appraisals of programs or investments to be led or managed by DELWP. Relevant economic frameworks to embed this approach include forward-looking methods, such as cost benefit analysis, cost-effectiveness, risk and impact analysis, and multi-criteria analysis.

Key areas where environmental-economic accounting will be used to support valuation work include:

- The accounts will provide a set of consistent metrics and physical units for the valuation of ecosystem services.
- The information provided in accounts will allow more robust environmental valuation for planning, policy analysis and business cases based on a better understanding of historical trends and the actual/expected state of ecosystem assets of interest.

- Accounting information will provide a better evidence base for cost-benefit analysis by assessing the impact of future marginal changes across a range of consistently defined ecosystem services and by incorporating uncertainties into the analysis, for example considering ecological thresholds.

The focus of this priority is to support forward looking analysis to inform policy, regulation and investment.

Priority 4. Adopt environmental-economic accounting as a regular practice for reporting on management outcomes and return-on-investment across DELWP and portfolio partners

This priority involves working towards standardised reporting on return-on-investment (ROI) across DELWP and portfolio partners to feed into regional and state-wide accounts (under Priority 1). This work will need to be aligned with current and emerging monitoring, evaluation and reporting (MER) initiatives across fire, water, land and biodiversity.

Priority actions include:

Strategy timeframe	Priority actions
Short term	4a. DELWP-wide review of linkages between MER frameworks and accounting frameworks to facilitate accounts-ready data 4b. Accounts at a landscape/regional scale covering investments in biodiversity across portfolio partners 4c. Work with Parks Victoria to assess proposed park management actions using ecosystem services framework
Medium term	4d. Accounts for DELWP funded investments to improve waterways 4e. Scoping the impacts and management of fire and other emergencies into the accounts framework
Long term	4f. Standardised reporting on ROI across portfolio programs to feed into regional/state-wide accounts (under Priority 1)

What it will deliver

A consistent and transparent approach will be developed to assess and compare the outcomes of programs to improve the environment, both within and between programs. The environmental-economic accounts will provide a framework to organise information from DELWP's MER processes across a range of themes including fire, water, land and biodiversity.

Benefits of programs will be reported in terms of consistent ROI metrics. ROI will be based on outcomes that can be reported in an environmental-economic accounting framework where appropriate. This will allow the accounts produced under Priority 1 to provide measures of change due to management covering ecosystem asset extent/condition and a range of ecosystem services to improve DELWP's understanding of the relative benefits across programs. This information will be able to be produced at a range of scales.

The environmental-economic accounts and MER linkages will also be improved by having readily available information on key ecosystem features and environmental outcomes through the accounts prepared under Priority 1, to assist with strategic planning and goal-setting to support future business cases.

How we will do it

A DELWP-wide review of linkages between MER frameworks and accounting frameworks will be conducted to facilitate accounts-ready data across DELWP and portfolio partners. Existing partnerships and processes with portfolio partners will be used to facilitate provision of accounts-ready data covering both data content and form. This will link in with the Priority 5 actions relating to data and systems.

Accounts focusing on specific management activities will continue to be tested for key portfolio themes including biodiversity, parks, waterways and fire management. Through this work, core processes requiring improvement for the delivery of the accounts will be identified for each application. This will assist with the longer term goal of consolidation into regular standardised reporting that allows the accounts produced under Priority 1 to include change due to management across diverse program areas.

Priority 5. Improve the measurement of environmental assets through ongoing data collection, modelling and more integrated systems

Integral to the delivery of the Strategy is the ability to have access to quality data, metrics and indicators, along with modelling and systems capabilities to enable robust analysis of historical data, impact assessments and scenario analysis. This priority action deals with three key enablers that are critical to measurement of environmental assets, namely data, modelling and information systems.

This priority involves influencing and supporting work in relevant areas across DELWP to move towards more regular data collection, monitoring and more integrated systems that can support environmental-economic accounting. This work will improve consistency in assumptions, data and models used within DELWP. In addition, it will strengthen DELWP's ability to assess interventions in the environment holistically by taking into account impacts across multiple environmental values (e.g. across land, water, biodiversity, ecosystem resilience).

Priority actions include:

Strategy timeframe	Priority actions
Short term	5a. Review of DELWP's capabilities to support accounting and valuation work to support the delivery of the Strategy with focus on knowledge, data & systems 5b. Contribute to the development of relevant measurement initiatives led by DELWP 5c. Encourage monitoring and collection of 'accounts ready' data (e.g., through Standard Outputs)
Medium term	5d. Monitor progress filling gaps in capabilities (from 5a) and identify new needs 5e. Investigate affordable methods to collect and analyse data across the State 5f. Assess capabilities for integrated modelling and data sharing across DELWP
Long term	5g. Monitor progress filling gaps in capabilities (from 5d) and identify new needs

What it will deliver

A key enabler for the efficient development of environmental-economic accounting is information systems bringing together functionality and expertise for integrated data analysis and modelling.

While there is a wealth of scientific information and modelling tools dealing with ecological processes and incorporating interventions from specific management actions, the Strategy will seek to increase DELWP's ability for integrated assessments including ecosystem assets, ecosystem services, productive systems using natural resources, population centres and the whole of the Victorian economy.

Strengthening measurement capabilities will provide in-depth understanding about overall outcomes from DELWP funded programs, considering linkages and interactions between natural and human systems.

How we will do it

The review of capabilities will be done in a collaborative way with relevant policy owners and technical experts using the governance arrangements established for the Strategy for significant decisions.

The Strategy will focus on data for ecosystem assets and ecosystem services of relevance to DELWP's core activities, and combine this with available data on natural products and socioeconomic information. Pilots will use consistent comparable temporally and spatially referenced data over time covering:

- The extent, condition and features of terrestrial and aquatic ecosystems (e.g. land cover, soil).
- The quantity of ecosystem services being provided (e.g. through physical metrics or indicators).
- The transactions occurring under portfolio programs to improve the environment (management activity data following DELWP output data standards and environmental expenditure data).
- Forecasts of changes in the environment (e.g. climate and climate change data).
- Localised regional data (e.g. patch size, connectivity).
- Probabilistic modelled data (e.g. Bayesian models on risks for threatened species).

In terms of modelling services, the Strategy will require biophysical modelling capabilities that provide:

- Capacity to model cumulative chains of complex processes across ecosystems to assess interactions of changes in ecological features or functions or impacts of climate scenarios.
- Regular estimates of how portfolio program activities to protect natural resources or improve the environment are expected to change ecosystem condition and/or quantity of ecosystem services.
- Estimates of how alternative policy or management scenarios (such as land use changes) are expected to change ecosystem condition and/or quantity of ecosystem services.

Implementation of the Strategy will require access to integrated information systems. EnSym is currently used as the key integrating platform for environmental-economic accounting. Future needs include:

- A comprehensive and well-managed catalogue of data, models and systems available within DELWP.
- Efficient flow of the data identified above at appropriate intervals from on-ground transactions (paddock level) into a tool that provides easy aggregation at a regional and state-wide level.
- A platform to integrate spatial data, along with other non-spatial information and probabilistic information and models, that allows combining information on ecosystem condition and services with economic information to report trends and linkages across Victorian regions.
- A platform to enable integration of data from multiple sources within DELWP or other external sources outside DELWP (relevant to priority actions requiring complex analyses in the longer-term).
- Capability for the development of modules covering particular ecosystems or biophysical modelling relationships that can be added as needed.

The accounting framework will need to be flexible and deal with changes in policy direction, goal measures and related data collection or ongoing improvements in metric development. Accounts also need to provide an indication of the confidence levels and uncertainty surrounding estimates reported. Addressing these issues will require solid statistical capabilities for example to undertake data diagnostic tests and back-casting. In addition, it will be important to maintain ongoing research, development and experimentation around environmental indicators and aggregates, upscaling and downscaling, validation data and quality criteria.

Priority 6. Influence the development and implementation of internationally accepted standards for environmental-economic accounting

A key building block of the Strategy is ensuring environmental-economic accounts follow leading international standards and best practice. The SEEA provides a solid foundation to guide development and applications of environmental-economic accounting, as it has been agreed and supported internationally across a number of statistical agencies.

This priority involves feeding our experience and findings back into the national and international processes to implement and further develop environmental-economic accounting standards. This includes providing advice on the use of specific valuation techniques to derive suitable shadow prices for ecosystem services with significant non-market benefits.

Priority actions include:

Strategy timeframe	Priority actions
Short term	6a. Produce peer-reviewed reports and communication products 6b. Participate in national meetings and engage with other Australian governments 6c. Engage with international bodies to learn and share DELWP experiences (e.g. World Bank, UN Forum of experts in the SEEA, World Forum on Natural Capital)
Medium and long term	Continue influencing activities as above (6a, 6b, 6c)

What it will deliver

This priority will consolidate DELWP's leading role in environment-economic accounting and achieve stronger support for a consistent approach nationally. DELWP will maintain a productive relationship with authoritative bodies in the development of the SEEA, such as the UNSD and ABS. This will enable timely feedback and access to expert groups to ensure Victorian environmental-economic accounts follow leading international standards, while engaging with initiatives in other jurisdictions that are relevant to Victoria.

By engaging with ongoing international research in this area, DELWP will be able to foster innovative thinking to address environmental challenges shared across many jurisdictions and have first-hand access to ongoing developments and best knowledge available in this field.

How we will do it

A central part to the delivery of the Strategy is ensuring each project applies the SEEA and relevant ecosystem service frameworks. A standard quality assurance process will be in place for each piece of work and could involve engagement with independent experts through participation in panel discussions and/or peer reviews of project work.

DELWP will influence ongoing development in best practice internationally by putting theory into practice, while showcasing Victoria's leadership and experience as instrumental in progress to date. Key activities in this area include engaging with leading international and national organisations at the forefront of environmental-economic accounting.

The priority actions will require communicating with public and private institutions regarding the practice and implications of accounting obligations arising from the development of state and national accounting and working collaboratively with national bodies such as the ABS and Bureau of Meteorology to contribute to the development of the SEEA standard from the Victorian perspective.

Priority 7. Build capability and knowledge transfer to mainstream uses of environmental-economic accounting

This priority involves establishing suitable organisational arrangements and building institutional capabilities for the development and knowledge transfer of environmental-economic accounting over time. This priority deals specifically with the following key enablers: governance, collaboration across disciplines and knowledge transfer.

Priority actions include:

Strategy timeframe	Priority actions
Short term	7a. Review of DELWP's capabilities to support accounting and valuation work with focus on governance, cross-disciplinary collaboration, training and development
Medium and long term	Continue monitoring progress in capabilities (from 7a) and identifying new needs

What it will deliver

Good governance is essential to build an inclusive and efficient approach for the management and coordination of activities to achieve the strategic outcomes. The governance model will define the roles and accountabilities in the delivery of priority actions and related projects, and ensure strategic advice is provided to support cross-disciplinary collaborations and knowledge transfer in a timely fashion.

These organisational arrangements will ensure priorities for environmental-economic accounting reflect DELWP organisational needs, that activities are aligned with other relevant corporate strategies, and ensure priority actions and tasks are embedded in DELWP business plans.

How we will do it

The following key management roles and arrangements will be established under the governance model (see Figure 5):

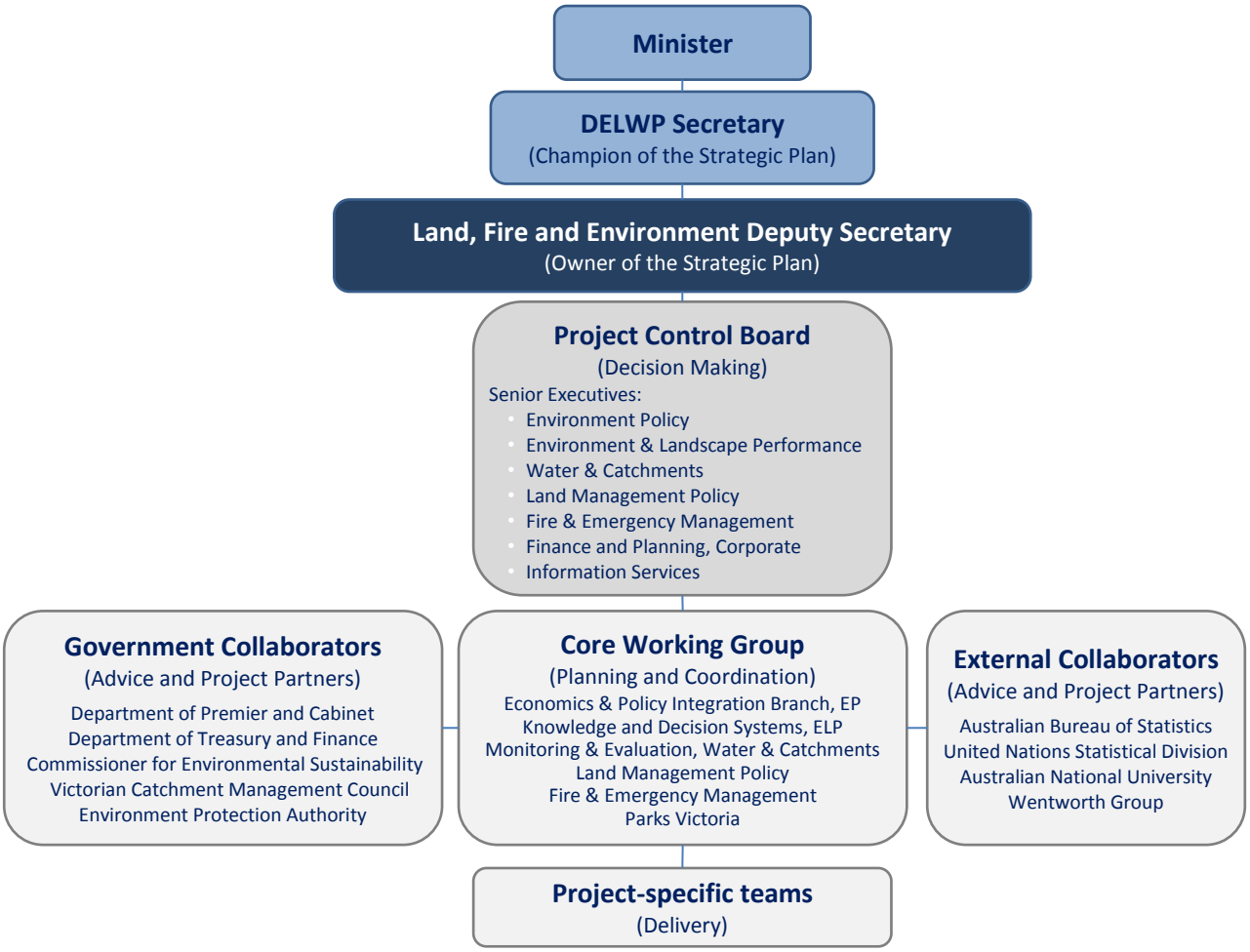
- The Deputy Secretary of LFE will be the owner of the Strategic Plan and the Secretary of DELWP will act as champion, with relevant members of the senior executive team operating as the Project Control Board (PCB) and meeting every six months (or as required).
- A dedicated PCB for the delivery of this Strategy will be formed. Since the Strategy deals with crosscutting work, it will be important to maintain representation in relevant coordinating bodies, such as the Environmental Strategic Alignment Group (ESAG). The PCB will provide strategic advice and ensure actions build on and complement related corporate initiatives and strategies, including ESAG, MER frameworks and the Environmental Information Strategy.
- A core working group will be responsible for planning and coordination of work with collaborators and project specific teams. It will help prioritise efforts between development needs, delivery of ongoing accounting work, and maintaining channels for knowledge transfer.

DELWP has a good mix of capabilities and skills in priority areas and the Strategy will require engagement of a range of disciplines, including environmental sciences, economics, statistics and public policy. Projects will seek staff expert advice through project based cross disciplinary reference groups, as advised by the PCB.

Knowledge transfer is critical to mainstream environmental-economic accounts that meets users' needs. The following channels for knowledge transfer will be developed as part of this Strategy:

- **Training and development** will focus on the application of accounts and valuation for planning and developing relevant policies and programs for DELWP. Training material will be based on the SEEA, external peer-reviewed publications and practical experience, focusing on the presentation of core concepts, methods, findings and appropriate uses of the outcomes.
- **A library and a central repository of data** will be used to document the information used and knowledge generated through this Strategy. They will be developed according to broader needs of relevant users and be located in the corporate server. Documentation will include data sources, methodologies and results (e.g. ecosystem accounts, ROI analyses, valuation results).
- **An intranet portal** will provide access to selected information and highlight outcomes of current work. The intranet portal will have links to training and communications material and provide the location of a library or repository for stakeholders to access project documentation.

Figure 5. Key roles in the governance for the Strategic Plan



Summary of recent experience and future applications

Many priority actions identified in the Strategy relate to continuing or developing applications at DELWP where environmental-economic accounting can be used to better inform the delivery of significant public policy projects and programs. This will require strong collaboration and knowledge transfer across multiple teams across DELWP.

Table 3 provides a summary of work most relevant to each DELWP division. The table covers recent work undertaken by DELWP, selected priority actions in this Strategy along with other future potential areas of applications.

Table 3. Recent experience and examples of future applications by DELWP

Environment (Biodiversity, climate change resource use and emissions)	**Land**	**Water**	**Fire and other emergencies**	**Planning and local infrastructure**
Focus of recent accounting and valuation work by DELWP				
• Victorian experimental ecosystem accounts (2013) • Regional environmental accounts trial for selected CMAs (2013) • Pilot accounts for tenders on native vegetation (2014) and threatened species (2015) • Climate vulnerability modelling for West Gippsland CMA (2014)				
• Pilot ecosystem accounts and valuation of ecosystem services for Victorian Parks (2014)				
DELWP priority areas (included in this Strategy)				
• Biodiversity accounts as baseline for Victorian Biodiversity Strategy (1b) • Accounts to support State of Bays reporting under Victorian Coastal Strategy (1c) • Second Victorian experimental ecosystem accounts (1j) • Accounts at a landscape/ regional scale covering investments in biodiversity across portfolio partners (4b)	• Valuation of ecosystem services under different land uses to support Industry Taskforce (3a) • Valuation of ecosystem services to support the Environment Management Plan for Port Phillip Bay (3b) • Forest accounts to complement State of the Forests report in 2018 (1h)	• Scoping study and conceptual models for accounts to support catchment condition and management reporting (1d) • Catchment accounts to complement VCMC reporting in 2017 (1f) • Accounts for DELWP funded investments to improve waterways (4d)	• Scoping work on impact assessments, resilience and risk analysis for natural disasters (3e) • Scoping the impacts and management of fire and other emergencies into the accounts framework (4e)	
• Victorian economy-wide or sectoral accounts of resource use and emissions (1k) • Practical guidance for DELWP on valuing the benefits of ecosystem services (3f) • Work with PV to assess park management using ecosystem services framework (4c) • Standardised reporting on ROI across portfolio programs to feed into regional/state-wide accounts (under Priority 1) (4f)				
• Engage with others on collaborative projects e.g. CMAs, Parks Victoria, EPA, Melbourne Water, Trust For Nature, Wentworth Group (1e) • Initiate discussion with Victorian central government agencies on potential use and application of accounting and valuation work (2a) • Scoping of valuation work to support assessment of risks/vulnerability to climate change & strategies for mitigation and adaptation (3c) • Valuation framework for climate change impacts on ecosystem services (3d) • State-wide ecosystem services assessment to support land use decisions and climate mitigation and adaptation strategies (3g)				
Other potential future applications				
• Further develop accounting frameworks for reporting on threatened species status and management actions	• Further valuation of ecosystem services to complement State of the Parks reporting • Assessing benefits of ecosystem services under different land management options	• Valuation work to inform strategy to improve riparian land and waterways • Aquatic ecosystem accounts to link to existing water accounts for consumptive use	• Regional reporting on ecosystems condition in areas affected by fires and surrounding landscapes	• Inventory of iconic ecosystems and supporting public infrastructure (e.g. MPA, ports/bays) • Assessing impacts of public infrastructure management on adjacent ecosystems
• Assessing the economic & environmental contribution of the VIC NRM sector • Accounting for and valuing impacts of resource use and emissions				
• Assessing impacts and fire recovery needs for specific ecosystem services linking to land, water and biodiversity				
Examples of DELWP applications in collaboration with other State departments				
• Undertaking integrated modelling and valuation work linking the environment to the primary industries sector, particularly agriculture: – Assessing impacts of the modernisation of farm irrigation infrastructure on ecosystem services – Assessing biophysical impacts of climate variability and change on Victorian agriculture as well as ecosystems				

7. Benefits of the Strategy

The key role of environmental-economic accounting is as a catalyst for better planning by providing a consistent framework for reporting on the state of our environmental assets and the services these provide over time. Consistent measurement of environmental assets along with valuation will provide much needed information on how the environment relates to the Victorian community and how improvements or degradation of ecosystems are likely to impact on the State economy and broader society.

A summary of the benefits for DELWP, portfolio partners and the Victorian government in the medium to longer term is presented below.

Figure 6. Overview of the Strategy and broader longer-term benefits

Vision: Victorian Government policy and reporting is built on international environmental-economic accounting standards to better manage environmental assets for a sustainable, healthy and productive Victoria

Purpose: Use best practice environmental-economic accounting for integration into reporting, decision-making and evaluation by DELWP and portfolio partners and the Victorian government

Objectives	Challenges (opportunities)	Priorities	Benefits for DELWP
Objective 1 Apply best practice for consistent reporting on Victoria's environment	Need for better information on the degradation of ecosystems, and the impact of this on the economy and broader society	1. Develop statewide and regional environmental-economic accounts that meet the priority needs of DELWP and portfolio partners 2. Collaborate to progress the inclusion of the environment in Victoria's measures of progress and appraisals of investments with significant impacts on the environment 3. Incorporate valuation into decision-making frameworks by DELWP to inform land and water use and environmental policy and regulation 4. Adopt environmental-economic accounting as regular practice for reporting on management outcomes and return on investment across DELWP and portfolio partners 5. Improve measurement of environmental assets through ongoing data collection, modelling and more integrated systems 6. Influence the development and implementation of internationally accepted standards for environmental-economic accounting and valuation 7. Build capability and knowledge transfer to mainstream uses of environmental-economic accounting	• DELWP will respond more effectively and in a timely fashion to emerging environmental issues that are critical to Victorian communities • Being better able to describe value to the community of investing in the environment and linking this to economic decision-making • Improved resource allocation across programs, demonstrating value-for-money and understanding tradeoffs • Time and cost savings in accessing data that is readily available for public use in DELWP • Stronger environmental partnerships with CMAs and other organisations on environmental management • More informed and evidence based policy development within DELWP • More efficient evaluation, monitoring and reporting of program outcomes within DELWP • Improved accountability to the government and the public
Objective 2 Integrate the benefits of a healthy environment in policy and planning	Ability to demonstrate the value of investing in and protecting the environment to central agencies being limited by piecemeal information		
Objective 3 Improve evaluation of program investments in the environment	Increasing demand for consistent MER approaches across the portfolio that allow to compare and improve program outcomes		

8. DELWP's role and key partners

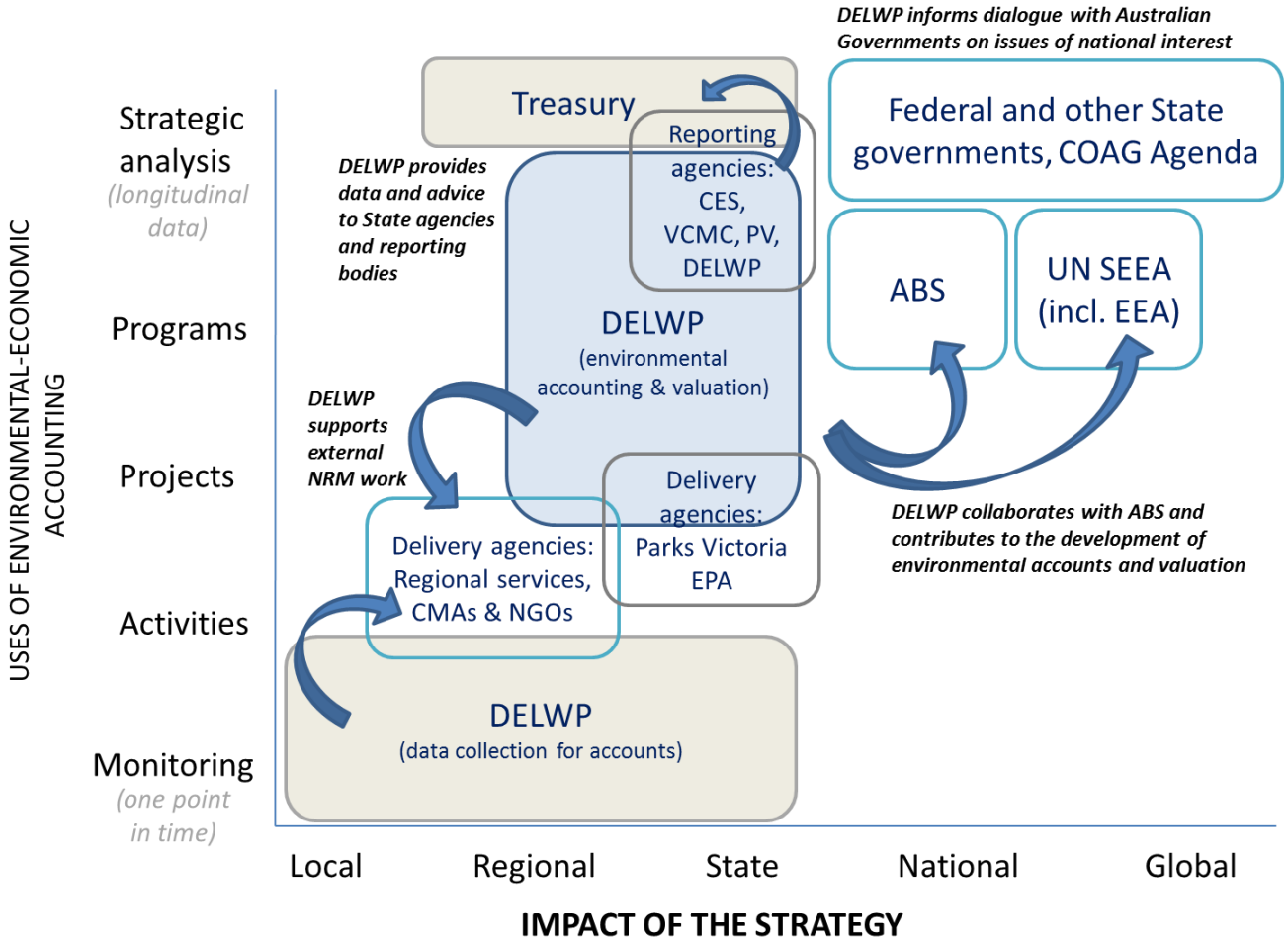
Trials of environmental-economic accounting in Australia have been undertaken in recent years through the initiatives of a range of different parties. This is partly because this area is still relatively new and there has not been a clear leading role to streamline and promote this work at the program, regional or national levels. Moreover, development of accounts requires drawing information from many different organisations and databases. Through this Strategy, DELWP will position itself as the leading institution to implement environmental-economic accounting in Victoria and influence stakeholders, building on its experience from ten years of ground work in related areas.

This Strategy will be implemented in collaboration with the following key stakeholders who are involved in the use or management of natural resources or the protection of environmental assets:

- DELWP partners, including CMAs, Parks Victoria, Landcare groups, Environment Protection Authority Victoria, and the CES;
- DELWP contractors or parties involved in the delivery of programs, e.g. CMAs, private landholders;
- Finance and planning agencies at the State and local government levels; and
- Other interested stakeholders.

In addition, the Strategy will involve liaising with ABS, UNSD and academics active in this field as a sounding board to ensure the work is robust. An overview of key partners in the Strategy and the services provided by DELWP to other organisations are outlined in Figure 7.

Figure 7. Mapping of key partners for the Strategy



9. Implementation

The implementation of the Strategy will follow a three-staged approach. It will start by undertaking preparatory workshops targeted at specific themes involving DELWP and portfolio partners and experts to ensure there is a common understanding about the purpose of the Strategy and confirm the scope of priority actions. Following these workshops, a formal Implementation Plan and a Communications Strategy will be produced. Responsibilities, the scope of work for particular actions, along with costs and resources needs will be outlined through the Implementation Plan.

The focus of each of the three stages of implementation is:

- **In the short term** (over the first two years, 2015 and 2016), the work will focus mainly on reviewing and developing core capabilities, developing key relationships with external organisations, and producing pilot accounts and valuation applications to meet DELWP needs.
- **In the medium term** (2017 and 2018), moving from pilot into production for key accounts and valuation work and increased collaborative work with other government agencies (e.g. CES, DTF) and other organisations undertaking pilots at the regional or State scale.
- **In the long-term** (towards the last two years, 2019 and 2020), DELWP will focus on consolidating state-wide accounting and valuation work with partners and work towards a program for ongoing production of key accounts over time. A state-wide ecosystem assessment will also be pursued.

Table 4 lists the actions in each stage.

Table 4. Summary of key stages for implementation

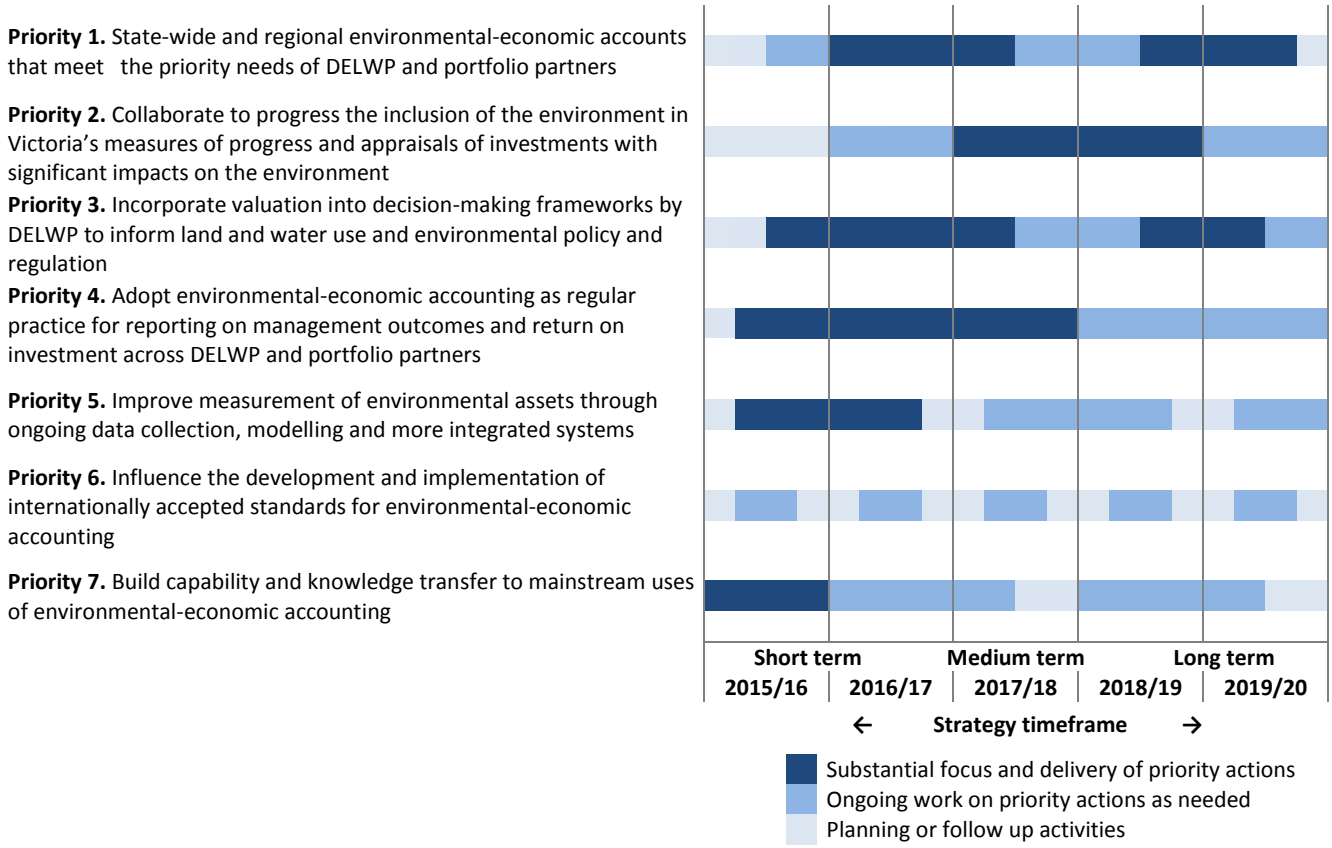
Stage	Description	Priority actions
Short-term focus (2015-2016) **Build and strengthen core capabilities, prioritise work for current DELWP needs and disseminate pilot findings**	This period will focus on initiating and tailoring pilot accounts to address strategic priorities for DELWP. Additional work to progress measurement/modelling of environmental assets and/or commissioning of valuation studies may be required. The audience for this work is primarily DELWP and portfolio partners. However, engagement with potential collaborators will continue in preparation for the medium and longer term work outlined below.	1a. Form partnership with Victoria's Commissioner for Environmental Sustainability (CES) to include environmental-economic accounting in the new reporting framework 1b. Biodiversity accounts as baseline for Victorian Biodiversity Strategy 1c. Accounts to support State of Bays reporting under Victorian Coastal Strategy 1d. Scoping study and conceptual models for accounts to support catchment condition and management reporting 1e. Engage with potential partners to develop collaborative projects e.g. CMAs, Parks Victoria, EPA, Melbourne Water, Trust For Nature, Wentworth Group 2a. Initiate discussion with Victorian central government agencies on potential use and application of accounting and valuation work 3a. Valuation of ecosystem services to support the Industry Taskforce 3b. Valuation of ecosystem services to support development of the Environment Management Plan for Port Phillip Bay 3c. Scoping of valuation work to support assessment of risks/vulnerability to climate change and strategies for mitigation and adaptation 4a. DELWP-wide review of linkages between MER frameworks and accounting frameworks to facilitate accounts-ready data 4b. Accounts at a landscape/regional scale covering investments in biodiversity across portfolio partners 4c. Work with Parks Victoria to assess proposed park management actions using ecosystem services framework 5a. Review of DELWP's capabilities to support accounting and valuation work to support the delivery of the Strategy with focus on knowledge, data & systems

Stage	Description	Priority actions
		5b. Contribute to the development of relevant measurement initiatives led by DELWP 5c. Encourage monitoring/collection of 'accounts ready' data (e.g. Standard Outputs) 6a. Produce peer-reviewed reports and communication products 6b. Participate in national meetings and engage with other Australian governments 6c. Engage with international bodies to learn and share DELWP experiences (e.g. World Bank, UN Forum of experts in the SEEA, World Forum on Natural Capital) 7a. Review of DELWP's capabilities to support accounting and valuation work with focus on governance, cross-disciplinary collaboration, training and development
Medium-term focus (2017-2018) **Support DELWP needs as well as engaging with external collaborators to promote broader applications**	In this period, effort will be shared between directly supporting DELWP needs and collaborations to promote broader use of environmental-economic accounting. This could involve working with the CES to develop environmental-economic accounts; participating in regional accounts initiatives in Victoria, for example with the Wentworth Group of Concerned Scientists; and working with central agencies on measures of progress.	1f. Victorian catchment accounts to support Victorian Catchment Management Council (VCMC) reporting and evaluation in 2017 1g. Advice to support the State of the Environment (SoE) 2018 as agreed in 1a above 1h. Victorian forest accounts to complement State of the Forests report in 2018 2b. Work with Department of Treasury and Finance (DTF) and ABS to explore role of environmental-economic accounting to inform measures of Victoria's progress 2c. Form productive partnerships with central government and other Victorian agencies for broader use of environmental-economic accounting 3d. Valuation framework for climate change impacts on ecosystem services 3e. Scoping work on impact assessments, resilience and risk analysis for natural disasters 3f. Practical guidance for DELWP on valuing the benefits of ecosystem services 4d. Accounts for DELWP funded investments to improve waterways 4e. Scoping the impacts and management of fire and other emergencies into the accounts framework 5d. Monitor progress filling gaps in capabilities (from 5a) and identify new needs 5e. Investigate affordable methods to collect and analyse data across the State 5f. Assess capabilities for integrated modelling and data sharing across DELWP
Long-term focus (2019-2020) **Consolidation of state-wide environmental-economic accounts for Victoria in collaboration with key players**	This period will focus on consolidating state-wide work in partnership with other government agencies and the CES and work towards a program for ongoing production of key accounts over time. A state-wide ecosystem assessment will also be pursued in partnership with other government agencies and the CES.	1i. Maintain collaboration with portfolio partners for ongoing accounts production 1j. Second Victorian ecosystem accounts (updating and expanding on 2013 accounts, analysis of trends and drivers) 1k. Victorian economy-wide or sectoral accounts of resource use and emissions (e.g. carbon, waste) 2d. Continue strategic work with Victorian central government agencies to influence uses of environmental-economic accounting across the Victorian government 2e. Undertake integrated modelling and valuation work with other Departments, linking the environment to the primary industries sector, particularly agriculture 3g. State-wide ecosystem services assessment to support land use decisions and climate mitigation and adaptation strategies 4f. Standardised reporting on ROI across portfolio programs to feed into regional/ state-wide accounts (under Priority 1) 5g. Monitor progress filling gaps in capabilities (from 5d) and identify new needs

Indicative timelines

An overview of the indicative timelines for each of the implementation stages across the priority areas and actions identified in the Strategy is presented in Figure 8 below.

Figure 8. Focus of priority actions and indicative timelines



Project management

An important element for the implementation of the Strategy is ensuring deliverables and plan expectations are feasible given resources available. To achieve this, project plans will be prepared for each piece of work and include estimates of resources required from experts across DELWP branches.

Project plans will be signed off by the Project Control Board. DELWP project management champions will be engaged during development of individual project plans to ensure best practice techniques are used to develop and implement projects.

Potential risks

Potential risks in the implementation of the Strategy will need to be considered early on. A full assessment of such risks along with mitigation measures will be considered in the Implementation Plan.

The following risks have been identified based on DELWP's experience to date:

- **Monitoring data may not be available or limited** – environmental data may not be available for the accounts on a regular basis or measurements taken may require further analysis to address statistical issues. This risk could be reduced by strengthening cross-disciplinary work with scientists, exploring external data sources or using DELWP's modelling capabilities to infer data across landscapes.
- **Committing to environmental-economic accounting standards that are under development –** as with the development of other areas in the SNA, it is important to recognise that standards can evolve over time as they become more widely implemented. The conceptual basis of the SEEA has been developed in consultation with multiple lead statistical and scientific organisations worldwide and it is unlikely that existing classifications systems for ecosystem assets will change significantly.

However, ecosystem services is an emerging area for which linkages, concepts and measures are more difficult to standardise. This risk will be managed by maintaining productive collaborations, not only with lead agencies at the forefront of the development of international standards, but also with local organisations having a track record of best practice and expert panels for peer reviews.

- **Limited resources for the delivery of projects or regular accounts** – if multiple major priority actions go ahead at the same time, current resources available (e.g. staff, systems, budget) may be insufficient to progress priority actions in a timely fashion. This risk can be managed by using the project control board to prioritise projects and confirm expectations.
- **Maintaining consistency of reporting on the environment at different scales** – accounts for different audiences at the program and regional/state scales should be able to be reconciled and have a storyline with consistent findings and explanations for discrepancies. This risk will be addressed by prioritising initial work on a single scale, producing program accounts with regional breakdowns and including a thorough QA process in the production of the accounts.
- **Increased demand from external stakeholders requesting inputs to their work** – stronger engagement with external agencies and stakeholder groups can increase requests for collaboration beyond the priority actions identified in this Strategy. This risk can be managed by defining clear liaison roles with suitable communications material for dissemination and providing information on the focus of DELWP's work so that priority actions from the Strategy are not diverted.
- **Differentiating roles of DELWP and CES for environmental-economic accounting** – there may be concerns about a real or perceived overlap of effort across stakeholders working on environmental-economic accounting. This risk can be reduced by clarifying the distinctive roles of DELWP and CES, having agreements in place and communicating to other external stakeholders about what DELWP can do.

These risks will be discussed further in the Implementation Plan, along with proposed prevention and mitigation measures.

10. Evaluation and review of the Strategy

Once the implementation of the Strategy has been initiated, progressive evaluation of each piece of work completed will be undertaken. This will involve feedback on service delivery (e.g. quality of work, timeliness, resources), debrief on key issues that need additional support or capabilities, and feedback from account users or policy makers, as well as partnering teams and other external organisations. This feedback will be incorporated into the performance indicators for the three objectives of the Strategy and reporting to the project control board.

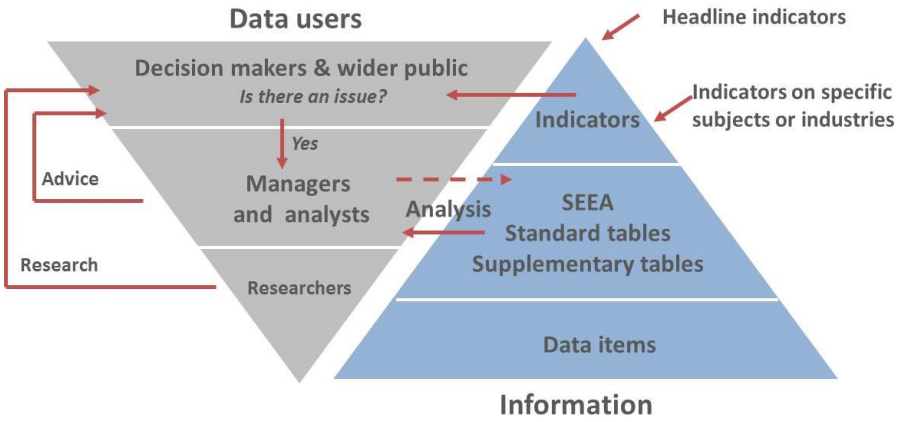
The Strategy will be fully reviewed after five years at the completion of the program of works. An interim review will be carried out in three years to highlight any major issues in the implementation of the Strategy, particularly progress of collaborative work with external parties. This will ensure the Implementation Plan can be updated as needed in terms of emerging priorities, resources and new sources of information.

Appendix I

Uses of environmental-economic accounting

The information pyramid in Figure A.1 below illustrates how statistics and indicators can be used to support research, analysis and decision-making more broadly. Underlying environmental data and other statistics can be drawn into accounts and then be used to derive high-level indicators, based on the conceptual stock and flow relationships in an accounting framework. This model can be applied to all levels of data collection, collation and reporting.

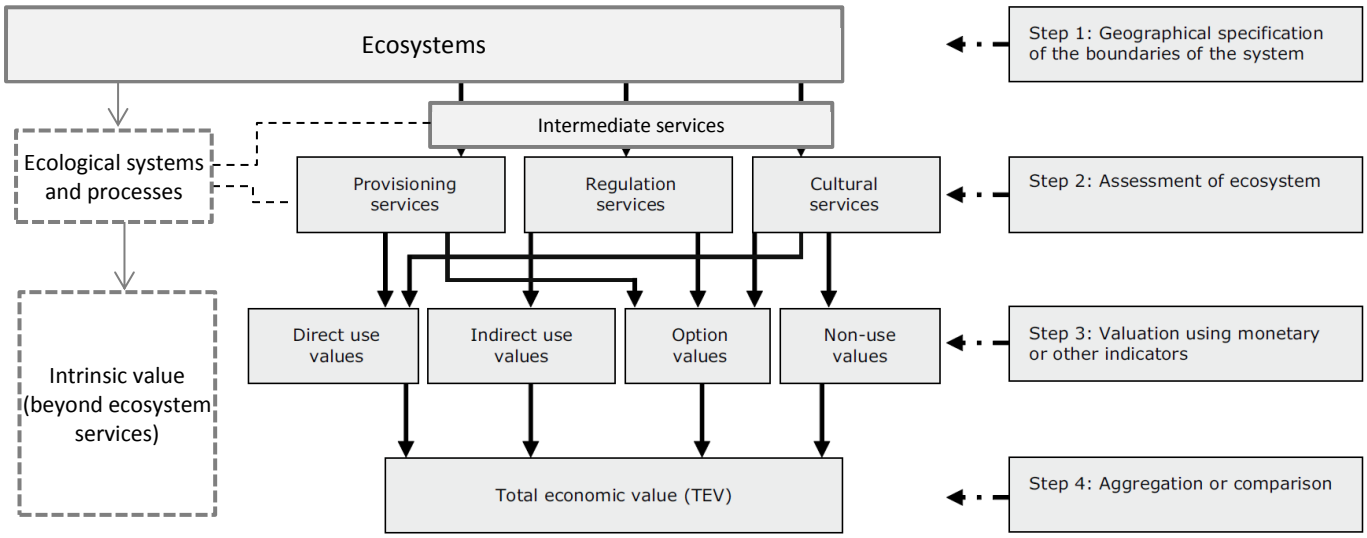
Figure A.1. Aggregation of environmental statistics into accounts and indicators



Source: Vardon et al., 2012. 'The System of Environmental-Economic Accounting for Water: development, implementation and use'. Published in Water Accounting – International Approaches to Policy and Decision-making. Edited by J. M. Godfrey and K. Chalmers.

A framework linking environmental information from accounts to inform valuation of ecosystem services is provided in Figure A.2. Environmental-economic accounting can include ecological indicators describing the health and integrity of ecosystems and species, as well as other relevant metrics to measure provisioning, regulating and cultural ecosystem services in physical units. Environmental valuation can use this information and apply suitable techniques to derive welfare values for individual ecosystem services (reflecting human benefit values). Non-overlapping values of ecosystem services can be aggregated if desired.

Figure A.2. Linkages of measurement of environmental assets and valuation



Source: Adapted by DELWP from Hein et al. 2006. 'Spatial scales, stakeholders and the valuation of ecosystem services'. Ecological Economics 57, pp. 209-228.

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