

EXPLANATORY NOTES

Environmental-Economic Accounts for ACT State of the Environment Reporting Proof of Concept

Introduction

Environmental-economic accounting is a method of integrating environmental data with economic and, to a lesser degree, social data.

This accounts presented in this publication are experimental. Improvements can be made as revised methods and new data sources continue to become available and based on feedback from various stakeholders.

The environmental-economic accounts produced for the Proof of Concept (Environmental-Economic Accounts for ACT State of the Environment Reporting) comprise a suite of environmental accounts produced by the Office of the Commissioner for Sustainability and the Environment in collaboration with the Australian National University and the Australian Bureau of Statistics. The accounts are based on the United Nations System of Environmental-Economic Accounts Central Framework¹ (SEEA-CF) and SEEA Experimental Ecosystem Accounting (SEEA-EEA).²

The framework and associated accounts described in the System of Environmental-Economic Accounting 2012 - Experimental Ecosystem Accounting (SEEA-EEA) are a complement to the conceptual framework and accounts presented in the System of Environmental-Economic Accounting. SEEA-EEA, however, is not an international standard for ecosystem accounts. The framework has been drafted by the European Commission (EC), Organisation for Economic Co-operation and Development (OECD), United Nations Statistical Commission (UNSC) and World Bank. It is consistent with the System of Environmental-Economic Accounting and the 2008 System of National Accounts (SNA).³

The SEEA-CF and SEEA-EEA provided the conceptual foundation for the ACT accounts with adaptations made to suit the data sources available and to highlight areas of particular policy interest. In addition some adaptation was needed to apply the SEEA to the ACT, as it is geographically small, and made up of land which is either urban area or nature reserve and is either leasehold or managed by the government.

The Proof of Concept consists of the following data tables for:

¹ United Nations et. al., (2014) System of Environmental-Economic Accounting 2012 Central Framework

² United Nations et. al., (2014) System of Environmental-Economic Accounting 2012 - Experimental Ecosystem Accounting.

³ Australian Bureau of Statistics 4680.0.55.001 - Information Paper: An Experimental Ecosystem Account for the Great Barrier Reef Region, 2015

Land

- landuse_change_account_2014-16.xlsx
- landuse_change_matrix_2014-16.xlsx
- landcover_change_account_2000-2015.xlsx
- landcover_change_matrix_2000-2015.xlsx
- landcover_landuse_matrix_2014-15.xlsx

Environmental Condition

Terrestrial

- terrestrial_condition_table_2000-16.xlsx

Water condition

- water_condition_account_reaches_2014-16.xlsx
- water_condition_account_rivers_lakes_2014-16.xlsx

Atmosphere

- air_quality_pollution_account_2007-16.xlsx
- carbon_dioxide_concentration_2006-16.xlsx

Biodiversity

Species

- listed_species_account_2001-16.xlsx
- listed_species_account_total_change_2001-16.xlsx
- listed_species_classes_table_2001-16.xlsx

Waste

- Waste_account_2014-2015.xlsx
- Waste_account_2015-2016.xlsx

Water

- water_asset_tables_2011-15.xlsx
- water_supply_use_tables_2011-15.xlsx

Air Emissions

GHG

- carbon_dioxide_emissions_ANZIC_2013-2016.xlsx
- carbon_dioxide_transport_emissions_table_2013-2016.xlsx

Pollutants

- air_pollution_tables_ANZSIC_division_2007-2016.xlsx

Environmental Expenditure

- environmental_expenditure_2014-16.xlsx

The accounts produced for the Proof of Concept aim to integrate data from different sources into a consolidated framework making it possible to link the physical characteristics of the environment (e.g. vegetation extent and condition) and the flows of natural resources (e.g. water) and residuals (e.g. solid waste) to economic data, such as the ACT Government's budget, financial policies and frameworks.

Scope

The Accounts cover the area of the ACT (Figure 1), but exclude National Land and water owned by the Commonwealth of Australia. This excludes, for example, Lake Burley-Griffin and Jarvis Bay.

The ACT sits within NSW and spans two biographic regions. Moreover, the ACT is bounded by five local government areas and four Rural Lands Protection Board areas of NSW; is part of three catchment areas; and five Local Aboriginal Land Council areas are acknowledged.

In scoping the accounts consideration had to be given to geospatial, atmospheric, ecosystem, catchment, geo-political and statutory jurisdictions and boundaries. While recognising the challenges and ecological artificiality of restricting the scope of the accounts to the ACT constitutional bounds (where possible), this was done as it is the area for which the Commissioner has statutory responsibility. In some cases data was not easily disentangled, while in others understanding the relationships with the surrounding areas was important; for example, the exports of waste to NSW, and flows of water between the ACT and NSW.

State of the Environment Reporting Area 2015

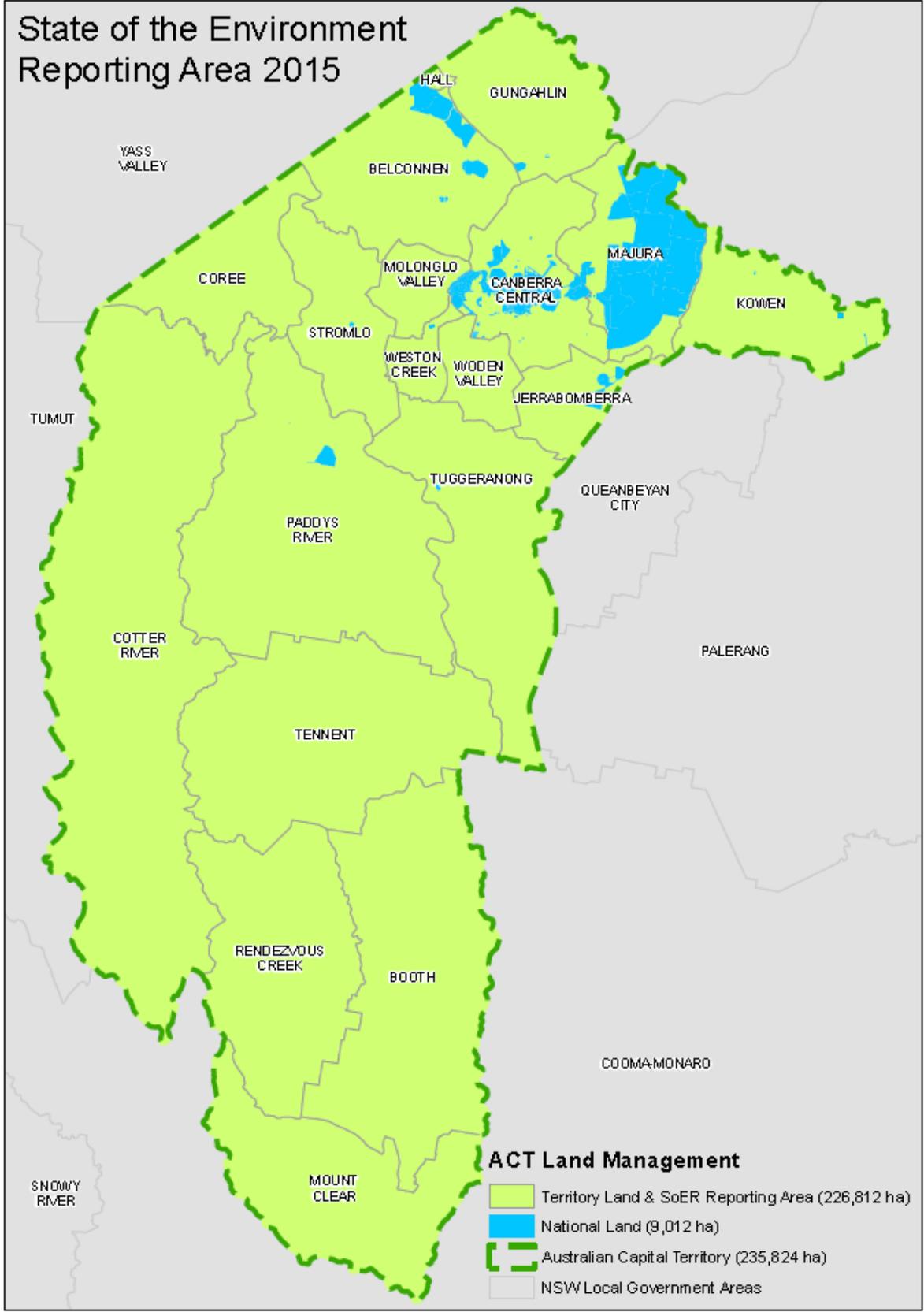


Figure 1. State of the Reporting Area 2015

Data Sources

A range of local, national and international data sources were used. These are detailed in the relevant sections below. Significant effort was made to source data that had been collected or was, at least, used by ACT Government in its environmental operations, management and policy development. Where available, this data was used in preference to data sourced elsewhere. Where ACT data was unavailable or incomplete, the accounts were produced with national or, in the case of CO₂ concentrations in the atmosphere, international data.

Methodology

Each account was developed in accordance with the concepts outlined in the SEEA-CF and SEE-EEA. Where appropriate the accounting templates were amended in consultation with data holders and with the end use of the accounts in mind (i.e., for state of the environment reporting).

A range of methods was used to build each account and details are provided below. The methods were based on those used by the ABS and other Australian data agencies (e.g. BoM, Geoscience Australia, ANU) as well as international experience.

Data Management

The accounts produced for this release integrate data from different sources into a consolidated information set. The following data management principles applied:

- Account development was guided by the ABS Data Quality Framework.
- Where possible the accounts were compiled on financial year time frames. Where source data was only available per calendar year appropriate conversions were made.
- The time series provided for each account was a function of data availability.
- The individual data sets collected had not been produced for the express purpose of populating SEEA accounts. These data sets therefore had to be analysed and standardised to produce accounts which can be maintained consistently over-time and which are aligned with SEEA concepts and definitions.
- The ABS Guideline for the Quality Management of Statistical Outputs Produced from Administrative Data was used in the interpretation and analysis of this data.

Expert Advice and Review

The accounts were developed in collaboration with the Australian National University and the Australian Bureau of Statistics.

A workshop was held in August 2016 to scope the development of the accounts and to identify data sources and methods which may be available. The attendees of the workshop are listed in Table 1.

Table 1. Expert Workshop – Attendee List

Name	Affiliation
Dr Michael Vardon	Visiting Fellow ANU(previously Australian Bureau of Statistics, World Bank and United Nations)
Professor Albert Van Dijk	Director Water and Landscape Dynamics Group at the Fenner School
Dr David Summers	Postdoctoral Fellow Fenner School, ANU
Peter Burnett	Phd Candidate, previously Senior Executive Commonwealth Environment Department
Mark Lound	Director Energy, Land and Water Statistics (ABS)
Mark Eigenraam	Director at Institute for the Development of Environmental-Economic Accounting
Carl Obst	Director at Institute for the Development of Environmental-Economic Accounting
Richard Mount	Head Environmental Information Services Branch (BoM)
Dr Neville Crossman	Director Natural Resource Economics and Decision Sciences Research Team
Peter Cochrane	Advisor to the Chief Author Commonwealth SoER 2016
Lisa Wardlaw-Kelly	Program Manager of Environment and Agriculture Branch (ABS)
Matt Jakab	Assistant Director in our Geospatial Solutions area and is currently in-posted from Geoscience Australia
Steven May	Managing a project on developing an updated ecosystem account for the Great Barrier Reef (ABS)
Mladen Kovac	Chief Economist OEH NSW
Dr Heather Keith	Lead author of Central Highlands Experimental Ecosystem Accounts and carbon/forest expert (ANU)
Dr Chris Dey	Adjunct School of Physics USyd (Footprints)
Sarah-Jane Hindmarsh	A/g Director Economics & Productivity Section, Policy Analysis & Implementation Division, Department of the Environment and Energy
Associate Professor Tommy Wiedmann	School of Civil and Environmental Engineering (UNSW)
Warwick McDonald	Research Director, Water Resources Management (CSIRO)
Sue Ogilvy	Director Ecological accounting and investment solutions
Dr Kate Auty	Commissioner Sustainability and the Environment ACT
Becky Smith	State of the Environment Manager ACT

The Institute for the Development of Environmental-Economic Accounting (IDEAA Group) provided expert review of the penultimate accounting tables and the accompanying indicators and interpretative text.

Land

Land accounts were developed with two different datasets land cover and land use. Land cover was defined using the Geoscience Australia Dynamic Land Cover Dataset (DLDC).⁴ Land use was defined using the Territory Plan Land Use Zoning from the Australian Capital Territory development and planning data.⁵

Land cover

The DLDC data is a national scale dataset developed to measure and understand land cover change over time. Annual datasets are developed across 22 land cover classes (Table 1) based on temporal greenness patterns using MODIS satellite image data. Annual datasets exist for 2002 until 2015.

Table 1: Geoscience Australia Dynamic Land Cover Dataset land cover classes

Dynamic Land Cover Dataset classes	
<ul style="list-style-type: none"> • Extraction Sites • Inland Waterbodies • Salt Lakes • Irrigated Cropping • Irrigated Pasture • Irrigated Sugar • Rainfed Cropping • Rainfed Pasture • Rainfed Sugar • Wetlands • Tussock Grasses - Closed 	<ul style="list-style-type: none"> • Alpine Grasses – Open • Hummock Grasses – Open • Tussock Grasses – Open • Shrubs and Grasses - Sparse-Scattered • Shrubs – Closed • Shrubs – Open • Trees – Closed • Trees – Open • Trees – Scattered • Trees – Sparse • Urban Areas

Land use

The Territory Plan Land Use Zoning is developed as part of the planning and development across the ACT. Datasets are available for 2014, 2015 and 2016. These dataset provide 24 classes (Table 2) across the jurisdiction.

Table 2: Australian Capital Territory, Territory Plan Zoning land use classes

ACT Territory Plan Zoning land use classes	
<ul style="list-style-type: none"> • Designated • Suburban • Community facilities • Transport • Mixed use • Hills, ridges and buffer areas • Urban open space • Suburban core • Rural • River corridor 	<ul style="list-style-type: none"> • Business zone • Local centre • Urban residential • Services • Restricted access recreation zone • Services zone • Medium density residential • Leisure and accommodation • High density residential • General industry

⁴ Lymburner, L., *et al.* 2011. The National Dynamic Land Cover Dataset. Geoscience Australia, Canberra, Australia.

⁵ ACT Territory Government, Land use zones, ACTMapl, ([Available here](#))

- | | |
|--|---|
| <ul style="list-style-type: none"> • Broadacre • Core zone | <ul style="list-style-type: none"> • Mountains and bushlands • Industrial mixed use |
|--|---|

Land account tables

Change accounts

Land cover (DLCD) and land use (land use zoning) change accounts were developed to report on changes (additions and removals of different land cover types) between opening and closing dates.

Land cover change by land use account

These account tables were developed using the DLDC and territory plan land use data to report on changes (additions and removals of different land cover types) of land cover for each land use between opening and closing dates. A single table for each land use class was developed quantifying additions and removals between opening and closing dates..

Land cover change by land use matrix

Land cover change matrix were developed to quantify the changes between different land cover classes. These tables present land cover classes across the columns (x axis) and additions and removals from each class along the y axis with the opening and closing stocks at the top and bottom respectively.

Environmental Condition Accounts

Land condition

The accounts of environmental condition were constructed from metrics developed as a part of the 'Australia's Environment Explorer'.⁶ Australia's Environment Explorer is a publically available online tool and data repository (www.ausenv.online) where users can view, evaluate and access comprehensive, national-scale information on the condition and trajectory of our environment.

Relying on systematic broad scale satellite observations and integrated landscape modelling, Australia's Environment Explorer provides comprehensive annual time series on 13 environmental indicators are organised in 6 Themes: land cover, bushfire, water availability, rivers and wetlands, landscape health, and carbon storage (Table #.1). Time series data are available from 2000 to 2016 for most indicators. All these datasets can be viewed, interrogated and downloaded for further analysis from the website for free.

Data from Australia's Environment Explorer was used to create the Environmental Condition Score (ECS). The ECS is a composite of nine indicators from Australia's Environment Explorer, combining tree cover, soil exposure, inundation, vegetation carbon uptake and river runoff (Table. 2). The ECS is calculated as the average of ranking in the indicators,

⁶ Van Dijk, A.I.J.M., Summers, D.M., 2016. Australia's environment in 2015. Australian National University, Canberra, Australia, www.ausenv.online.

each scored from zero to ten. Thus, the ECS provides a time series where each year can be viewed relative to the whole dataset.

The ECS has been applied to national and state assessments of environmental condition⁷ and an assessment for the ACT has previously presented to the London Group on Environmental Accounting.⁸ For this set of accounts the ECS was calculated from 2000 to 2016.

Table .2: Environmental indicators and their sources from Australia’s Environment.

Indicator	Description
Tree cover*	Determined as the percent of area classified as forest at 25 metre resolution mapping using Landsat imagery following the National Carbon Accounting System (NCAS) classification. ⁹
Land cover	Land cover classification from Geoscience Australia Dynamic Land Cover Data. ¹⁰
Soil exposure*	Annual mean percentage of soil that is unprotected by living vegetation or litter. Derived from a fractional cover algorithm that exploits MODIS satellite imagery to estimate fractions of photosynthetic vegetation, non-photosynthetic vegetation and exposed. ¹¹
Fire intensity and occurrence	Annual maximum fire intensity (°C) and average frequency, respectively, of fire mapped at 2.5 km resolution as derived from the Geoscience Australia Sentinel system. ¹²
Inundation*	Percent of area covered by water at least once during the year as mapped from MODIS satellite observations following the methodology of Guerschman and colleagues (CSIRO). ¹³
Vegetation leaf area*	Annual mean leaf area index (area of leaf per area of ground) (m ² m ⁻²) as estimated from MODIS satellite imagery. ¹⁴
Carbon fire emissions	Annual emission of carbon from wildfire estimated the Global Fire Assimilation System v1.2. ¹⁵
Vegetation carbon uptake*	Gross primary production, the amount of carbon taken up by the vegetation through photosynthesis, as estimated by the OzWALD model-data fusion system. ¹⁶
Precipitation, soil moisture, runoff and river inflow*	The OzWALD model-data fusion system was used to populate precipitation (rainfall and snowfall), soil moisture, runoff and river flow. ¹⁷

*Denotes indicators used in the accounts and included in environmental condition score

⁷ Van Dijk, A.I.J.M, Summers, D.M., 2017, Australia’s 2016 environment scorecard: rains return but in some cases too late, The conversation. ([Available here](#))

⁸ Vardon, M., *et al.*, 2016, Ecosystem condition – Preliminary review from six Australian case studies. Paper LG/22/F28. Meeting of the London Group on Environmental Accounting. 28-30 September 2016, Oslo, Norway. ([Available here](#))

⁹ Furby, S., 2002. Land Cover Change: Specification for Remote Sensing Analysis. National Carbon Accounting System Technical Report No. 9. Australian Greenhouse office, ([Available here](#))

¹⁰ Lymburner, L., *et al.* 2011. The National Dynamic Land Cover Dataset. Geoscience Australia, Canberra, Australia.

¹¹ Guerschman, J.P., *et al.* 2011. MODIS-based standing water detection for flood and large reservoir mapping: algorithm development and applications for the Australian continent. CSIRO Canberra, Australia.

¹² Geoscience Australia, 2014. Sentinel Hotspots Product Description Document V1.2, code D2014-145826, Geocat Reference 70869. Geoscience Australia, Canberra, Australia.

¹³ Guerschman, J.P. *et al.* 2011. MODIS-based standing water detection for flood and large reservoir mapping: algorithm development and applications for the Australian continent. CSIRO Canberra, Australia.

¹⁴ Yang, W. *et al.* 2006. Analysis of leaf area index and fraction of PAR absorbed by vegetation products from the terra MODIS sensor: 2000-2005. IEEE Transactions on Geoscience and Remote Sensing 44, 1829-1842.

¹⁵ Kaiser, J.W. *et al.* 2012. Biomass burning emissions estimated with a global fire assimilation system based on observed fire radiative power. Biogeosciences, 9, 527-554

¹⁶ Yebra, M. *et al.* 2015. Global vegetation gross primary production estimation using satellite-derived light-use efficiency and canopy conductance. Remote Sensing of Environment 163, 206-216

¹⁷ Van Dijk, A.I.J.M., 2010. The Australian Water Resources Assessment System Technical Report 3. Landscape Model (version 0.5) Technical Description. CSIRO: Water for a Healthy Country National Research Flagship. ([Available here](#))

Water condition

Data for water condition was provided by the Upper Murrumbidgee Waterwatch Catchment Health Indicator Program (CHIP).¹⁸ This is a community engagement and water monitoring program that collects biophysical information on water and catchment indicators across a range of rivers and water bodies in the Upper Murrumbidgee catchment to monitor water and catchment health. Most of the data is collected by an extensive network of trained volunteers and extensive annual reports are produced annually.

The water condition indicators are: Water Quality Score (chemical and physical indicators of water quality), Water Bug Score (macro-invertebrates indicators) and Riparian Condition Score (measure of riparian condition along relevant reaches). As a part of the CHIP methodology, these separate scores are rescaled and combined into a single overall measure of water and catchment health called the CHIP score.

A comprehensive description of the different indicators, how they were measured, the sampling density and how the different scores were developed can be found in the Upper Murrumbidgee Waterwatch Catchment Health Indicator Program annual reports for 2013-2014¹⁹, 2014-2015²⁰ and 2015-2016.²¹

Below we provide a brief description of how the indicators were developed by the Upper Murrumbidgee Waterwatch CHIP and any specifics and post analysis relevant to the ACT Water Condition accounts.

Water quality Score

A range of chemical and physical tests were used as indicators to build a Water Quality Score. These were pH (pH units), electrical conductivity (EC μ S), Turbidity (NTU), dissolved organic matter saturation (DO %), total phosphorus (TP mg/L) and nitrate (N mg/L). In order to make these different indicators directly comparable they were rescaled to an indicator rating of between one (excellent) and five (degraded). The overall Water Quality Score was then derived by finding the average of all of these 5 scores.

¹⁸ Upper Murrumbidgee Waterwatch Program, <http://www.act.waterwatch.org.au/>

¹⁹ Upper Murrumbidgee Waterwatch Catchment Health indicator Program 2013-14
[http://www.act.waterwatch.org.au/Files/CHIP2013_14%20Report%2004FEB2015_FINAL%20\(low%20res\).pdf](http://www.act.waterwatch.org.au/Files/CHIP2013_14%20Report%2004FEB2015_FINAL%20(low%20res).pdf)

²⁰ Upper Murrumbidgee Waterwatch Catchment Health indicator Program 2014-15
http://www.act.waterwatch.org.au/Files/CHIP/CHIPReport2014_15.pdf

²¹ Upper Murrumbidgee Waterwatch Catchment Health indicator Program 2014-15
<http://www.act.waterwatch.org.au/Files/CHIP/CHIP%202015-16.pdf>

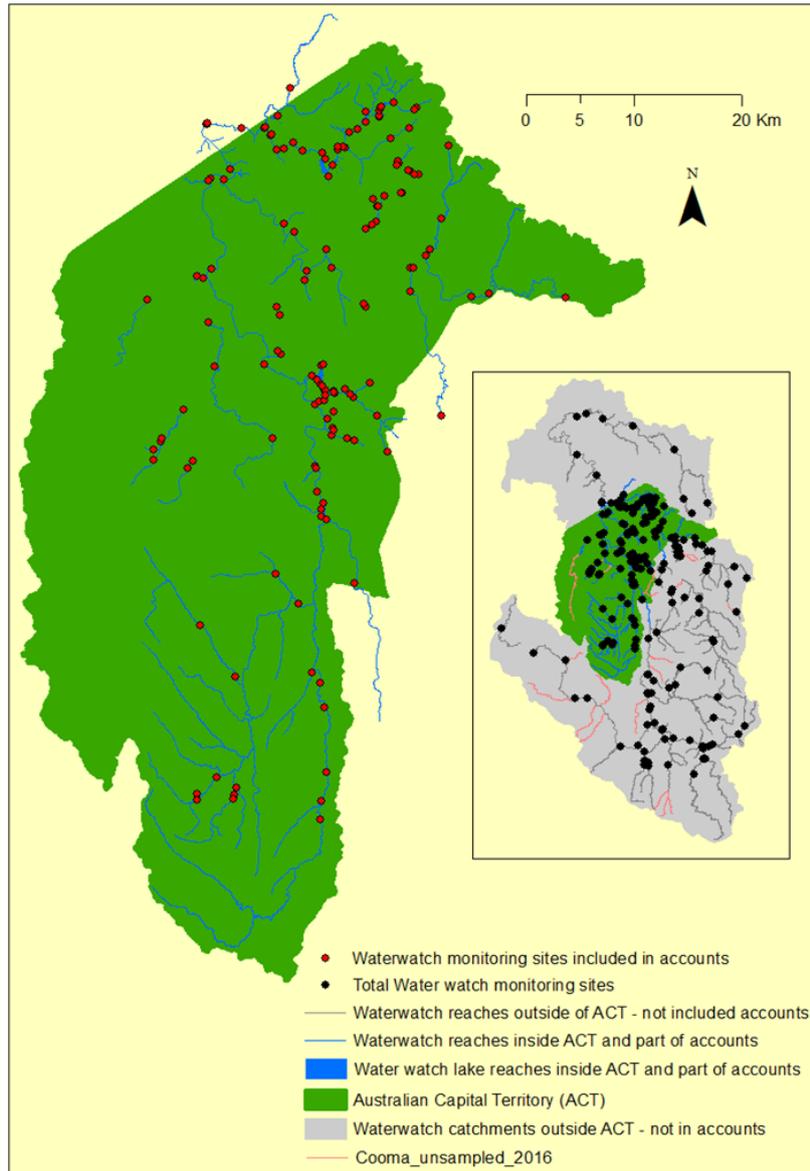


FIGURE 2: SPATIAL DISTRIBUTION OF WATERWATCH REACHES AND SAMPLING SITES USED FOR THE ACT ENVIRONMENTAL ACCOUNTS AND THE TOTAL DATASET COLLECTED FOR THE UPPER MURRUMBIDGEE WATERWATCH PROGRAM IN 2016

Water Bug Score

The Water Bug Score was developed using the SIGNAL 2.0 system of stream health classification. This system measures a range of key sensitive macro-invertebrate taxa including Mayflies, Stoneflies and Caddisflies. In the 2013-2014 and 2014-2015 reports macro-invertebrate assessments used a four classification system before being increased to a five classification system for 2015-2016. This additional assessment has allowed the Water Bug Score to be expanded to include rescaled to categories between one (excellent condition) to five (degraded condition) for inclusion in the CHIP Score, where previously the

Water Bug Score was from one (excellent) to four (poor).²² The expansion of this indicator has not been accounted for in the ACT Environmental Accounts presented here. As such comparisons across years need to be done cautiously.

Riparian Condition Score

The Riparian Condition Score, measured using the 'Rapid Appraisal of Riparian Condition' (RARC), provides a measure of the functional characteristics of the river bank vegetation. This is an important part of overall aquatic ecosystem health. Riparian Condition Score was introduced in the 2014-2015 assessment, as such there is no data for this indicator for the 2013-2014 accounts. Where appropriate the water Riparian Condition Score was also rescaled to categories between one (excellent condition) to five (degraded condition) for inclusion in the CHIP Score.

CHIP Score

The CHIP Score is a measure that combines each of the previously discussed scores into a single metric of water and catchment health. The CHIP Score is derived as an equally weighted average of the different individual scores (Water Quality Score, Water Bug Score and the Riparian Condition Score) after they had been rescaled to between one (excellent condition) to five (degraded condition).

Spatial coverage

The total area of the Upper Murrumbidgee Waterwatch program extends beyond the boundaries of the ACT. The area of the program was broken up into catchments and within each catchment sampling was designed to monitor biophysically and ecologically similar 'reaches' (water bodies such as stretches of rivers or creeks and lakes and wetlands). The catchments used in the Upper Murrumbidgee Waterwatch program were the Cooma, Ginninderra, Molonglo, Yass and Southern ACT. Of these, only data from the Ginninderra, Southern ACT and the northern part of Molonglo that intersects the ACT were included.

In 2015-16, the Upper Murrumbidgee Waterwatch Program conducted 1,973 water quality surveys, 208 water bug surveys and 196 riparian condition surveys across 243 individual sampling sites covering 96 individual reaches.²³ 59 of these reaches were inside the ACT, with five of those crossed the border into New South Wales (Figure 2).

Aggregated Indicator Scores

The Upper Murrumbidgee Waterwatch Program collects detailed information on individual reaches and provides a comprehensive annual assessment of each. However, in order to understand trends at broader geographical areas we aggregated reaches together. To do this individual reaches that made up larger water bodies such as rivers or lakes were combined and their condition scores averaged. For example, there are six reaches along the Murrumbidgee River within the ACT and these were averaged to provide aggregated condition scores.

²² Upper Murrumbidgee Waterwatch Catchment Health indicator Program 2014-15 ([Available here](#))

²³ Upper Murrumbidgee Waterwatch Catchment Health indicator Program 2014-15 ([Available here](#))

Atmospheric condition

Atmospheric condition was defined as air quality and carbon dioxide concentrations in the atmosphere.

For air quality condition was defined as the number of days per calendar year that the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) was exceeded permissible standards.). AAQ NEPM sets the standards and goals for the maximum allowable number of exceedances of each of the 6 NEPM pollutants monitored in the ACT.²⁴ Air quality is measured at three monitoring stations located at Monash, Civic, and Florey. These data were from the ACT Air Quality Report 2015. Analysis of this account needs to recognise that certain events can impact on air quality and that there is spatial variation in air quality.

The ACT State of the Environment report “must include an assessment about the degree of compliance with NEPM standards”.²⁵

The concentration of carbon dioxide in the atmosphere was sourced from the USA National Oceanic and Atmospheric Administration (NOAA)²⁶. Data are the yearly average.

Species

The species account measures trends in the conservation status of threatened species and ecological communities listed under the *Nature Conservation Act 2014* (NC Act).

At the time the account was created there were no ecological communities listed under the NC Act.

Under the NC Act s63 the Minister must make a threatened native species list. The list must contain the species eligible to be included in 1 of the following categories:

- (a) extinct;
- (b) extinct in the wild;
- (c) critically endangered;
- (d) endangered;
- (e) vulnerable;
- (f) conservation dependent.

The list may contain the species eligible to be included in 1 of the following categories:

- (a) regionally threatened;
- (b) regionally conservation dependent;

²⁴ ACT AIR QUALITY REPORT 2015 Environment Protection Authority | June 2016

²⁵ *Commissioner for Sustainability and the Environment Act 1993* s19(2)(b)

²⁶ ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_mlo.txt

(c) provisional.

Species are periodically added and removed from these lists as well as moving between categories on the lists as they become more or less threatened. Legislative instruments are not necessarily updated annually, although there can be more than one a year too. Currently the accounts provide one account for each legislative instrument.

Water

Physical supply and use table.

The ABS Water Account Australia (WAA) and BoM Nation Water Account (NWA) were the data sources used in the construction of this account.

The supply and use of water products by industries and households directly used the estimates in the WAA²⁷ for distributed water, re-use and self-extracted water for industries except the water supply industry and households. For the water supply industry, the amount extracted from Bendora, Corin and Cotter Dams known from the NWA²⁸ was recorded as the amount self-extracted by the water supply industry in the ACT with the balance between total supply of distributed water and the amount self-extracted by the water supply industry being recorded as an import from NSW. Exports from Cotter to Googong or the Murrumbidgee River to Googong are recorded as exports. For households, the amount of rainwater used²⁹ was added as a use of a natural input.

For the split of natural inputs between surface and groundwater use, was only able to be determined for agriculture from the WAA.³⁰

Water asset account

The NWA was the primary source of data for the water asset account. The NWA uses an accounting system that may be mapped into the SEEA Central Framework.³¹ The NWA

²⁷ WAA, Tables 15.1 to 15.5 Physical Water Supply and Use, by Water Type, Australian Capital Territory (Megalitres), 2010-11 to 2014-15
http://www.abs.gov.au/AUSSTATS/subscriber.nsf/log?openagent&46100do015_201415.xls&4610.0&Data%20Cubes&76F5D4D4E83ABD53CA2580750012A507&0&2014-15&25.11.2016&Latest

²⁸ Line item 17.12 Entitled diversion of allocated surface water to urban water system, e.g. 2012
http://www.bom.gov.au/water/nwa/2012/canberra/statement/notes_s17_12.shtml

²⁹ WAA, Table 6.2 Water Consumption from Rainwater Tanks, Households, by State and Territory (Gigalitres), 2000-01 to 2014-15 (a)
http://www.abs.gov.au/AUSSTATS/subscriber.nsf/log?openagent&46100do006_201415.xls&4610.0&Data%20Cubes&156F160F96E3F1C7CA2580750012A334&0&2014-15&25.11.2016&Latest

³⁰ WAA, Table 4.4 Intermediate Consumption of Water, Agriculture Industry, by State and Territory and Origin of Water (Megalitres), 2008-09 to 2014-15
http://www.abs.gov.au/AUSSTATS/subscriber.nsf/log?openagent&46100do004_201415.xls&4610.0&Data%20Cubes&BBA80CFCAB317B11CA2580750012A2D5&0&2014-15&25.11.2016&Latest

³¹ Vardon et al. (2012) The System of Environmental-Economic Accounting for Water: development, implementation and use.
http://www.researchgate.net/publication/262007240_The_System_of_Environmental-Economic_Accounting_for_Water_development_implementation_and_use

presents information for the Canberra region, and hence covers the ACT and a part of NSW. In particular, the NWA includes the Googong Dam. The aggregated data for the Canberra region on volume of water in storage are presented in the Statement of Water Assets and Water Liabilities.³² Additional data on the volume held in the different storages (Bendora, Corin, Cotter and Googong) is found in the WAA, the “Line items notes” for 2010-11 to 2013-14³³ and “Supporting information” for 2014-15 to 2015-16.³⁴ The data for 2014-15 to 2015-16 are presented in figures and hence cannot be translated directly into the asset account format without obtaining the data behind the figures from the BoM.

Air Emissions

There are two air emission accounts:

Greenhouse Gas (CO₂e) Emissions

This account was initially developed using two primary data sets:

- Pitt and Sherry data (as used to calculate the ACT *Greenhouse Gas Inventory (GGI) for 2015-16 with recalculations for 2014-15*)
- ABS *Survey(s) of Motor Vehicle Use*

The GGI complies with UNFCCC reporting requirements while SEEA accounts for Australian use by ANZSIC industry categories. Concordance work was therefore required to build the greenhouse gas emissions account with ANZSIC categories. Estimates for this work were generated using Department of the Environment and Energy’s AGEIS (Australian Greenhouse Gas Emissions Information System) National Inventory by Economic Sector data

The greenhouse gas emissions account also contains information for CO₂-e by fuel type by sector disaggregated from the GGI. This was done to ensure the account was relevant and specific to the policy issues and environmental challenges specific to the ACT. The ABS Survey(s) of Motor Vehicle Use (Catalogue No. 9208.0) was used to make these calculations.

Air Pollutants

This account used data sourced from the National Pollution Inventory (NPI) database. The account reported, where possible, on ACT National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) NEPM reportable substances noting that the NPI has no Ozone so TVOC & Oxides of Nitrogen were substituted.³⁵

³² E.g. WAA 2016, Statement of Water Assets and Water Liabilities 2016.

<http://www.bom.gov.au/water/nwa/2016/canberra/statement/waterassetsandwaterliabilities.shtml>

³³ E.g. 2013 Line items 13.2 and 17.12

<http://www.bom.gov.au/water/nwa/2013/canberra/notes/lineitem.shtml>

³⁴ Figure 4N,

<http://www.bom.gov.au/water/nwa/2016/canberra/statement/waterassetsandwaterliabilities.shtml>

³⁵ <https://www.nap.edu/read/1889/chapter/8>

Concordance was necessary to transpose the NPI categories to ANZSIC categories for the Air Pollutant account.

Diffuse sources from the NPI were:

- a. aggregated where appropriate i.e., when quantities not significant; and
- b. disaggregated where quantities are high and information of significance to other accounts i.e., emissions from transport and solid fuel burning from wood heaters.

Pollutants emitted by Diesel, Petrol & LPG were disaggregated using the emission estimation techniques for combustion engines.³⁶

Waste

Waste account data was provided by ACT NoWaste, primarily through data collected by the ACT Waste Feasibility Study. The data contains a number of provisos, assumptions, caveats and exclusions.³⁷

The first draft of the account maintained ACT NoWaste reporting categories. For the second draft the account was reformatted using ANZSIC categories. For 2015/16 the second draft also includes 79,202 Tonnes of asbestos waste from Mr. Fluffy houses: a programme carried out by Asbestos Response Taskforce to demolish approximately 1,000 affected houses. This waste was included as a sub-total so it could be clearly identified and did not distort other supply /use figures. The 1,000 houses will be demolished over a ten year period.

³⁶ Emission estimation technique manual for Combustion engines Version 3.0 June 2008 ISBN: 0642548072 © Commonwealth of Australia 2008 <http://www.npi.gov.au/system/files/resources/afa15a7a-2554-c0d4-7d0e-d466b2fb5ead/files/combustion-engines.pdf>

³⁷ Waste account data provided by ACT NOWaste must be accompanied by the following provisos, assumptions, caveats and exclusions:

1. The data provided for the waste account is partially self reported by industry and relies on industry participants to provide the information on a voluntary basis. The Waste Feasibility Study provides the information without any express or implied warranties that the information is accurate, correct or up-to-date. The Waste Feasibility Study does not guarantee, and accepts no legal liability whatsoever arising from, or connected to, the use of any of this information or any previously published information by ACT NOWaste.
2. The Waste Feasibility Study recommends that users exercise their own skill and care with respect to their use of this information and that users carefully evaluate the accuracy, currency, completeness and relevance of this information for their purposes.
3. This information is not a substitute for independent professional advice and users should obtain any appropriate professional advice relevant to their particular circumstances.
4. Waste streams are grouped by category. The approach to classify waste streams into the three main waste categories varies across jurisdictions. ACT categories are based upon advice from the Department of the Environment and from an industry expert. With one exception (relating to the commingled waste stream) where a stream could be allocated to more than one category e.g. mattresses which originate from households and commercial operators alike, the waste stream was allocated to the main category.

Environmental Expenditure

The Environmental Expenditure Account presents ACT Government and ICON Water (an unlisted public company owned by the ACT Government) expenditure on environmental protection and natural resource management. Data for the account was sourced from:

- Environment, Planning and Sustainable Development Directorate;
- Transport Canberra and City Services;
- Emergency Services Agency
- Environment Protection Authority
- Land Development Agency
- ICON Water
- Infrastructure Planning & Design – Chief Minister’s Treasury and Economic Development Directorate
- Access Canberra

The data was obtained cooperatively with the Finance and Project management areas of the listed sources.

The account includes an amount for volunteering calculated on a replacement cost basis.

For further information please contact the Office of the Commissioner for Sustainability and the Environment

GPO Box 158, Canberra ACT 2601

Telephone: (02) 6207 2626

Facsimile: (02) 6207 2630

Email: envcomm@act.gov.au

Website: www.environmentcommissioner.act.gov.au