# Valuation of Water Supply Services in Australia's National Ecosystem Accounts

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## Abstract

The Australian Bureau of Statistics (ABS) recently released the first National Ecosystem Accounts for Australia, providing insights into the monetary valuation of water supply services for drinking and material use. These accounts demonstrate practical applications of the System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) methods, offering critical feedback for updating the SEEA Central Framework on water valuation.

Physical water supply estimates were derived from the Water Account and Water Supply and Sewerage Services census (WSSS), focusing solely on surface water. The WSSS ensured full coverage using data from water utilities, though the distinction between potable and non-potable water was unavailable—household water use was used as a proxy for drinking water.

The monetary valuation was based on tradable water allocations, which allow volumes to be traded independently of entitlements and land, enabling market-based pricing. Approximately 1,750 GL of surface water allocations are traded annually, representing 15–20% of total physical supply. New South Wales and Victoria dominate trading due to their developed water markets in the Murray-Darling Basin. Prices are influenced by factors like rainfall, storage levels, and agricultural demand, with a volume-weighted median price used for national valuation.

This work highlights the utility of market-based pricing for estimating water supply valuation while contributing to broader environmental-economic assessments. Additionally, challenges remain in valuing surface water used as an energy source. The residual value method is one possible approach, though alternative methods are also under discussion.


## 1. Introduction

Australia's inaugural National Ecosystem Accounts, published in February 2025, represent a significant advancement in the integration of environmental and economic data. These accounts provide a structured framework for assessing the contributions of ecosystems to human well-being and economic activity. This paper focuses specifically on the valuation of water supply services, including surface water used for drinking, material use, and energy generation. The valuation approach draws on the System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) framework and offers practical insights to inform the ongoing revision of the SEEA Central Framework, particularly Issue D7, which addresses the valuation of water.

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## 2. Background and Policy Context

Water supply services are classified as final ecosystem services under the SEEA EA framework. They encompass the natural processes—such as water flow regulation, purification, and retention—that contribute to the availability of water suitable for economic use. In the Australian context, these services are critical not only for supporting industrial and agricultural production but also for ensuring the health and well-being of households and communities.

The development of the National Ecosystem Accounts was led by the Australian Bureau of Statistics (ABS), in collaboration with key stakeholders including the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Department of Climate Change, Energy, the Environment and Water (DCCEEW), and the Bureau of Meteorology (BoM). These accounts are aligned with international standards, including the SEEA EA and the IUCN Global Ecosystem Typology (GET), and are intended to support both domestic policy development and international environmental reporting obligations. The first release was experimental and will be refined through a structured consultation process with users and experts.

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# 3. Data Sources and Methodology

The valuation of water supply services in Australia's National Ecosystem Accounts relies on a combination of physical and monetary data sources, each selected to ensure national coverage, coherence with existing statistical frameworks, and alignment with SEEA EA principles.

### 3.1 Physical Estimates

Physical estimates of water supply services were derived from two primary sources: the ABS Water Account, Australia and the Water Supply and Sewerage Services (WSSS) census. These sources provide comprehensive data on water abstraction and distribution across Australia, with a particular focus on surface water. Groundwater and desalinated water were excluded from the scope of the inaugural National Ecosystem Accounts due to limitations in data quality and incomplete methodological development.

Regarding *"water used for drinking"*, limitations in the available data meant it was not possible to distinguish between potable and non-potable water, nor to isolate water used exclusively for drinking purposes. As a result, water supplied to households was used as a proxy. While this proxy includes water used for other household activities such as gardening and cleaning, it provides a reasonable approximation of the ecosystem service of water provision for human consumption.

*"Water used as a material"* was defined as water abstracted or distributed for use in production processes across industries such as agriculture, mining, manufacturing, and services. This includes both self-extracted water and water supplied by utilities. *"Water used as an energy source"* refers primarily to the use of surface water in hydroelectric generation, which is typically non-consumptive, as the water is returned to the environment after use.

Water used as an energy source, such as in hydroelectric systems, was considered during the development of the National Ecosystem Accounts but was not ultimately included. While CICES classifies it as a provisioning service—specifically an abiotic output—SEEA Ecosystem Accounting generally treats it as a natural resource input to the economy, unless the ecosystem contributes to flow regulation. This highlights a key difference in how ecosystem contributions are defined across frameworks.

### 3.2 Monetary Valuation

Monetary valuation of water supply services was conducted using two distinct approaches, each tailored to the nature of the service and the availability of market data.

For water used for drinking and material purposes, market-based pricing was employed. This approach utilised data on tradable water allocations, which represent volumes of water that can be traded independently of land or entitlements. These allocations are actively traded in Australia's water markets, particularly in New South Wales and Victoria, where mature trading systems exist. Prices were calculated using volume-weighted averages derived from water trading data sourced from the Bureau of Meteorology's Water Market Dashboard, with adjustments made to exclude outliers and ensure consistency.

For water used as an energy source, the residual value method was applied during the development of the National Ecosystem Accounts. This approach estimates the value of the ecosystem service by calculating the gross output of hydroelectricity producers and subtracting the value of all other inputs—such as intermediate consumption, labour, and capital services, including depreciation (formerly referred to as consumption of fixed capital) and the return on produced capital. The resulting residual is attributed to the ecosystem service of water provisioning. While this method is particularly suitable for services that lack direct market prices but where the ecosystem's contribution to economic output can be inferred, the estimates derived using this approach were not included in the final publication, as the method was deemed internally to be too experimental for release, and require further investigation and consultation.

Together, these methods provide a comprehensive and policy-relevant valuation of water supply services, enabling integration with national accounts and supporting informed decision-making.

## 4. Results and Insights

The results of the valuation exercise provide a comprehensive picture of both the physical flows and the monetary value of water supply services in Australia. These insights are critical for understanding the scale and significance of ecosystem contributions to the economy and for identifying areas where methodological improvements are needed.

### 4.1 Physical Supply

Over the period from 2015–16 to 2020–21, the majority of surface water supply services in Australia were associated with energy generation. Approximately 82 per cent of total surface water use was attributed to hydroelectricity production, a *non-consumptive* use where water is returned to the environment after generating power. This highlights the substantial role that ecosystems play in supporting renewable energy infrastructure.

Material use accounted for the largest share of *consumptive* water use, with around 9,000 gigalitres (GL) of surface water extracted for use in agriculture, mining, manufacturing, and other industries. This represented approximately 86 per cent of all consumptive use. Water used for drinking purposes, estimated using household water supply as a proxy, amounted to roughly 1,500 GL, or 14 per cent of consumptive use.

These figures underscore the importance of distinguishing between consumptive and non-consumptive uses in ecosystem accounting, as well as the need for improved data granularity to better capture the diversity of water use across sectors and regions.

### 4.2 Monetary Valuation

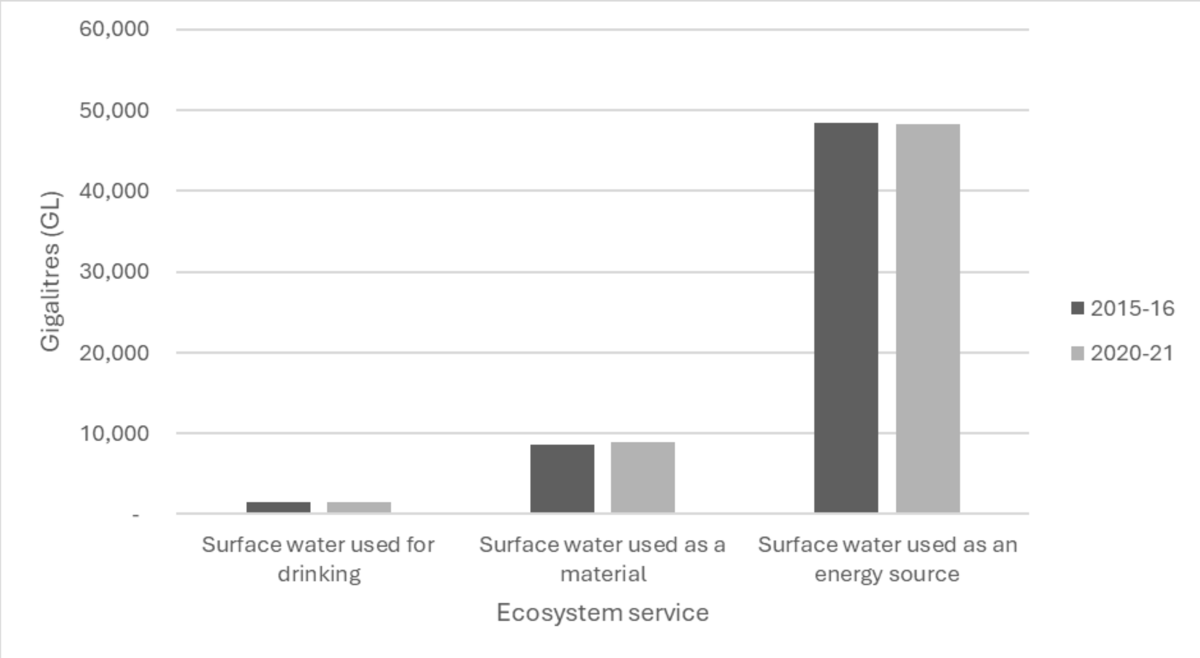
The monetary valuation of water supply services revealed significant variation in value across different uses and over time. For surface water used as a material input in production, the national value declined from approximately $1.77 billion in 2015–16 to $1.18 billion in 2020–21. This represents a 33 per cent decrease, largely driven by a 36 per cent reduction in the price of water allocations, which in turn reflected changing climatic conditions and water availability.

Water used for drinking purposes also experienced a notable decline in value, falling from $307 million to $193 million over the same period. This 37 per cent decrease was similarly influenced by a drop in allocation prices, which are used as a proxy for the value of water supplied to households.

In contrast, the value of water used as an energy source (which, as noted above, was not published) increased from $509 million to $591 million, a rise of 16 per cent. This growth was driven by a 17 per cent increase in the estimated price of water used in hydroelectric generation, calculated using the residual value method. The increase reflects both higher electricity prices and improved financial performance among major hydroelectricity producers.

These results demonstrate the utility of market-based and residual valuation methods in capturing the economic significance of water supply services. They also highlight the sensitivity of ecosystem service values to external factors such as climate variability, market dynamics, and regulatory settings.

**Figure 1: National Ecosystem Services for Water Supply, 2015–16 to 2020–21**




The monetary valuation revealed significant variation across uses and over time. For surface water used as a material input, the national value declined from approximately $1.77 billion in 2015–16 to $1.18 billion in 2020–21.

***Table 1: Monetary value of "Surface water used as a material" ($m) – Total Economic Use***

| Region | 2015–16 | 2020–21 |
|---|---|---|
| **New South Wales** | 571 | 464 |
| **Victoria** | 559 | 322 |
| **Queensland** | No Price | 189 |
| **South Australia** | np | 86 |
| **Western Australia** | np | 22 |
| **Tasmania** | 67 | np |
| **Northern Territory** | No Price | No Price |
| **Australian Capital Territory** | np | np |
| **Australia** | **1,767** | **1,184** |

*np – data not available for publication*

Water used for drinking fell from $307 million to $193 million over the same period.

***Table 2: Monetary Value of "Surface water used for drinking" ($m) – Total Economic Use***

| Region | 2015–16 | 2020–21 |
|---|---|---|
| **New South Wales** | 103 | 66 |
| **Victoria** | 91 | 49 |
| **Queensland** | No Price | 29 |
| **South Australia** | 27 | 25 |

| | | |
|---|---|---|
| **Western Australia** | 3 | 6 |
| **Tasmania** | 6 | 8 |
| **Northern Territory** | No Price | No Price |
| **Australian Capital Territory** | 6 | 4 |
| **Australia** | **307** | **193** |

*np – data not available for publication*

In contrast, the value of water used as an energy source increased from $509 million to $591 million.

***Table 3: Monetary Value of "Surface water used as an energy source" ($m) – Total Economic Use****

| Region | 2015–16 | 2020–21 |
|---|---|---|
| **New South Wales** | 109 | 115 |
| **Victoria** | 49 | 52 |
| **Queensland** | 7 | 8 |
| **South Australia** | 0 | 0 |
| **Western Australia** | 20 | 14 |
| **Tasmania** | 324 | 402 |
| **Northern Territory** | 0 | 0 |
| **Australian Capital Territory** | 0 | 0 |
| **Australia** | **509** | **591** |

*experimental estimates, data not published

## 5. Challenges and Future Directions

The process of valuing water supply services within Australia's National Ecosystem Accounts has revealed several methodological and data-related challenges that warrant further attention. These challenges are not unique to Australia and may be instructive for other countries seeking to implement ecosystem accounting under the SEEA EA framework.

One of the primary limitations encountered was the lack of data distinguishing between potable and non-potable water. This constraint made it difficult to isolate water used exclusively for drinking purposes, which is a key component of provisioning services. In the absence of more granular data, household water supply was used as a proxy, acknowledging that this includes water used for a variety of domestic activities beyond consumption.

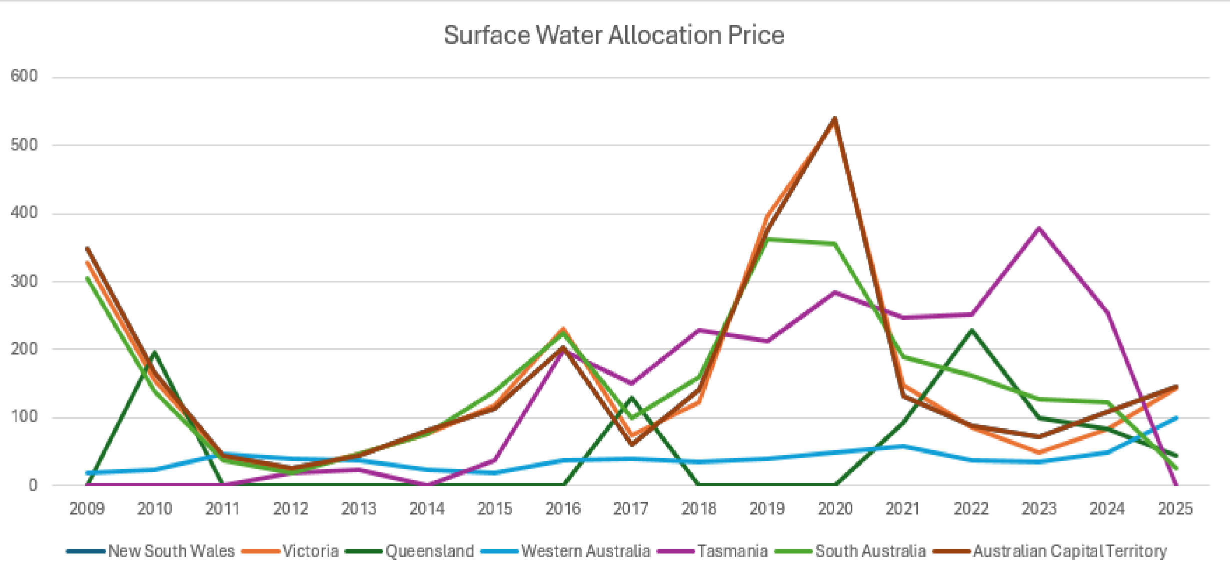
Another challenge relates to the spatial resolution of water abstraction data. Without detailed geographic information on where water is extracted and used, it is difficult to link water flows to specific ecosystem types or locations. This limits the ability to assess ecosystem condition and to attribute service flows to particular ecological assets. Future improvements in spatial data infrastructure and integration with geospatial models may help address this gap.

The use of market prices for water allocations, while practical and policy-relevant, also presents limitations. Water markets in Australia vary in maturity and coverage across states and territories. In regions with thin markets or limited trading activity, price signals may not accurately reflect the value of water as an ecosystem service. This method is generally more appropriate for water used as a material input—such as in agriculture or industry—than for water used for drinking, where water quality adjustments should be considered in future applications. Additionally, further work is needed to assess whether trading for environmental purposes (e.g. environmental water holdings) should be included or excluded from valuation, given its distinct policy and ecological objectives. In cases where market data is insufficient, proxies or imputed values must be used, which introduces uncertainty into the valuation process.

The residual value method, applied to estimate the value of water used in hydroelectric generation, is conceptually robust but operationally complex. It requires detailed financial data and careful alignment with national accounting principles. Assumptions about capital returns, asset utilisation, and input costs can significantly influence the results. While the method provides a useful estimate of the contribution of ecosystems to energy production, its sensitivity to underlying assumptions—and the challenges of applying it in regulated markets—mean that its viability remains subject to ongoing debate within the environmental accounting community. For these reasons, although the method was tested during the development of the National Ecosystem Accounts, the resulting estimates were not included in the final publication.

Looking ahead, several avenues for methodological enhancement are being considered. These include the potential use of replacement cost methods for drinking water, which would estimate the cost of substituting surface water with alternatives such as desalinated water. However, in the Australian context, desalination is generally not a feasible substitute due to its significantly higher cost compared to the actual cost of water supply under current conditions. Additionally, improvements in spatial data resolution and ecosystem mapping could enable more precise attribution of service flows to ecosystem assets. Continued collaboration with data providers, researchers, and stakeholders will be essential to refine these approaches and to ensure that future iterations of the accounts are both scientifically robust and policy-relevant.

***Figure 2: Volume-Weighted Average Price of Surface Water allocation prices by state/territory ($/ML)***




## 6. Implications for SEEA Revision

Australia's experience in compiling and valuing water supply services within its National Ecosystem Accounts offers several important lessons for the ongoing revision of the SEEA Central Framework. These lessons are particularly relevant to Issue D7, which concerns the treatment and valuation of water in environmental-economic accounting.

One of the key insights from the Australian approach is the practical utility of market-based pricing for estimating the value of water provisioning services. The use of tradable water allocations provides a transparent and policy-relevant method for assigning monetary values to water used for drinking and material purposes. These prices reflect actual transactions in regulated markets and are influenced by factors such as rainfall, storage levels, and agricultural demand. As such, they offer a credible basis for valuation that aligns with the exchange value concept endorsed by the SEEA EA.

The application of the residual value method to water used in hydroelectric generation also demonstrates the feasibility of valuing ecosystem services that do not have direct market prices. By estimating the contribution of water to the gross operating surplus of energy producers, this method captures the economic significance of non-consumptive uses and supports the integration of ecosystem services into national accounts. However, the method's sensitivity to assumptions and data quality highlights the need for clear guidance and standardisation in its application.

Australia's experience also underscores the importance of spatially resolved data in ecosystem accounting. The ability to link water abstraction and use to specific ecosystems and geographic locations is essential for assessing ecosystem condition, attributing service flows, and informing place-based policy interventions. Enhancing the spatial resolution of water data and integrating it with ecosystem extent and condition metrics should be a priority for future methodological development.

Finally, the challenges encountered in distinguishing between potable and non-potable water, and in valuing water used for drinking, point to the need for greater clarity in the SEEA Central Framework regarding the classification and treatment of water services. This includes guidance on the use of proxies, the treatment of regulated prices, and the role of replacement cost methods in the absence of market data.

In summary, Australia's work provides a valuable case study for the SEEA revision process. It demonstrates the practical application of existing valuation methods, identifies areas for improvement, and offers concrete recommendations for enhancing the consistency, transparency, and policy relevance of water valuation in environmental-economic accounting.

***Table 4: Summary of methods used per geographic region****

| Region | Summary of method applicability by region, based on data quality |
|---|---|
| AUS | 1. Estimates produced for 2020–21 and 2015–16 use state prices, weighted to the PSUT service flow of each state |
| NSW | 2. Estimates produced for 2020–21 and 2015–16<br>3. Relatively mature and robust water market has resulted in high quality prices |
| VIC | 4. Estimates produced for 2020–21 and 2015–16<br>5. Relatively mature and robust water market has resulted in high quality prices |
| QLD | 6. No estimates have been produced for 2015–16<br>7. Prices have not been consistently reported up to and including 2020–21. 2020-21 Prices have been benchmarked to 2021-21 levels and moved back to 2020-21 by similar NSW prices |
| SA | 8. Estimates produced for 2020–21 and 2015–16<br>9. Relatively mature and robust water market has resulted in high quality prices |
| WA | 10. Estimates produced for 2020–21 and 2015–16<br>11. Although the surface water market in WA is "thin", with fewer trades than eastern states, the prices which have eventuated reflect the scarcity of the resource and the current water market. |
| TAS | 12. Estimates produced for 2020–21 and 2015–16<br>13. Some data quality concerns a level shift in the raw data. This is under query with BOM, and current level shift adjustment has been applied to correct the time series. |
| ACT | 14. Estimates produced for 2020–21 and 2015–16. NSW prices have been applied to estimate ACT values.<br>15. There is no ACT data on water trading. However, given the proximity to NSW water resources, NSW prices are deemed an appropriate similar market. |
| NT | 16. No estimates have been produced for 2020–21 and 2015–16<br>17. The NT water department does not collect price information on allocation trades. No similar market has been identified. |

* Note that this represents markets data only (water used for drinking and used as a material)

## 7. Conclusion

The valuation of water supply services within Australia’s National Ecosystem Accounts provides a compelling example of how ecosystem accounting can be applied in practice to support environmental and economic decision-making. By integrating physical and monetary data, and by employing a combination of market-based and residual valuation methods, the accounts offer a nuanced understanding of the role that ecosystems play in delivering essential services to households, industries, and the energy sector.

The results demonstrate that water supply services are not only substantial in volume but also significant in economic value. The observed variations in value over time reflect the influence of climatic conditions, market dynamics, and regulatory frameworks, underscoring the importance of context-sensitive valuation approaches. Moreover, the challenges encountered—such as data limitations, methodological complexity, and spatial resolution—highlight the need for continued investment in data infrastructure and methodological refinement.

Australia’s experience contributes valuable insights to the international community, particularly in the context of the SEEA Central Framework revision. It illustrates the feasibility of integrating ecosystem service valuation into national statistical systems and offers practical recommendations for improving consistency, transparency, and relevance. As countries around the world seek to better understand and manage their natural capital, the lessons from Australia’s water accounts can inform the development of robust, policy-relevant ecosystem accounting frameworks.

In closing, the work presented in this paper affirms the importance of recognising ecosystems as active contributors to economic production and human well-being. It calls for sustained collaboration among statisticians, economists, ecologists, and policymakers to ensure that ecosystem services are appropriately measured, valued, and integrated into the systems that guide national and global decision-making.

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