Department of Planning and Environment

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BASIX Water Review – Stage 1

Prepared for the NSW Department of Planning and Environment by the University of Technology Sydney's Institute for Sustainable Futures

December 2023

Acknowledgement of Country

The Department of Planning and Environment acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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Executive summary

The NSW Building Sustainability Index (BASIX) is a state government policy promoting energy and water-efficient homes. BASIX water mainly affects new homes and major renovations, playing a crucial role in ensuring water security and drought resilience. This is why reviewing BASIX water to understand its effectiveness in delivering water efficiency outcomes is a key action under the NSW Water Strategy. The Department of Planning and Environment engaged the University of Technology Sydney's Institute for Sustainable Futures to review the effectiveness of BASIX water as part of the first review of BASIX water since 2006. This report outlines the findings of Stage 1 of the review, which involved targeted consultation with key stakeholders from water utilities and all three levels of government.

The review highlights strong support for the objectives of BASIX water and its mechanism to deliver equitable, effective water reductions across NSW. Stakeholders also strongly support the regulatory requirement for water efficiency in new and renovated homes across NSW. There is also evidence that BASIX water is not currently meeting its targeted water savings overall. It is missing significant cost-effective water efficiency opportunities as a result of the installation of less efficient fixtures and appliances in many BASIX homes. Questions also remain about the effectiveness of many rainwater systems installed under BASIX, including because of connection and maintenance issues.

Currently, BASIX water sets water use targets for each home based on average water use. However, for urban water planning and water security across NSW, drought restrictions do not limit indoor water use. In the context of climate change, it is now essential to consider alternative water sources that can provide a stable supply regardless of rainfall. It is also essential to look within our homes to maximise opportunities to sustainably reduce water use. Stakeholders support the retention and improvement of BASIX water to meet NSW's current and future goals for sustainable water management. In reconsidering BASIX water, the findings suggest there is a need to explore:

- embedding minimum water efficiency standards to address water scarcity directly
- expanding the scope of current water saving objectives including by potentially incorporating integrated water management (IWM) objectives and moving towards a broader role for IWM in precincts, catchments, and regions
- improving rainwater systems installed under BASIX, including initiatives to address maintenance over time

- assessing landscape water use, including the roles of deep and healthy soils in water use efficiency and irrigated landscapes in urban cooling
- improving compliance (checking the completed structure against BASIX certificates)
- designing better communications around BASIX and potentially improving the function of the BASIX tool with a shift towards promoting outcomes beyond target levels
- ensuring data collection is fit for purpose in monitoring, evaluation, reporting, and improvement.

This report provides eight recommendations for improving and expanding BASIX water. These recommendations will guide the next stages of the BASIX water review, aiming to develop a revised policy mechanism for sustainable water management in new and renovated homes across NSW.

Introduction

The Department of Planning and Environment (the department) engaged the Institute for Sustainable Futures (the institute) at the University of Technology Sydney (UTS) to conduct the "Stage 1 review" of "BASIX water" – the water component of the NSW Building Sustainability Index (BASIX).

Stage 1 of BASIX water review involved the collection, collation, and review of:

- about 255 relevant documents
- available data, in particular the database of BASIX certificates
- targeted government and utility stakeholder interviews.

The institute interviewed 52 stakeholders from across NSW Government agencies, as well as the Australian Government. Other stakeholders interviewed included several local councils, Sydney Water, Hunter Water, local water utilities, and other organisations such as select professional representative peak bodies. These results informed the recommendations in this report, and a proposed program of work for subsequent stages of the review, which will involve broader consultation with a range of stakeholders including building and industry stakeholders.

This report outlines the approach to the Stage 1 review and its findings, together with recommendations for strategies to shape the future of the BASIX water framework.

Context of the review

NSW introduced the BASIX scheme in July 2004. It was the first planning instrument of its kind in the world. It promoted more sustainable outcomes in new and renovated dwellings and focused on energy and water efficiency across the state.

BASIX water sets average water savings targets at an individual residential dwelling level. The targets vary based on locations across the state. They aim to achieve a reduction in water use ranging from zero reductions in some areas and up to 40% less water used per person per day in other areas, compared to a baseline set in the early 2000s.

We have not updated BASIX water since first introducing it almost 20 years ago. But we have reviewed the energy and thermal comfort requirements of BASIX several times. Although the water efficiency requirements for BASIX have not changed since 2004, the context in which BASIX water operates has changed significantly. Water use in homes, community sustainability expectations,

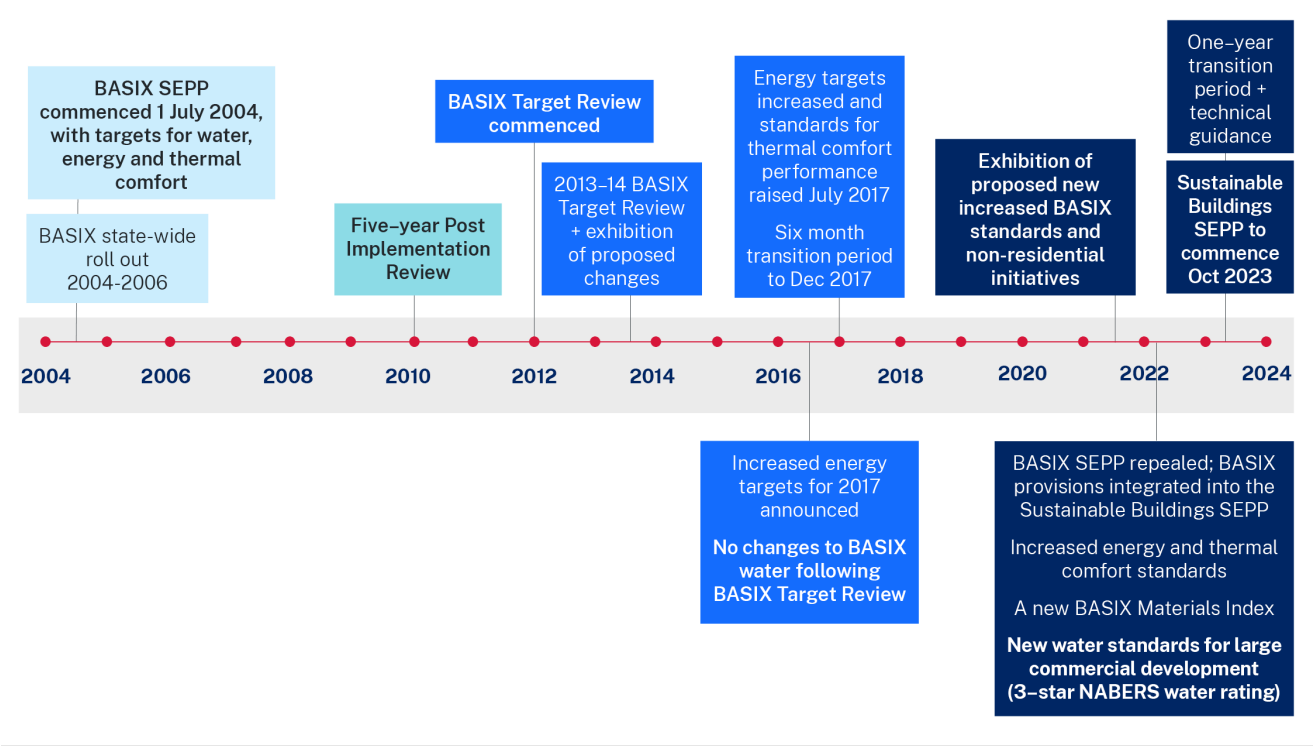
scientific understanding of climate change, and governments' goals for managing water resources in cities have all shifted. Residential development changes include the shift from low to medium and high density, and smaller lot sizes.

The NSW Auditor General's 2020 review of water conservation[1] recommended a review of BASIX water, including targets, program design and implementation. The NSW State Water Strategy (Action 6.6)[2] also committed to a review of BASIX that considers its effectiveness in driving and sustaining water efficiency. This report details the outcomes from Stage 1 of that review.

Key events in the development of BASIX

Figure 1 provides a high-level overview of key events since the introduction of BASIX, including subsequent reviews and changes.

Figure 1 High level BASIX timeline



Planning instruments

In addition to BASIX, there are various strategies and instruments for land and water planning, from the scale of individual homes up to the NSW state level.

For water planning, these include, but are not limited to:

- water strategies
- water security plans
- integrated water cycle management plans (IWCM)
- the plumbing code and water efficiency labelling and standards (WELS) scheme.

For land use planning these include, but are not limited to:

- the Environmental Planning & Assessment (EP&A) Act
- State Environmental Planning Policies (SEPPs)
- Local Environment Plans (LEPs)
- Development Control Plans (DCPs).

Study objectives and approach

The review collected evidence to assess BASIX water's effectiveness and appropriateness and consider opportunities and barriers to it supporting NSW achieve water and land planning goals.

The objectives were to:

- develop a solid understanding of the effectiveness and appropriateness of BASIX water across NSW
- consider any additional information required to inform a full policy review
- consider opportunities to improve BASIX water as a planning instrument
- develop a program of work for further stages of the review.

The approach to the Stage 1 review involved four key steps:

- reviewing literature
- interviewing stakeholders
- reviewing data
- developing a program of work for subsequent stages of the BASIX water review.

BASIX overview

What is BASIX?

The NSW Government introduced BASIX in 2004 as a key planning tool to encourage sustainable residential development. The main goals of the BASIX scheme were to deliver equitable, effective water and greenhouse gas reductions across NSW. There are three design requirements in the BASIX tool for residential development: energy, thermal comfort heating and cooling loads, and water.

BASIX covers all new residential development types, as well as alterations and additions worth more than $50,000. We applied BASIX in stages: single dwellings in Sydney from 1 July 2004; then all single dwellings and multi-unit dwellings in NSW in 2005; and incorporated renovations in 2006.

Photo courtesy of Vince Bucello/DPE

What are the BASIX water targets?

BASIX water's potable water use reduction target range from 0% to 40% from a pre-BASIX home benchmark of 247 litres per person per day. The targets vary by location depending on climate and rainfall. The 40% water target covers most new residential developments in the state, which are in coastal regions.

BASIX targets were developed using data from state and federal energy and water utilities, as well as long-term climate statistics from the Bureau of Meteorology. Variations in the targets applied to each zone reflect the practicality of achieving water savings in areas with lower rainfall and the current water use patterns of existing homes in those areas compared to the NSW water benchmark.

How does BASIX operate?

The *Environmental Planning and Assessment Act 1979* outlines the provisions for BASIX and the department manages it. BASIX was developed in consultation with industry groups, local government, and water utilities. The aims were to be flexible, adaptable, and responsive for each new home, and avoid setting prescriptive measures and actions that do not result in measurable savings.

Once design plans are complete, there are four steps.

1. Conduct a BASIX assessment via the online tool.
2. The tool assesses the data against a benchmark.
3. It generates a BASIX certificate if the data meets the required targets. NSW development applications and development approval processes require this certificate. It serves as a commitment to building as described.
4. The building approvals process checks compliance with BASIX.

How does the BASIX model work?

The model, or engine, accepts details of a proposed new dwelling and water saving measures. We split the key inputs the BASIX water tool requires into six categories: site details, landscapes, fixtures, alternative water, pool and spa, and central systems and common areas (for multi-unit dwellings only).

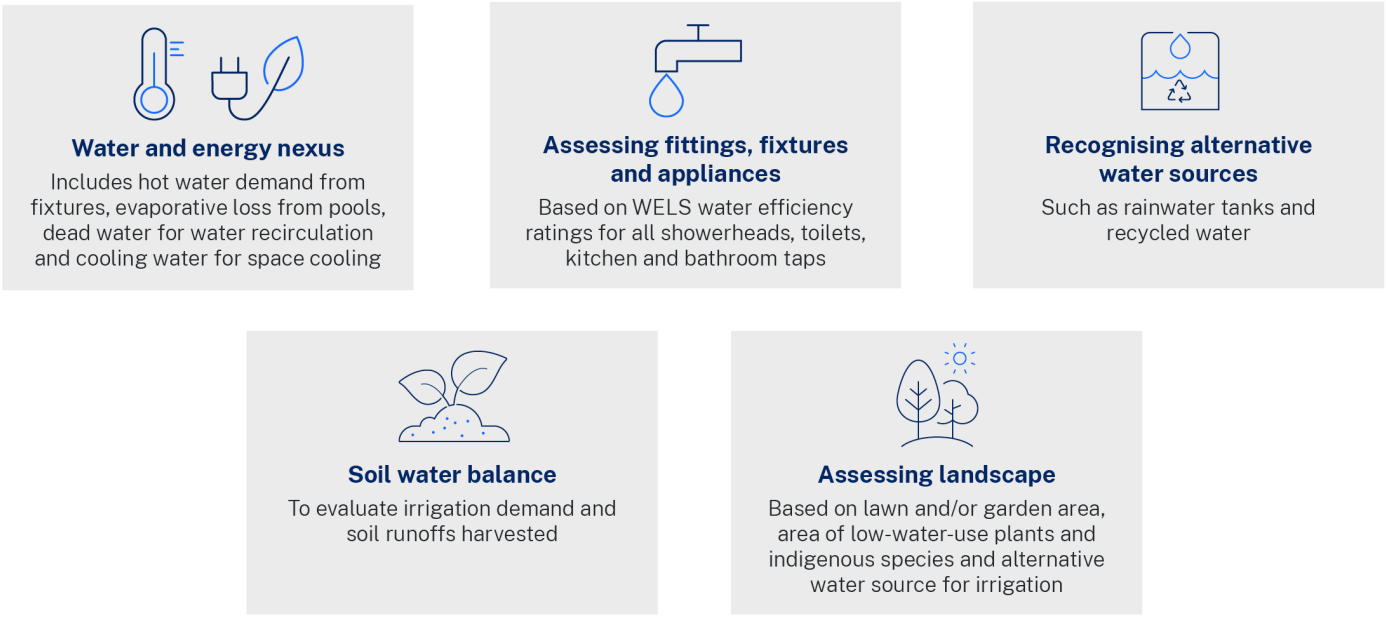
The tool then calculates expected potable water use. It compares this to the BASIX benchmark consumption to calculate the percentage saving, denoted as the BASIX water score. The savings target ranges from 0% in the west of NSW to 40% along the coast.

The model uses NSW pre-BASIX average residential consumption to establish the BASIX benchmark. To calculate the BASIX benchmark for a proposed new dwelling, the tool multiplies this number by the assumed number of occupants. The number of occupants is based on the dwelling type, number of bedrooms, and location. The tool uses Australian Bureau of Statistics census data to convert this into an average number of occupants.

How does BASIX assess water usage?

BASIX water assesses potable water consumption and savings based on user inputs.

Figure 1 BASIX features that assess water savings



This shows how BASIX assesses water usage. It includes plumbing fixtures, alternative water sources, landscape as well as impacts on energy and soils.

What are the approval and compliance processes?

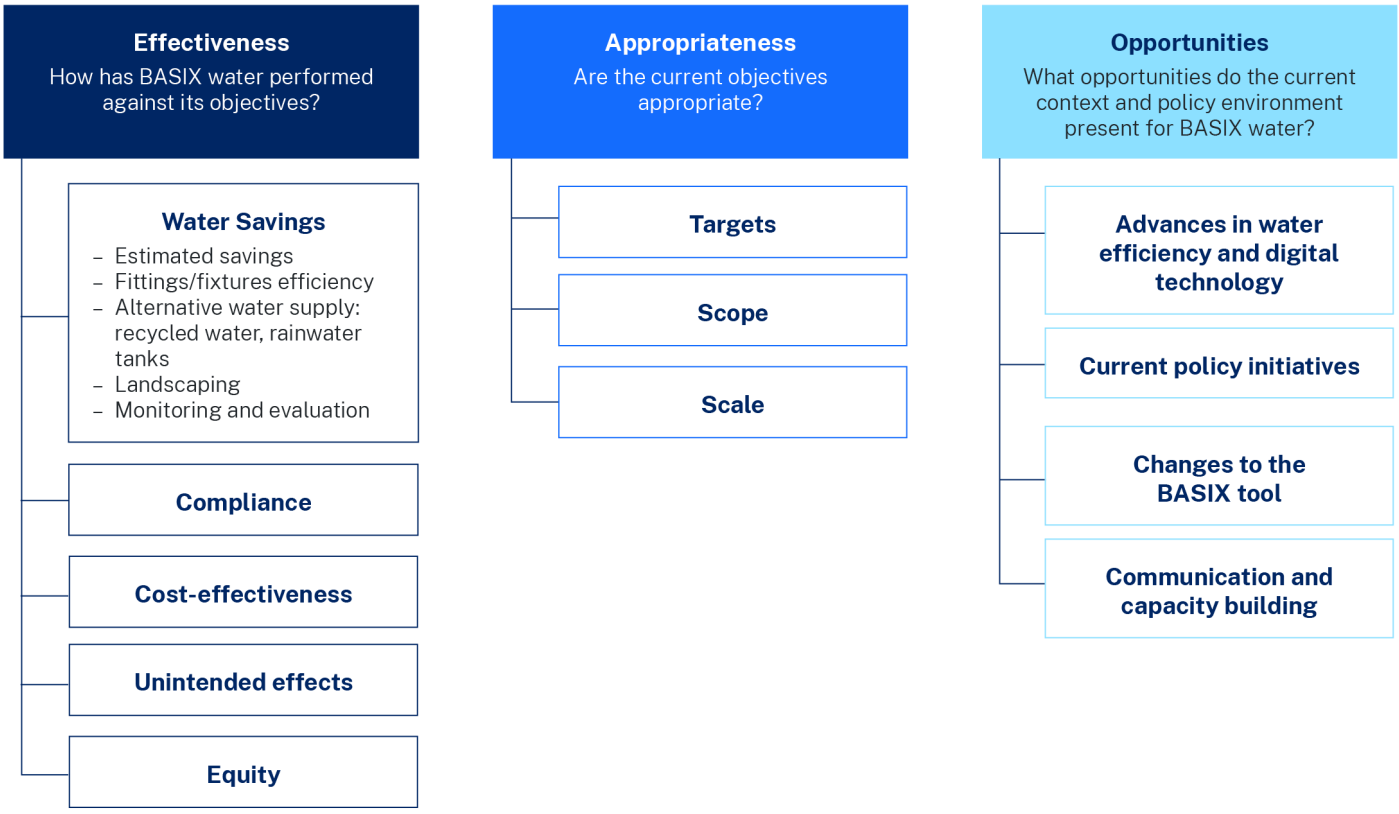
The building approvals process checks compliance with BASIX. A certificate documents all BASIX commitments, which is submitted as part of the development application for the dwelling (or where applicable, a complying development certificate application). The principal certifying authority (a building certifier or local government building inspector) must check and ensure BASIX

commitments before issuing the final occupation certificate. BASIX does not verify all water commitments, such as kitchen taps, bathroom basin taps, hot water recirculation systems, pools, and outdoor spas, and this leaves room for non-compliance.

Stakeholder perceptions and data substantiation

Stage 1 of the review involved interviewing stakeholders about the effectiveness, equity, strengths, weaknesses, and recommendations for BASIX water. It identified key issues and perceptions from stakeholders and the literature about the effectiveness and appropriateness of BASIX water. The review then considered whether available data or previous research supported these issues and highlighted areas where more research could help to close significant knowledge gaps, such as rates of compliance and property-matched water consumption data.

Figure 2 Analytical framework developed for the synthesis of findings



We discuss the identified key issues and opportunities below.

Total water savings

‘BASIX water has had an impact that can be seen in declining residential water use’

Effectiveness – Water Savings

Stakeholders agreed that since its inception, BASIX has played a role in decreased residential water use across most of NSW. At the same time, most stakeholders thought it was time to collect new data on the performance of BASIX homes across NSW (metro, regional, rural), different climatic zones, and different dates of BASIX implementation.

Evidence from the series of BASIX water savings monitoring reports showed that water use in BASIX homes was lower than in non-BASIX homes, but not close to meeting the reduction targets.[3,4]

Overall, there is a clear need for improved and updated monitoring and evaluation work to assess BASIX water’s performance.

Efficiency fixtures and appliances

‘BASIX is leading to water efficient fixtures in homes’

Effectiveness – Water savings: Fixtures

Many stakeholders believe BASIX has successfully made water-efficient items more common in homes and the market – for example, showerheads and dual-flush toilets. However, some noted that BASIX was initially designed to help save an average amount of water each year. They think there is an opportunity to also address water shortages during situations such as droughts or when water demand is high. Several stakeholders thought water-efficient fittings and fixtures are as good as they can be and the 40% target was difficult to meet.

BASIX certificate data shows BASIX is promoting water efficiency levels beyond the general market for showerheads and taps, but not for toilets. Still, it is missing significant cost-effective water-efficiency opportunities for all types of plumbing fixtures.

‘BASIX isn’t handling washing machines well’

Effectiveness – Water savings: Appliances

There are views that rental and low-income housing, which does not supply a washing machine and dishwasher, must install more expensive water-efficiency options to meet BASIX water requirements.

In addition, BASIX only accounts for water-efficient washing machines and dishwashers for multi-unit developments, and not for single dwellings and townhouses. Even in multi-unit dwellings, BASIX does not appear to encourage efficient washing machines.

The BASIX benchmark says washing machines use 20% of water in homes. BASIX could do more to encourage water savings with high-water-efficiency washing machines and embedding indoor water efficiencies for uses that are unrestricted in drought.

Landscaping

‘Current approach to landscaping is not driving water savings’

Effectiveness – Water savings: landscaping

Stakeholders said the current form of the landscaping measure is not effective and homeowners and developers do not see it as a significant contribution to achieving the BASIX water objective.

There is little evidence that current landscaping offers effective water savings.

Stakeholders also indicated that soil quality and depth are key issues to consider in assessing water efficiency landscapes. They also suggested that the objective of creating greener and cooler spaces in the context of climate change requires further consideration of BASIX’s treatment of water for landscaping.

Photo courtesy of Department of Planning and Environment

Connections to alternative sources

‘Is only a single tap being connected?’

Effectiveness – Water savings: alternative sources

Most stakeholders who addressed this issue emphasised their concern that BASIX can consider recycled water or rainwater systems as compliant when only one end use is connected to the source. The data from BASIX certificates indicates most households opt for multiple connections to their alternative sources. But there may be a discrepancy between a certificate’s inclusions and the completed structure. This is clear when looking at the last “on-ground truthing” study.[5]

Photo courtesy of Department of Planning and Environment

‘BASIX is not driving recycled water’

Effectiveness – Water savings: Recycled Water

Many stakeholders were concerned about the planning and investment uncertainty for recycled water. They saw little incentive for public and private water utilities to develop or expand recycled water schemes. This was due to several reasons, including:

- minimal connections required per property (for example, garden tap or toilet)
- no planning requirements or incentives to encourage the installation of recycled water infrastructure or the allocated space when building new communities and houses (for example, distribution networks and pipes when using recycled water within a property)
- reluctance to install dual plumbing in multi-unit residential new builds because of uncertainty around recycled water demand.

There appear to be barriers or limitations to BASIX supporting recycled water. Data from BASIX certificates shows only a very low proportion of BASIX homes connected to recycled water schemes.

The context for this is a small number of recycled water schemes existing and being initiated across the state. However, the presence of BASIX water has not acted to overcome the range of barriers that exist for recycled water schemes.

Rainwater tanks

'Many rainwater tanks are not working'

Effectiveness – Water savings: Rainwater tanks

Rainwater systems and their operation was one of the most discussed topics among stakeholders. Their concerns included system design, installation, and maintenance.

The available evidence from certificate data shows BASIX water has contributed to a high prevalence of rainwater tanks and rainwater use in NSW homes – 90% in new single dwellings in 2019 and 15% in multi-unit dwellings.

There is an overall lack of quantitative data and research on rainwater tanks and a need to understand how to maximise rainwater usage.[6] Some recent work has taken initial steps towards understanding the issues. Hunter Water inspections found 41% of systems were faulty.[7] Sydney Water's free pilot assessment also found 24% of systems needed a maintenance service and 15% a repair service.[8] A user survey also found 50% felt they didn't know enough to be able to tell if their rainwater tank was not working properly.[9]

'BASIX rainwater tanks are not cost-effective'

Effectiveness – Cost-effectiveness

Many stakeholders thought rainwater systems were rarely the most cost-effective approach for a homeowner.

Investigations into the cost-effectiveness of rainwater tanks show mixed conclusions. Some studies show cost-effective water savings, while others show a high cost to rainwater use.

One study found rainwater tanks were not cost-effective, with a benefit-cost ratio of 0:32.[10] It found large tanks with outdoor and all indoor connections more cost-effective than small tanks with outdoor-only connections. It also found BASIX compliance was a key driver of rainwater tank uptake in NSW.[11] A more recent study found rainwater tanks were cost-effective.[12] There is therefore scope to include questions of how to improve cost-effectiveness in any further review of NSW rainwater tanks.

Compliance

‘BASIX commitments are not being adhered to’

Effectiveness – Compliance

Most stakeholders said the current compliance model – a single point of certification that private certifiers complete after construction – was a significant weakness.

The available evidence shows that non-compliance is an issue of concern, resulting in lost water savings.

The “on-ground truthing” study showed only 27% of 465 homes were compliant with the commitments on their BASIX certificate. Most homes were under-compliant in at least one commitment.[13] Compliance ranged from 98.7% (for the presence of a rainwater tank) down to 61.9% (for shower efficiency). Compliance for rainwater tanks dropped to 43% when checking the volume and number of connections. The “truthing” showed 31.7% of dwellings had a rainwater tank larger than reported. Only 44.2% of owners reported installed pools in BASIX. Only 27.4% of properties complied with all BASIX commitments for toilets, showers, and rainwater tanks.

Equity

‘BASIX is an unfair burden on regional areas’

Appropriateness – Equity

Some stakeholders expressed concern that BASIX water’s approach was creating barriers and unfair burdens on some groups, particularly in regional areas. However, BASIX certificate data does not support this view. On the contrary, regional areas generally exceed targets compared to metropolitan areas, potentially indicating targets may not be set at the right level in the regions.

Targets

‘BASIX does not maximise viable water efficiency in homes’

Appropriateness – Targets

Stakeholders generally believed that people aim for the 40% pass score and do not go over it.

The available evidence from certificate data shows BASIX is not promoting water efficiency beyond the 40% target.

In 2018, 43% of BASIX single dwellings had exactly the 40% mark (that is 0% target exceedance). In metro areas, average exceedances have steadily decreased (from 4% in 2011 to 2.4% in 2015, holding steady at 2.4% in 2019).

In regional areas, exceedances have increased (from 5.2% in 2015 to more than 7.5% in 2019). The data indicates that in metro areas, BASIX target compliance largely drives the adoption of water-efficiency measures, while other factors may be in play for regional areas. This may include necessity for large rainwater tanks as a main source of drinking water, particularly on lots without mains supply, as well as a higher driver to be more self-reliant in times of drought.

For a large share of new single dwellings, installations continue with the least efficient fixtures allowed under BASIX (40% of showerheads, 22% of toilets, and 40% of kitchen taps). However, owners would choose more water-efficient fixtures at very minor price increases.

Opportunities may exist to consider the role of tool redesign, incentives to encourage users to go beyond targets (for example, using nudges and a behavioural economics approach), and/or sustainable finance (for example, to make high-water-efficiency appliances more affordable).

‘Targets are outdated and too low’

Appropriateness – Target, scope, and scale

Many stakeholders were hopeful that BASIX water might expand its scope and scale. Some stakeholders would like to see the water reduction targets lifted from their current levels, and improved geographic targeting with a regional focus.

There is strong evidence supporting the cost-effectiveness of increased stringency for BASIX water in one form or another.

Studies show that installing more efficient fixtures and larger rainwater tanks will easily meet an additional 5% to 10% water target.[14] [15] [16] Such upgrades incur an extremely minor increase of 0.05% to project costs.[17] The pathway to achieving 10% increased stringency has also been demonstrated in detail for both single-dwellings[18] and multi-unit dwellings.[19]

More research in this area could model the impacts of a variety of policy options and higher targets.

Summary of key findings

Stakeholders strongly support the retention and improvement of BASIX water to meet NSW's current and future goals for sustainable water management. There is also support for exploring opportunities to expand the scope of BASIX water. There is a need for further studies that build on the key findings below.

Figure 3 Summary of key findings

Outcomes of Stage 1 BASIX water review

Stage 1 Review - key recommendations

The recommendations below indicate areas for further exploration in future stages of the BASIX water review:

1. Retain BASIX water, improve its functionality, and consider expanding its scope in the next stage of the review.
2. Consider embedding minimum water efficiency standards to expand the scope of the BASIX water saving objective and address water scarcity directly.
3. Explore expanding the scope of BASIX to address IWM objectives linked to catchment and precinct planning.
4. Investigate opportunities for improving compliance under BASIX water.
5. Implement improvements to data collection and the BASIX water tool.
6. Develop a communications and engagement plan to educate, build capacity, and improve engagement with BASIX water.
7. Undertake wide stakeholder engagement, including with industry stakeholders, as part of any expansion of the scope of BASIX water.
8. Develop a MERI (monitoring, evaluation, reporting, and improvement) plan for BASIX water that links to the new Sustainable Buildings SEPP.

Next steps

Taking this review forward involves two work streams to improve and expand BASIX water. The department will develop an action plan by June 2024 to address the key recommendations under each work stream.

[1] Audit Office of NSW (2020), Water Conservation in Greater Sydney – NSW Auditor-General's Report. 23 June 2020. Available at: https://www.audit.nsw.gov.au/our-work/reports/water-conservation-in-greater-sydney
[2] DPIE (2021) NSW Water Strategy. August 2021. Available at: https://www.dpie.nsw.gov.au/water/plans-and-programs/nsw-water-strategy.
[3] SWC (2016a), BASIX Multi-Unit Water Savings Monitoring Report 2014-15.
[4] SWC (2016b), BASIX Single Dwelling Water Savings Monitoring Report for 2014-15.
[5] Schlunke, A. (2011), BASIX Water Savings Monitoring and Compliance Program: On-ground Truthing Survey Results.
[6] ISF (2013), Lower Hunter Water Plan Options Investigation - Rainwater Tanks. Final Report prepared for: HWC 2013.
[7] Hunter Water (HWC) (2017), Rainwater tank inspections.
[8] SWC (2019), Rainwater System Assessment.
[9] HWC (2019), Survey Report: Tell us about your rainwater tank.
[10] BMT (2013), A Financial Analysis of the Domestic Use of Rainwater Tanks in NSW.
[11] BMT (2013), A Financial Analysis of the Domestic Use of Rainwater Tanks in NSW.
[12] Frontier Economics (2021), Cost Benefit Analysis of options for onsite rainwater harvesting.
[13] Schlunke, A. (2011), BASIX Water Savings Monitoring and Compliance Program: On-ground Truthing Survey Results.
[14] Urban Water Cycle Solutions and Kingspan Water & Energy (2020), Alternative Water Strategy for Sydney.
[15] AECOM (2013), BASIX - Water Index - Increased Stringency of BASIX Water Index for Residential Flat Buildings. Report prepared for: Department of Planning and Infrastructure NSW. July 2013.
[16] Allen Consulting Group (2013), Benefit-cost Analysis of Proposed BASIX Stringency Changes - Report to NSW Department of Planning and Infrastructure.
[17] AECOM (2013), BASIX - Water Index - Increased Stringency of BASIX Water Index for Residential Flat Buildings. Report prepared for: Department of Planning and Infrastructure NSW. July 2013.
[18] MBM (2012a), Cost Estimate of the Effects from an Increased BASIX Stringency on Class 1 and Class 2 Developments - Part 1 Single Detached Dwellings.
[19] MBM (2012b), Cost Estimate of the Effects from an Increased BASIX Stringency on Class 1 and Class 2 Developments - Part 2 Attached and Low-rise Multi-unit dwellings.