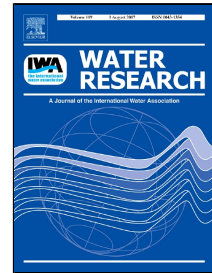


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Urban water metabolism indicators derived from a water mass balance – bridging the gap between visions and performance assessment of urban water resource management



M.A. Renouf, S. Serrao-Neumann, S.J. Kenway, E.A. Morgan, D. Low Choy

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4 **Renouf, M.A.^{a,c}, Serrao-Neumann, S.,^{b,c} Kenway, S.J.^{a,c}, Morgan, E.A.^{b,c}, Low Choy, D.^{b,c}**

5 ^a School of Chemical Engineering, University of Queensland, St Lucia, Brisbane, Queensland 4072, Australia

6 ^b Cities Research Centre, Griffith University, Nathan, Queensland 4111, Australia

7 ^c Cooperative Research Centre for Water Sensitive Cities, Monash University, Victoria, 3800, Australia.

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9 Corresponding author. Email: m.renouf@uq.edu.au

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11 **Abstract:** Improving resource management in urban areas has been enshrined in visions for
12 achieving sustainable urban areas, but to date it has been difficult to quantify performance
13 indicators to help identify more sustainable outcomes, especially for water resources. In this
14 work, we advance quantitative indicators for what refer to as the ‘metabolic’ features of
15 urban water management: those related to resource efficiency (for water and also water-
16 related energy and nutrients), supply internalisation, urban hydrological performance,
17 sustainable extraction, and recognition of the diverse functions of water. We derived
18 indicators in consultation with stakeholders to bridge this gap between visions and
19 performance indicators. This was done by first reviewing and categorising water-related
20 resource management objectives for city-regions, and then deriving indicators that can gauge
21 performance against them. The ability for these indicators to be quantified using data from an
22 urban water mass balance was also examined. Indicators of water efficiency and hydrological
23 performance (relative to a reference case) can be generated using existing urban water mass
24 balance methods. In the future, complementary indicators for water-related energy and
25 nutrient efficiencies could be generated by overlaying the urban water balance with energy
26 and nutrient data. Indicators of sustainable extraction will require methods for defining
27 sustainable extraction rates.

28 **Keywords:** resource efficiency, water efficiency, water-related energy, nutrients, urban
29 hydrology, sustainability

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