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State of Circularity in Western Australia

A Summary Report

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Department of Transport

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Western Australian Planning Commission

Australian Government
Department of Industry, Science, Energy and Resources

AusIndustry
Cooperative Research Centres Program

This report summarises the first comprehensive assessment of circularity in Western Australia, providing insights into resource inflows, built stocks, and waste outflows—the socioeconomic metabolism—at the State, Greater Perth and municipal level. It captures the state of circularity, evaluates the policy landscape, and highlights key opportunities towards greater circularity—equipping businesses, governments and communities with critical insights to support evidence-based decision-making and advance effective circular practices. Through a multi-sector initiative, this research helps position WA as a leader in integrating circular economy, innovation and net zero efforts—ultimately contributing to a more resilient and sustainable future for all Western Australians.

State of Circularity in Western Australia: A Summary Report

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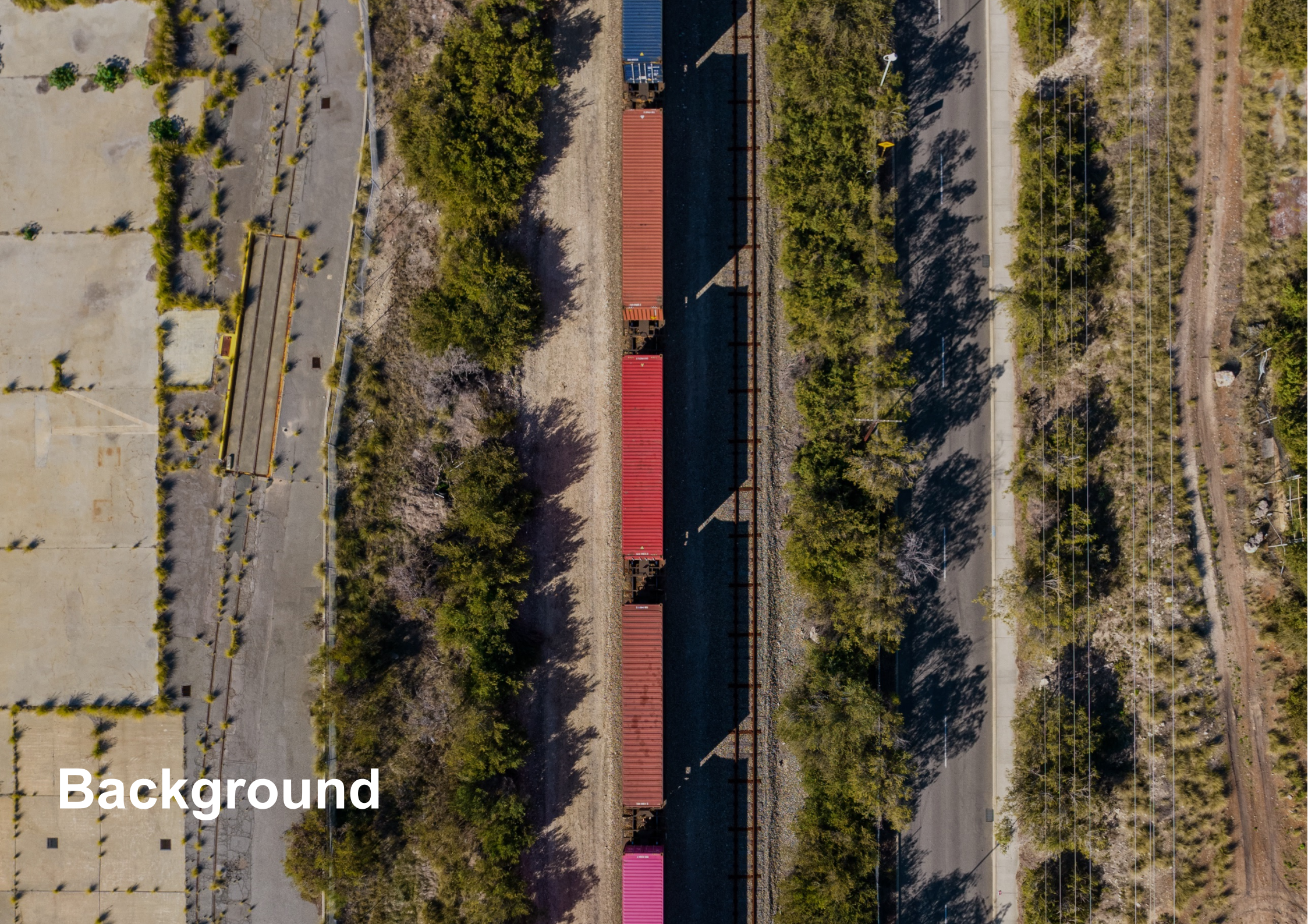

Background

Why do we need a circular economy?

Natural resource consumption and waste production are critical challenges in today's economy. In the past 50 years, material use has more than tripled and continues to rise[1]. In an interconnected world, where over 75% of natural resources are consumed in urban areas, which generate over 70% of global waste production[2], transforming linear value chains across multiple levels—national, regional and local—is essential[3]. With half of global greenhouse gas (GHG) emissions resulting from resource extraction and processing, and half from manufacturing and use[4], system-wide approaches are necessary.

The concept of a circular economy has emerged as a response to overcome these challenges. A circular economy is an economic system that addresses fundamental limitations of current economic models. While current economic models assume a linear flow of resources, based on a 'take-make-waste' logic[5], a circular economy takes a systemic approach, emphasising the cyclical and physical basis of our societies. It is widely recognised as an effective model for mitigating waste production, maximising the utility of materials and products, and reducing the dependence on virgin materials—while delivering economic, environmental and social benefits[6].

Enhancing circularity is expected to ease environmental pressures by promoting more sustainable production and consumption patterns and foster economic resilience by creating new opportunities for innovation, job creation, and resource efficiency. Effective circular economies also generate social benefits by encouraging equitable access to resources and promoting cross-sector collaboration to achieve more resilient, prosperous and inclusive societies.

Circular strategies can be implemented at multiple system levels (e.g., national, state, city, industry, product) and value chain stages (e.g., design, sourcing, manufacturing, end-of-life). These strategies include enhanced resource efficiency (narrowing flows), product re-design (slowing flows), closing supply chains and residual waste management (cycling flows), and restoring biophysical processes (regenerating flows)[7]. Practical circular measures include the 3Rs (Reducing, Reusing, Recycling)[8], recently expanded up to 10Rs[9].

Embracing these challenges and opportunities, leading businesses, governments and communities world-wide are adopting innovative circular strategies to accelerate the transition to a more circular world.

Global developments

Several national and regional roadmaps worldwide have committed to decoupling growth from material consumption and transitioning to sustainable, low-carbon societies. The connection between material use, waste generation and GHG emissions is increasingly recognised in the context of the Paris Agreement, as 27% of Nationally Determined Contributions (NDCs) refer to circular economy as part of their mitigation strategies[10]. Estimates suggest that circular strategies can reduce up to 20% of global GHG emissions (44% including energy efficiencies)[11] while reducing virgin material demand by 28%[12], underscoring the pivotal role of the circular economy in achieving net zero emission targets.

Nevertheless, recent figures show that global circularity is decreasing. The 2024 circularity gap report[12] revealed that global circularity declined from 9.1% in 2018 to 7.2% in 2023, and material consumption reached an all-time high. In simple words, 92.8% of the materials used in the global economy on an annual basis are virgin materials.

Adoption in Australia

As one of the countries with the highest consumption rates, Australia endeavours to incorporate circular economy approaches while sustaining economic growth and productivity. It ranks among the top ten countries globally for natural resource extraction[13]. Except for Canada and Chile, Australia consumes more materials per capita than any other OECD or Asian-Pacific country. It also has lower material productivity and supply chain autonomy than most OECD and regional countries. The results of a material flow analysis of the Australian economy as of 2019 showed a circularity rate of 3.7%, nearly half of the global average[14], and far below the Netherlands (24.5%)[15]. These metrics illustrate the country's challenge to move towards a resource-efficient economy.

Nationally, there is growing enthusiasm to transition towards a circular economy in response to internal and external factors such as the national waste crisis[16, 17], international trade pressures[18], and climate change and biodiversity impacts[19]. Unlocking Australia's circularity potential can significantly contribute to achieving decarbonisation targets[20]. Likewise, a circular economy could unlock substantial economic benefits while addressing environmental impacts on a sectoral basis[21]. Critical sectors such as mining, construction, manufacturing, agriculture, and waste management are well-positioned to leverage the country's abundant natural resources towards enhanced circularity[22]. Recognising this potential, all of Australia's

Environment Ministers have committed to partnering with industry stakeholders to design out waste and pollution, keep materials in use, and foster markets to achieve a circular economy by 2030[23].

In 2023, the Circular Economy Ministerial Advisory Group was formed to advise the Australian Government on transitioning to a circular economy[24]. Based on this advice, DCCEEW recently announced the new 'National Circular Economy Framework'[25] as the roadmap for Australia's circular economy transition. Three critical supporting targets were set for material footprints, material productivity and resource recovery. This policy framework articulates a consistent vision and actionable pathways for a national circular economy by aligning regulations and, more importantly, enabling integration and coordination across Australian cities and regions.

Mapping the circular economy of Western Australia

Transitioning WA from a linear "take-make-waste" model to a circular economy is essential for achieving emission targets, reducing environmental impact, and generating economic value while maintaining people's quality of life.

Although there is significant promise of resource efficiency gains, economic diversification, job growth and innovation, the implementation of a circular economy at multiple scales is inherently complex[26], highlighting the need for an evidence-based, system-wide approach that goes beyond current waste management strategies.

Western Australia (WA) is committed to becoming a sustainable, low-waste circular economy[27]. However, WA does not currently report progress towards a circular economy at the State and city level, which is essential to informing data-driven decision-making and practical circular solutions. The absence of a consistent circular economy monitoring framework prevents industry and government leaders from taking clear action. This represents a substantial gap that urgently needs to be addressed since, in the absence of a consistent approach, economy-wide efforts towards practical circular applications cannot be measured accurately or effectively progressed.

Although waste and end-of-life indicators (e.g., waste generation, landfill diversion rates, recycling rates) are helpful, they do not capture a systemic circular economy approach that encompasses elements of sustainable development (economic, social, environmental), multiple levels (cities, regions, nations), multiple actors (institutional sectors, industrial sectors, organisations), and different strategies (e.g., reduce, reuse, recycle, recover, remanufacture).

To address these gaps, this project proposes a system-wide perspective (Figure 1) that goes beyond waste management by applying integrated assessment methods to provide a comprehensive understanding of material flows and environmental impacts—from extraction and production stages, to final use and end-of-life. Supported by a consistent performance indicator framework within a digital circular monitor, this science-based observatory is expected to drive effective circular outcomes across the State.

This report presents a summary of the first comprehensive assessment of the state of circularity in WA (see Main Report[29] for further details), providing insights into resource inflows, built stocks, and waste outflows—the socioeconomic metabolism—at the State, Greater Perth and municipal level. It evaluates WA's capacity for circularity, the policy landscape and highlights key opportunities towards greater circularity, equipping businesses, governments and communities with insights to support evidence-based decision-making and positioning WA as a global leader in integrating circular economy and net zero approaches.

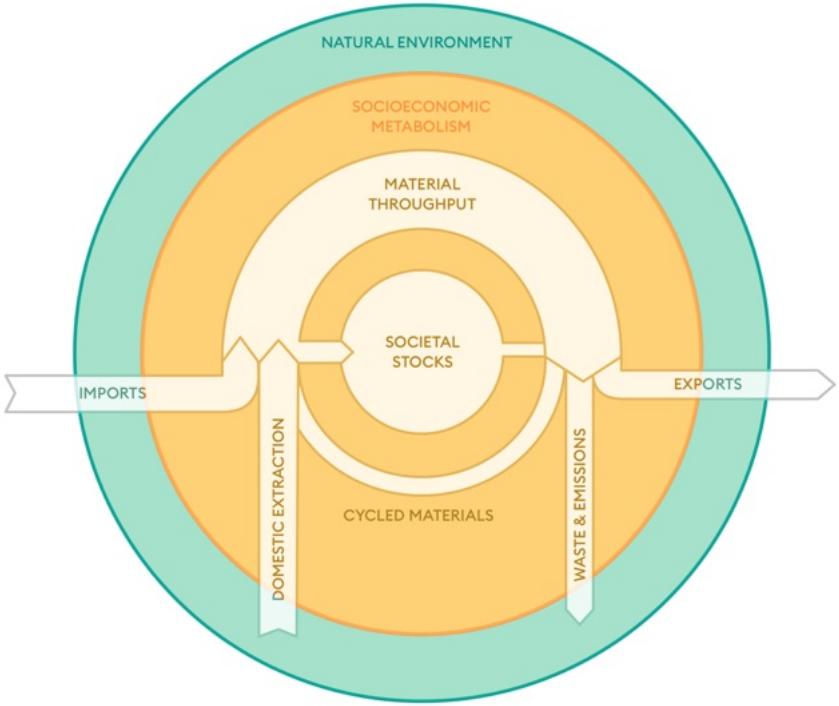

Figure 1. Scope of system-wide material flow accounting. Reproduced with permission from Open Corridor (2024)[28]

State of circularity

Western Australia

Material flows

Western Australia plays a pivotal role in both domestic and global material flows. With its resource-rich economy, the State's footprints are heavily influenced by primary industry, while final consumption drives significant impacts embodied in external value chains. The interplay between domestic extraction, consumption demands, and trade reveals a unique economic structure that presents both challenges and opportunities for circularity.

The Sankey diagram below (Figure 2) presents a disaggregated view of WA's material footprint for 2020-21, showing material inputs from domestic extraction and imports, through to initial processing, final products, and final destination—whether it be Greater Perth, Rest of WA, or exports.

Domestic extraction totals 1,068 Mt, reflecting the State's reliance on natural resource extraction to support its export-orientated economy. When factoring in raw material imports (193.7 Mt), this translates to a material intensity[i] of 3.1 Mt per billion AUD of Gross State Product (GSP). These leading indicators demonstrate the State's ability to generate economic value from material inputs but also point to areas where circularity improvements can help decouple economic growth from non-critical resource use.

Material productivity[ii], which measures the efficiency of material consumption relative to the GSP, stands at 3.2 billion AUD per Mt. WA's total raw material consumption amounts to 114.1 Mt (42 tonnes per capita), twice the OECD average (21.6 t/capita) and more than three times the global average (12.7 t/capita). About 80% (90.7 Mt) of total demand occurs in Greater Perth. This level of resource use highlights the material demands of the State's economy and emphasises the need for more circular practices in industrial and end-use sectors.

Western Australia is the top exporter among all Australian states, contributing 56% of the total value of Australia's goods exports[30]. One of the most significant contributors is the extraction and export of iron ore. While WA plays a vital role in sustaining global iron ore production, its ability to enhance circularity remains limited without investment in green steel production and remanufacturing. Other major exports include liquid natural gas (LNG), raising concerns about impacts external to WA. The dominance of primary industries in WA has positioned it among the world's simplest economies from an economic complexity perspective[31], highlighting challenges and opportunities regarding the State's long-term resilience within the global context.

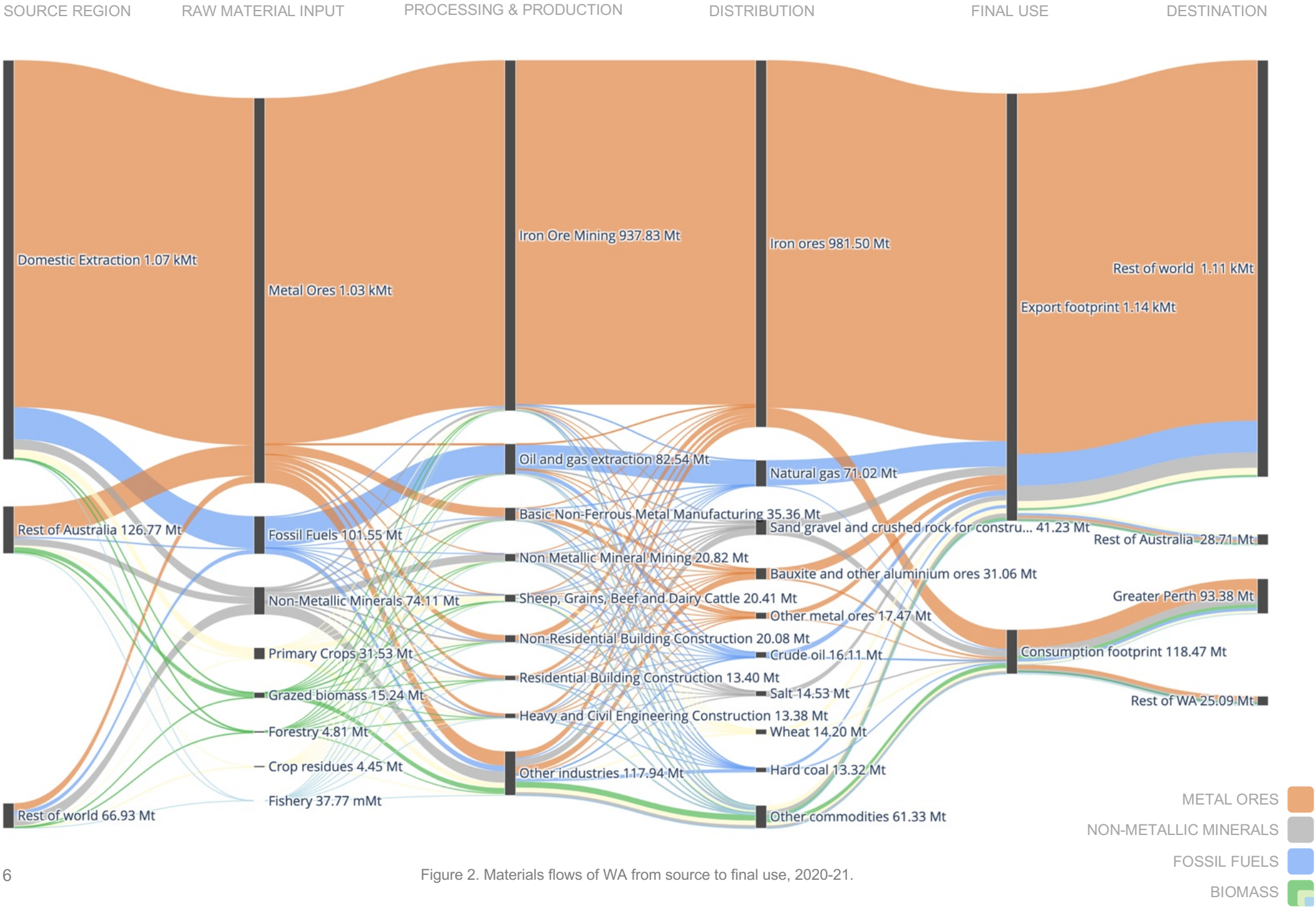

Figure 2. Materials flows of WA from source to final use, 2020-21.

Waste outflows

The Sankey diagram below (Figure 3) illustrates solid waste outflows in WA for 2020-21. A novel aspect of this analysis is the connection between the raw materials, the waste-producing region and sector, waste composition, and the final waste treatment[iii].

Total solid waste generation amounts to 6.6 Mt (2.5 tonnes per capita), with a significantly larger waste throughput from Greater Perth (5.2 Mt) compared to the rest of WA (1.4 Mt). Overall, WA's end-of-life recovery rate reached 62%[iv]. While this figure stands at an all-time high, there is still room for improvement from a circularity perspective.

The largest outflow is related to non-metallic minerals (3.5 Mt). A significant proportion of this is generated by construction-related industries and is eventually processed as recycled construction and demolition (C&D) waste. Nonetheless, much of the recovered C&D waste is likely recirculated within lower-quality applications (downcycling), which limits its effectiveness in displacing virgin materials in production processes[32], suggesting that circular strategies should be focused upstream in the construction lifecycle.

Waste generated by households and various industries in Greater Perth is largely composed of biomass (1.9 Mt). A significant portion of this biomass ends up in landfill, especially in the form of garden waste, food scraps, and paper and cardboard, suggesting a need for advancing organic waste recycling initiatives.

Fossil fuel-related waste (0.6 Mt), mainly from the industrial and household sectors in Greater Perth, are sent to landfill in the form of plastics or mixed waste, highlighting the difficulties in the plastic recycling value chain. These findings are consistent with the urgency raised by the National Plastics Plan.

Finally, metal-containing waste outflows are consistent with global and national trends, which point to high rates of material recovery with minimal quality losses. Specifically, 0.5 Mt of iron and steel, mostly generated by 'other industries', are recycled.

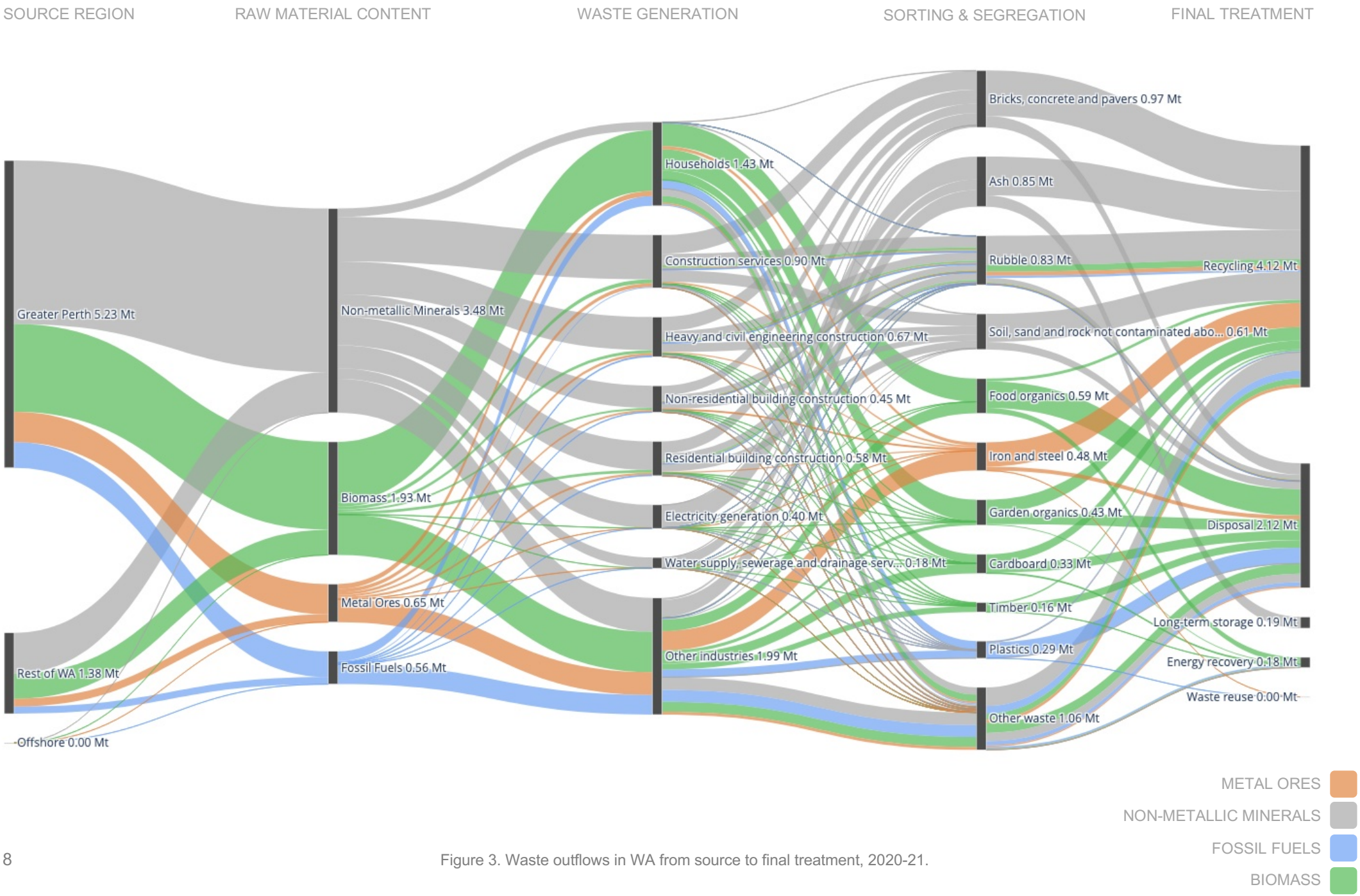

Figure 3. Waste outflows in WA from source to final treatment, 2020-21.

GHG emissions flows

From a circular economy perspective, analysing emissions flows can inform targeted strategies to reduce emissions through resource circularity, improved efficiency, and rethinking production and consumption patterns.

The Sankey diagram below (Figure 4) provides a clear breakdown of emission flows across various emission scopes and highlights state, interstate and international components of WA's emission footprint for 2020-21.

Emissions flows are categorised into three main sources: 1) direct emissions from sources within WA (76.9 Mt[v]), 2) indirect emissions from goods and services produced in other states but consumed in WA (Rest of Australia, 44.5 Mt), and 3) indirect emissions embodied in international imports (Rest of World, 51.7 Mt). Total emissions related to final consumption in WA amounts to 63.5 Mt, with 79% (50 Mt) driven by demand in Greater Perth.

Several key observations can be made. Firstly, the composition of WA's consumption footprint indicates that a significant portion of its environmental impact is embedded in upstream value chains, highlighting where shifts in demand may be an effective mitigation strategy.

Secondly, WA's export footprint (109.7 Mt) is substantially higher than its consumption footprint (63.5 Mt), indicating that WA is a net exporter[vi] of emissions. This is common in regions with resource-intensive industries, which are typically emission-intensive. Addressing these emissions requires transitioning towards cleaner production practices, alongside efforts to enhance the circularity of materials exported from the region.

The composition of emission sources—whether direct or indirect—is critical, as it shapes industries' decarbonisation strategies and their capacity to adopt circular approaches. On a sectoral basis, mining emerges as the largest contributor to emissions, followed by utilities. Within individual industries, non-ferrous metal manufacturing, oil and gas extraction, and iron ore mining account for most emissions. For emissions linked to final demand in WA, the construction, service, and retail industries dominate.

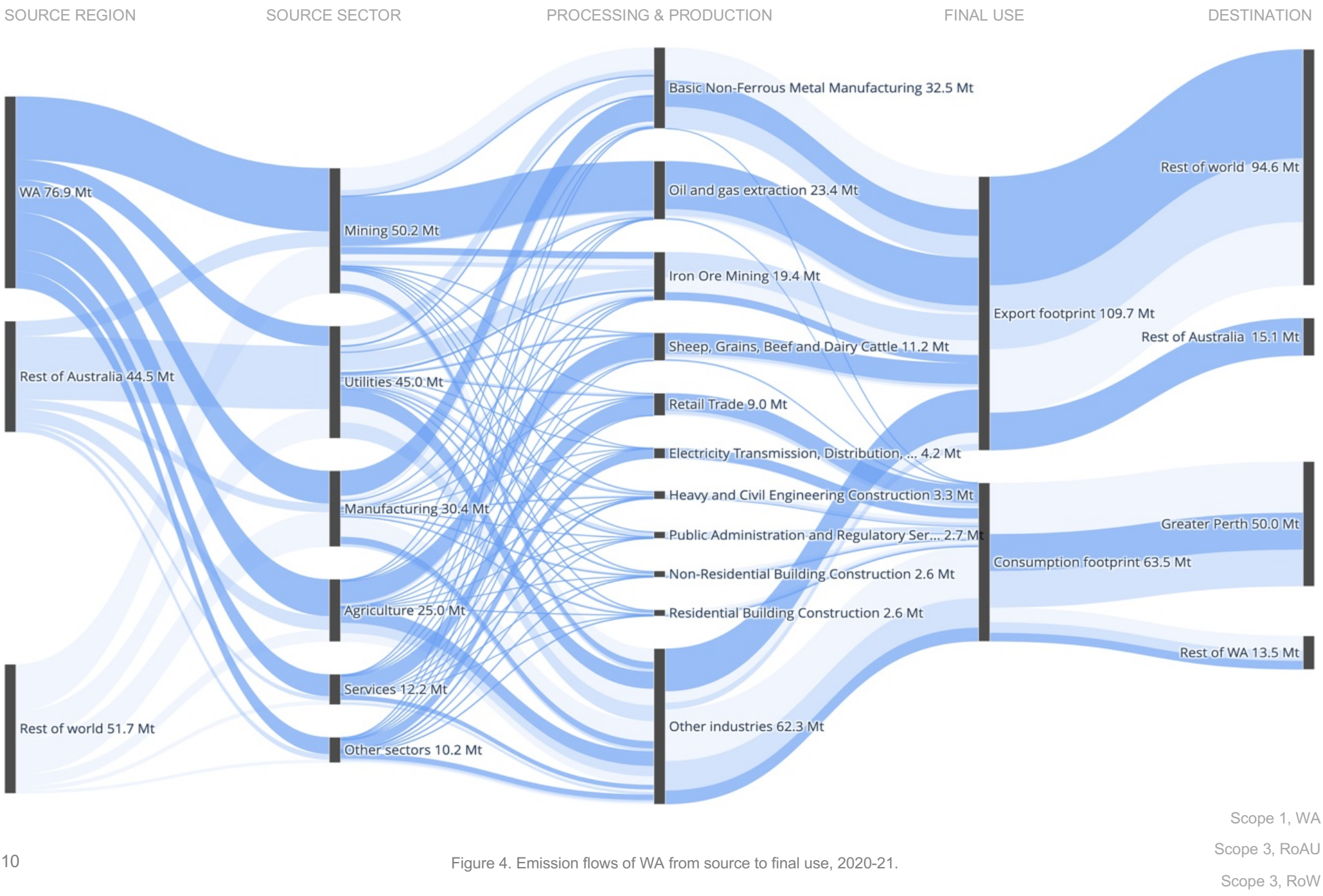

Figure 4. Emission flows of WA from source to final use, 2020-21.

Built stocks

The built environment represents by far the most significant proportion of in-use stocks globally[33]. WA is no exception. Built stocks can be broadly categorised into buildings and infrastructure assets, with buildings representing the largest component by mass and value.

As of 2021, WA's in-use building stock is estimated to be 288 Mt (see Main Report[29]). To understand how to better manage built stocks and all materials within, it is important to quantify the net addition to the built stock. This indicator for a given year is the number of materials added in the form of new buildings and infrastructure assets, minus those removed through demolition or deconstruction.

The Sankey diagram below (Figure 5) shows the inflows of materials for new building construction flowing from the left-hand side and outflows of material waste from Greater Perth and the rest of WA on the right. This results in a net addition to stock of 8.4 Mt (represented by the dashed node) and associated solid waste outflows of 2.0 Mt for 2020-21.

Concrete is the most significant material category in terms of inflows (53.8%), followed by ceramics (27.5%) and timber (11.1%). The net addition to stock is much more balanced in terms of building types than the existing stock, with residential buildings representing 45.6%, followed by commercial buildings (41.6%) and industrial buildings (12.8%). Greater Perth represents the most inflows (74.5%).

From a material reuse perspective, this scale and composition demonstrates the need to develop deployable technologies and strategies to reuse such materials. From an environmental standpoint, the colossal use of concrete over steel is concerning because, while steel-based materials are more easily reused or recycled, this is certainly not true for concrete or plasterboard which, typically, get down-cycled into lower-quality products. Outflows in terms of waste represent 2.0 Mt per year[vii], mostly in the form of sand, masonry, concrete and mixed construction and demolition waste.

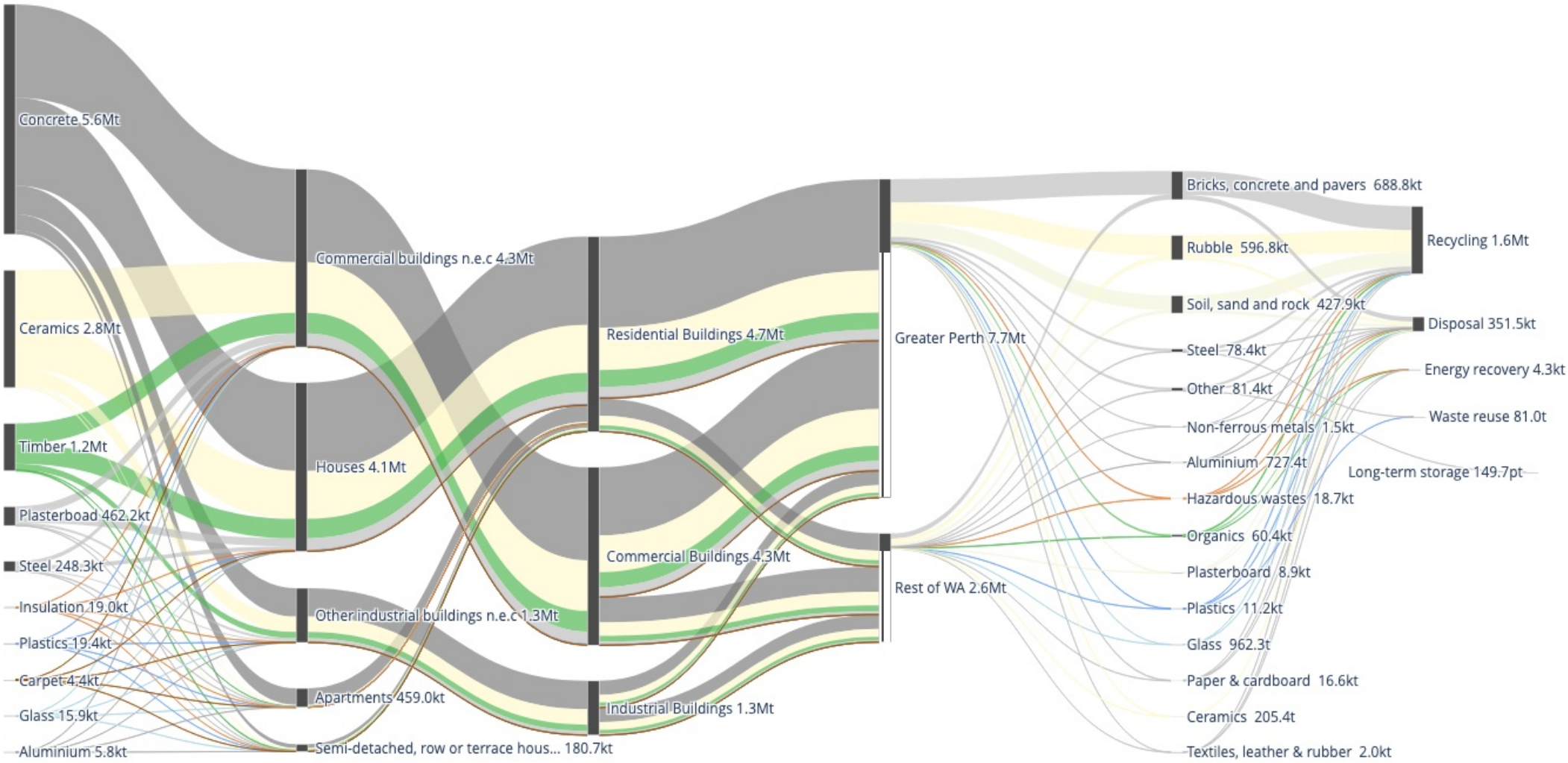

Figure 5. Material inflows, addition to building stock and waste outflows in WA, 2020-21.

City case studies

Cities offer a significant opportunity for addressing circularity, as the Australian population is rapidly urbanising (90% in 2021)[34]. Understanding cities from a systems perspective with inputs, internal processes and outputs of resources and waste (i.e. socioeconomic metabolism) is critical to reducing environmental pressures and advancing circular cities.

Material flows

Figure 6 breaks down the flow of raw materials from global and domestic extraction to final demand within the cities of Bunbury and Canning for 2020-21. Here, consumption occurring within the cities is broken down by system of functional demand—linking State, national and global impacts to local drivers and societal needs. Canning's material footprint (3.7 Mt) is approximately twice that of Bunbury's (1.4 Mt), equivalent to 38.6 and 42.4 tonnes per capita, respectively. A considerable share of extracted resources is destined for manufacturing activities distributed across a cluster of industries, with a noticeable participation of construction sectors.

The prevalence of external supply is a distinctive feature of the cities' material inflows. Interstate supply dominates (3.3 Mt), followed by international sources (1.5 Mt), with only 4.7% (0.2 Mt) of total raw material inputs originating from WA. Imports of metal ores are particularly relevant for both cities, while non-metallic minerals are more relevant in Canning. Grazed biomass and primary crops stand out as important for both cities, with most of the food-related supply originating from interstate sources.

Waste outflows

Figure 7 represents MSW outflows in Canning and Bunbury for 2020-21. Waste throughput in Canning is nearly three times that of Bunbury (48 Kt versus 17.5 Kt), equivalent to 0.5 and 0.53 tonnes per capita, respectively. Overall, recycling rates from both cities at 29.8% (19.5 Kt out of 65.5 Kt of waste generated) remain relatively low, with the national average at 42%, informed in the National Waste Report[35].

Biomass-related waste (43.9 Kt), mainly as food organics, cardboard, and office paper largely ends up in landfill. Plastics are also predominantly disposed of in landfill. Recovery rates for iron and aluminium are relatively low, particularly in the forms of aluminium cans and metal-containing food packages. Verge-side collection yields complex waste outflows (i.e. heavy and hard waste) that end up disposed of in landfill. Despite glass's high recyclability, there is a low performance of glass recycling as 5.2 Kt are disposed of in landfill, which calls for reforms to increase its recovery.

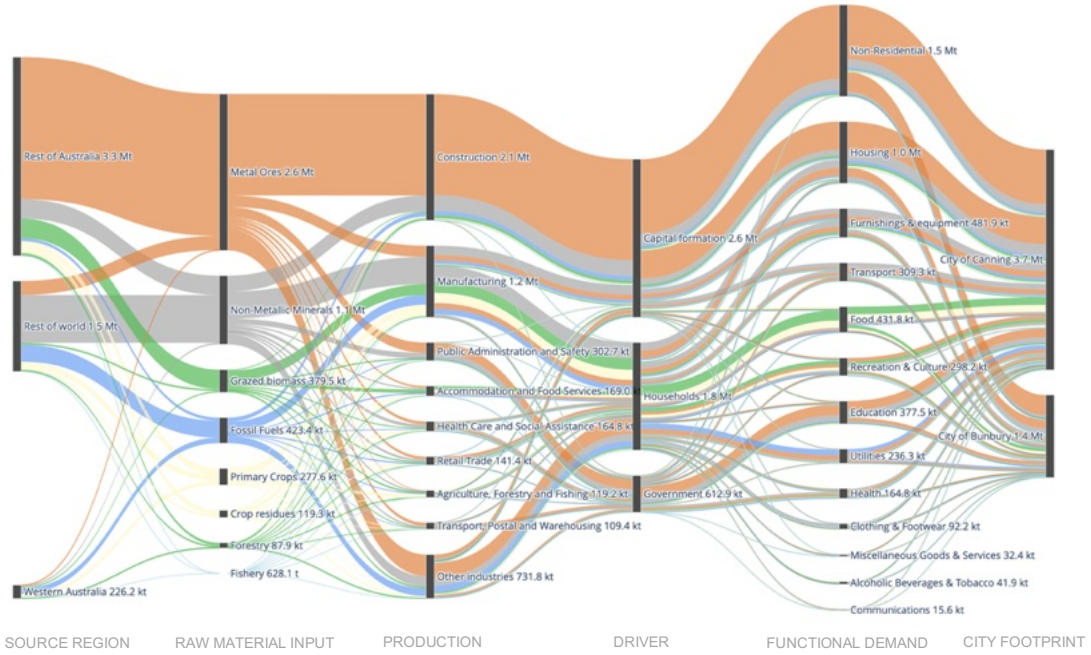

Figure 6. Material flows in the cities of Bunbury and Canning regions, 2020-21.

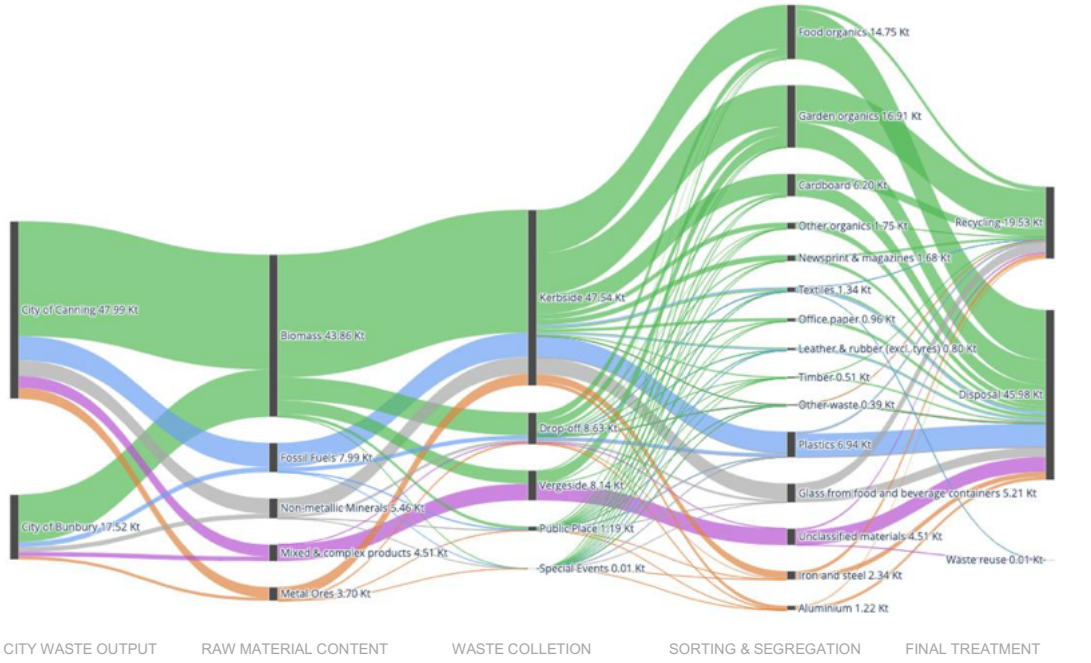

Figure 7. Municipal waste outflows in the cities of Bunbury and Canning regions, 2020-21.

Responses and Initiatives

Policy landscape

Western Australia is exploring policy mechanisms to upgrade the waste management framework and support the transition towards a circular economy[36]. The Waste Avoidance and Resource Recovery Act 2007, the central State waste legislation, establishes the requirement for developing a long-term waste management strategy. The latest update, the 'Waste Avoidance and Resource Recovery Strategy 2030', envisions achieving a sustainable and low-waste society based on a circular economy[27]. The Waste Avoidance and Resource Strategy Action Plan 2022-23[27, 37] sets three critical targets on waste generation per capita, recovery, and disposal by 2030. The action plan supports the deployment of industry-led and public projects, while other legislative instruments further reinforce this direction.

The Plan for Plastics launched in 2021 successfully banned single-use plastic from 2023 in WA through a two-stage regulatory framework[38]. Likewise, the container deposit scheme, Containers for Change, aims to increase the recovery and recycling of empty beverage containers while reducing their disposal in landfill[39]. On the other hand, voluntary approaches relying on industry-led actions, such as the 2025 National Packaging Target, have reported modest progress[40]. These results highlight the circular economy's reliance on finding a balance between cross-sectoral and industry collaboration, and mandatory government regulation.

In line with WA's economic development framework, the Diversify WA—Supply Chain Development Plan 2021-22 seeks to support WA's supply chains in building a more diverse and resilient economy while raising the demand for products with lower environmental impact[41]. This strategic plan recognises the dependence of WA's economy on global trade, which exposes it to potential risks in external supply chains, thereby underscoring the need for system-wide circular approaches. Western Australia's Battery and Critical Minerals Strategy 2024-2030 further points in this direction, acknowledging the role of the circular economy in maximising environmental, social and corporate governance outcomes[42].

As circular economy strategies are critical in reducing GHG emissions[43], their contribution is increasingly receiving recognition within WA's decarbonisation roadmaps. A dedicated circular economy framework is expected to unlock this potential, acting synergistically with the Western Australia Climate Policy[44] and the recently announced Sectoral Emissions Reduction Strategy for Western Australia[45], which assigns a central role to circular economy strategies to achieve net zero emissions. In contrast to all other Australian states and territories, WA's territorial emissions have continued to rise[46], positioning circular approaches as a potential response to curb this trend, and further strengthen commitments towards economy-wide targets.

Sectors and supply-chains

Sector-specific policy development and circular initiatives are emerging, with a growing interest from State and non-state actors in integrating circular approaches within internal processes. However, few have mandates to demonstrate evidence-based contributions. The Department of Transport stands out as a leader within the public sector, integrating circular strategies through the Sustainable Infrastructure Policy framework, a commitment to strengthening sustainable resource use and reducing lifecycle impacts across transport infrastructure and assets[47]. The Kwinana Industrial Area, where over 150 products, by-products and utilities are exchanged within a complex network of synergies, represented a successful example of industrial symbiosis and circular economies at the industrial precinct level[48, 49].

Local initiatives

Several local government authorities, including the City of Melville, City of Cockburn, and Town of East Fremantle, are pioneers in local and small-scale circular initiatives, aiming to encourage residents to adopt circular economy principles[50, 51]. These initiatives are further bolstered through the WasteSorted Community Education program administered by the Waste Authority[52]. Although these initiatives are very valuable in the context of education programmes focused on household waste, actions with a system-wide focus are necessary. This has been further highlighted in the recent 'Regional Circular Economy Horizon Scan' report, which calls for further transdisciplinary research, multi-sector collaboration and capacity building, and material-focused roadmaps for a circular economy[53].

Challenges and opportunities going forward

While WA has significant potential for circularity, beyond clear mandates to improve waste management processes, practical circular frameworks and actions are fragmented at the State, regional and municipal level. Although the interest in circular approaches is at an all-time high, WA lacks a comprehensive policy framework dedicated to circular economy foundations. A consistent, system-wide approach for assessing response measures and monitoring progress towards a circular economy, as delivered through this research, presents significant opportunities for addressing these gaps.

Recommendations

Our findings reveal that while WA has one of the world's most resource- and emission-intensive economies, the State is uniquely positioned to harness circular opportunities across its entire value chain, generating significant domestic, upstream and downstream benefits. However, this transition will require important shifts in policy, technology, and cross-sector collaboration.

This report mainstreams actionable recommendations to drive the circular economy transition in WA across eight systemic themes: policies and governance, economic instruments, supply chain diversification, net zero alignment, end-of-life management, built environment, enabling tools and technologies, and cross-sectoral collaboration. For details, see Main Report[29].

1. Western Australia has made significant modifications to its waste strategy to tackle the challenges and seize the opportunities presented by a circular economy. To build upon these governance signals, we recommend complementing this framework with three actionable policy mechanisms: **a consistent economy-wide lifecycle framework; targets focusing on resource productivity and material footprints; and an annual report to monitor progress towards a circular economy**.

2. The WA government plays a crucial role in establishing economic incentives to promote the adoption of circular practices. In the long-term, investments should be encouraged through fiscal reforms (e.g., tax deductions, subsidies, royalties) that enhance the competitiveness of secondary raw materials. More immediately, a feasible action is the utilisation of government spending power through **an integrated circular procurement framework** to stimulate the market for secondary materials.

3. WA is uniquely positioned to reduce emissions across its entire value chain. While ambitious national and state emission targets are vital for progressing and tracking goals related to territorial emissions, adopting circular economy strategies can unlock additional emission reduction opportunities, bolstering interim aspirations, and generating long-term co-benefits. In this regard, **the identification of tangible opportunities for emissions reduction from circular strategies** can effectively support the integration of circular approaches into decarbonisation roadmaps (see Recommendation 7).

4. Localised supply chains are critical for boosting economic complexity, promoting job growth, and a more resilient economy with fewer external dependencies. Western Australia's economy is heavily reliant on global trade to sustain economic development. From a circular economy perspective, locally oriented supply chains can minimise material inputs while reducing waste outputs. Two immediate actions can lay the foundations for stronger local supply chains: **mapping supply chain networks and enhancing opportunities for closed material and energy loops**.

5. Further developments in data collection and harmonisation of different accounting systems will allow for a better understanding of circular flows. The integration of waste management systems into a system-wide assessment framework will provide critical insights for understanding downstream environmental impacts and designing circular responses. We focus on two feasible near-term actions: **improving waste data traceability; and integrating waste management systems into an economy-wide lifecycle framework**.

6. There is a need to better quantify and monitor built assets and material components across the construction project lifecycle. Integrated assessment tools can provide valuable information about the quantities, qualities, and characteristics of material stocks. In the long-term, these technologies could facilitate material exchanges, enabling efficient and resilient markets for secondary construction materials. We outline two actionable recommendations that can lay the groundwork for further technological advancements: **dynamic mapping of built stocks; and forecasting material requirements**.

7. Science-based tools are essential for decision-making capacity, supporting effective policymaking, strategic investment, and urban planning. Integrated accounting frameworks enable actors to measure, monitor, and report changes over time with consistency and transparency. These enabling tools and technologies create a robust foundation for informed, data-driven actions. We outline three actionable advances: **scenario analysis and response measure design; deploy a circular monitor as a digital public good; and develop a circular resource hub to enhance community awareness and business capacities**.

8. Achieving true circularity requires collaborative efforts that extend beyond individual businesses or industries to include cross-sectoral partnerships, regional initiatives, and state and national policies. Such cooperation enables the alignment of circular strategies, data integration, and policy coherence, fostering a resilient circular economy that benefits all sectors and levels of society. We draw to immediate steps to foster cross-sectoral, industry and agency collaboration: **integrating efforts in a multistakeholder partnership; and developing a local circular economy agenda with local governments.**

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Footnotes

[i] Material intensity of raw material inputs is equal to RMI/GSP. Here, the area covered for material inputs completely overlaps with that in which added value is generated.
[ii] Material productivity is presented on a raw material consumption basis. The efficiency of material consumption in the production of good destined for export is not included.

[iii] Refers to the ultimate destination of the waste within the waste management system, including five options: disposal; recycling; energy recovery; long-term storage; and waste reuse.
[iv] Recovery rate is defined here as resources diverted from landfill.
[v] Does not include negative emissions from land use and land use change.
[vi] An economic system that exports more than it imports.
vii Includes residential and non-residential building construction waste only.