

# **Cleaning Up Our Act: The Future for Waste and Resource Recovery in NSW**

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Issues Paper

March 2020



**The NSW Government is developing the 20-Year Waste Strategy, which will set the future direction of the state's waste and resource recovery system.**

In 2018, NSW generated 21.4 million tonnes of waste. That figure is expected to increase as population and economic growth continue. However, our natural resources are finite, and the impacts of increasing amounts of waste on our environment need to be minimised.

The strategy is an opportunity for us to put into motion transformative changes in the way we create and deal with waste.

We need a smarter approach that makes use of all the levers available to us. We need to drive sustainable product design and waste reduction and maximise the amount of used material that is recirculated safely back into the productive economy.

The government has three objectives when it comes to waste: sustainability, reliability and affordability.

Sustainability means the NSW waste industry is self-sustaining, delivers improved environmental outcomes and, above all, protects human health.

Reliability means putting consumers at the centre of the process by making sure their waste is consistently managed in accordance with their expectations.

And affordability means that waste and recycling services are delivered at a reasonable cost, with customer needs as the focus.

We are engaged in frank and wide-ranging conversations with communities, local councils, experts and industry about how we can collectively deliver better outcomes in the waste system. At the same time, we're working with the federal government and the other states and territories on a national action plan to implement the National Waste Policy. All these discussions have informed this issues paper.



The 20-Year Waste Strategy will be a vehicle that not only enables the state, businesses and the community to improve our approach to waste. It is also intended to generate new economic opportunities, reduce costs to citizens and businesses through a smarter approach, and increase our resilience to external shocks.

This issues paper identifies the challenges the waste system faces and proposes a vision for the future NSW circular economy.

The strategy needs to work for all parts of NSW, both metropolitan and regional. We need to recognise the challenges and maximise the opportunities in different areas of the state.

I would like to invite your views on the vision, directions and options that are proposed in this issues paper to be included in the NSW 20-Year Waste Strategy.

**Matt Kean MP**

Minister for Energy and Environment



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**Acknowledgement  
to Aboriginal people**

We acknowledge the traditional custodians of Country and pay our respects to Elders past, present and emerging. We recognise that our facilities, including waste and resource recovery facilities, are built and operate on Aboriginal land and commit ourselves to thoughtful, inclusive and respectful ongoing management of these places.



Painting by Jordan Ardler, La Perouse Aboriginal Community, Bidjigal People.

The NSW Government is developing a state-wide 20-Year Waste Strategy. This issues paper has been prepared to help shape the development of the long-term strategy. It explores how we might achieve a sustainable, reliable and affordable resource recovery and waste system in NSW. It sets out the key challenges and opportunities and articulates a range of options.

**We want to hear your views on these options and the role we all can play in achieving economic growth and more jobs through creating value from our waste resources.**

## Rationale

By 2040, waste generation is expected to increase from over 21 million tonnes a year today to 31 million tonnes, growing faster than the rate of population.<sup>1</sup> This trend reflects structural changes to our economy from population growth, shifts in dwelling types and industry composition.

Based on current trends NSW will not meet established targets to divert 75% of waste from landfills by 2021. In 2017-18, only 65% of our waste was recovered, with 35% disposed as landfill.

If we don't act to disrupt this trend and ensure we have the infrastructure capacity needed to manage our waste, there is a risk that NSW's waste systems will not be able to cope. We do not yet have the processing capacity to recycle the 240,000 tonnes of waste we have been exporting each year, and our landfills are expected to reach capacity in the next 10-15 years.

We need to ensure there are viable and sustainable pathways to avoiding ever-increasing amounts of waste being landfilled. The closure of export markets for waste materials, and the emergence of new and complex waste materials (such as e-waste and solar photovoltaic (PV) systems) also provide additional motivation to ensure we manage our waste responsibly.

To do this we will need:

- to value our resources so we use and reuse them for longer to incentivise and empower the reuse market
- new technological and service solutions that realise more value from our waste and avoid or lessen the environmental costs of waste generation and disposal
- our waste and resource recovery systems and services to operate flexibly so they can adapt to changes in technology, economic activity and the way communities use their living and public places.

The NSW waste management sector is valued at around \$1.5 billion.<sup>2</sup> It employs more than 10,000 people and there is scope for this to grow, particularly in regional NSW. If we simply continue our current approach, we will miss out on the opportunity to develop a mature and competitive resource recovery sector in NSW.

In committing to a 20-Year Waste Strategy, we are looking for ways to shape resource recovery services and the industry to realise industry and job opportunities and to protect our environment and human health. While NSW has achieved major progress under five-yearly strategies since 2003, there is a need for a longer-term strategic focus where communities, industry and all levels of government are working together to build resilient services and markets.

A long-term strategy can give industry the confidence to respond to challenges and support investment and innovation. It can provide communities with certainty that waste is avoided and recovered where possible and is being managed sustainably.

<sup>1</sup> Waste generation expected to grow at 2.3% per annum compared to population growing at 1.4% per annum PwC (2019), *NSW Waste Sector: Key Findings, Volume I*

<sup>2</sup> Industry value-added in 2017-18 (estimated by DPIE using national data from IBISWorld 2019 on solid and liquid waste collection, treatment and disposal services, including waste remediation and materials-recovery services)

**Our vision is for the waste system to be sustainable, reliable and affordable as we realise a circular economy. This means we empower NSW businesses, communities and state and local governments to value resources and keep products and materials in use for as long as possible.**

Sustainable means:

- reducing environmental and human health risks associated with waste generation, processing, treatment and disposal
- encouraging waste to be viewed as a resource, in line with the NSW Circular Economy Policy.

Reliable means:

- securing reliable waste services across metropolitan and regional communities.

Affordable means:

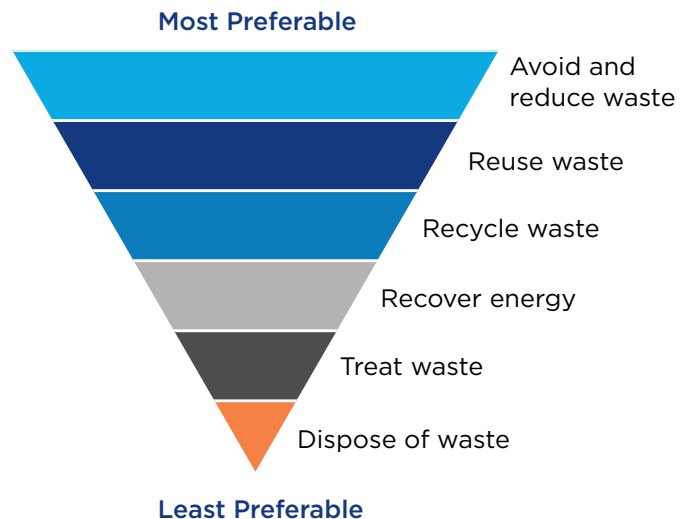
- promoting value-add opportunities to improve the cost-competitiveness of recovered materials
- managing waste more efficiently and orienting the waste sector to drive better value through recovery and re-manufacture of higher-quality materials.

The waste hierarchy shown in Figure 1 provides an order of preference for managing waste materials. Without exploring and implementing different ways to manage our growing volume of waste, management will inevitably flow to the 'least-cost' disposal pathway, which may not be the most preferable for our communities or create value in waste resources.

Early in 2019, the NSW Government released its Statement to help guide the state's transition to a circular economy. A circular economy is one in which resources are valued by keeping products and materials in use for as long as possible. Maximising the use and value of resources brings major economic, social and environmental benefits. It contributes to innovation, growth and job creation, while reducing our impact on the environment.

The 20-Year Waste Strategy is underpinned by these circular economy principles.

**Figure 1. The waste hierarchy**



**Source:** *Waste Avoidance and Resource Recovery Act 2001*

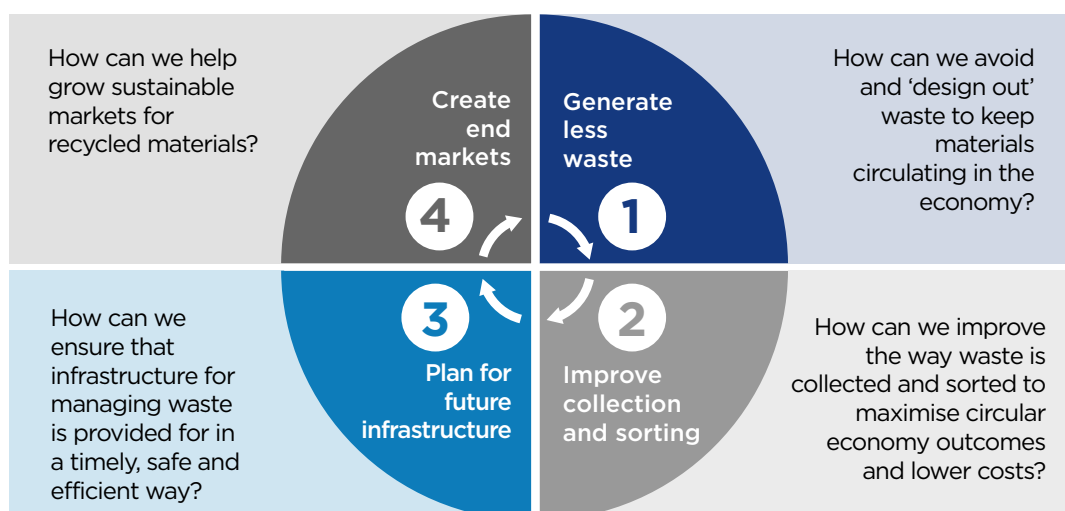
## Approach and summary of options

There will need to be appropriate policy, economic and technological options to realise the vision and achieve the outcome of a sustainable, reliable and affordable waste system.

The options in this issues paper have been developed based on extensive research and stakeholder engagement. This includes feedback from over 100 responses to the Minister for Energy and Environment, who wrote in August 2019 to industry, environment groups, local government and other key stakeholders seeking feedback on the key issues in the waste system. This feedback, along with technical reports prepared to better understand the key constraints facing services in NSW, is available on the department's website [yoursay.dpie.nsw.gov.au](https://yoursay.dpie.nsw.gov.au).

This issues paper seeks to test a number of these options, which have been mapped to four directions that represent specific stages in the circular economy (Figure 2).

**Figure 2. Alignment of 20-Year Waste Strategy directions with a circular economy approach**



**Direction 1:** **Generate less waste** by avoiding and 'designing out' waste, to keep materials circulating in the economy.

- Option 1.1:** State-wide targets
- Option 1.2:** Designing out waste
- Option 1.3:** Awareness and behavioural change
- Option 1.4:** Targets for government agencies
- Option 1.5:** Regulatory safeguards

**Direction 2:** **Improve collection and sorting** to maximise circular economy outcomes and lower costs.

- Option 2.1:** Recovering food and garden organics
- Option 2.2:** Standardise collection systems for households and businesses
- Option 2.3:** Network-based waste drop-off centres
- Option 2.4:** Waste benchmarks for the commercial sector
- Option 2.5:** Innovation and 'waste-tech'
- Option 2.6:** Joint local council procurement
- Option 2.7:** Combining commercial and industrial waste collection services
- Option 2.8:** Economic incentives and the waste levy

**Direction 3:** **Plan for future infrastructure** by ensuring the right infrastructure is located in the right place and at the right time.

- Option 3.1:** Long-term waste and resource recovery infrastructure needs
- Option 3.2:** Place-based development
- Option 3.3:** Making it easier to do business
- Option 3.4:** Innovative financing models

**Direction 4:** **Create end markets** by fostering demand for recycled products in NSW (particularly glass, paper, organics, plastics and metals) so that recovered materials re-enter our economy and drive business and employment opportunities.

- Option 4.1:** Recycled content in government procurement
- Option 4.2:** Standards for recycled content and materials
- Option 4.3:** Match suppliers with markets
- Option 4.4:** Best-practice regulatory environment for energy from waste projects

The implementation and progress of the four directions will be underpinned by an Implementation Framework that sets out the information and monitoring and reporting arrangements for the strategy.



We want to hear your views on whether we are using the right evidence and have identified the key challenges for waste into the future.

The Government is consulting widely with the community and stakeholders as we develop the 20-Year Waste Strategy. We invite the NSW community, industry and local government to comment on the directions, the options and our overall vision and approach set out in this paper.

Figure 3. Strategy development



We will carry out public consultation on this issues paper. We will invite public submissions on this paper and the discussion paper *Cleaning Up Our Act: Redirecting the Future of Plastic in NSW*, which addresses the NSW Government priority to reduce plastic waste. It will form part of the 20-Year Waste Strategy and contain specific measures to manage plastic waste and pollution in NSW. Other key policy measures are underway and will be incorporated as we develop the 20-Year Waste Strategy.

Using this combined feedback, we will develop a draft strategy that will present a proposed package of actions for implementation.

This will be supported by technical analysis of the interactions and the trade-offs between options alongside their feasibility, costs and benefits.

We will carry out further public consultation on the draft strategy later this year, before finalising the 20-Year Waste Strategy in early 2021.

## Making submissions

You can make written submissions on this issues paper to the Department of Planning, Industry and Environment via an online response form at [yoursay.dpie.nsw.gov.au](https://yoursay.dpie.nsw.gov.au).



Photo: Baled waste materials at a materials recovery facility.



Figure 4. Current and future policies with implications for the 20-Year Waste Strategy





# Direction 1: Generate less waste

## The case for action

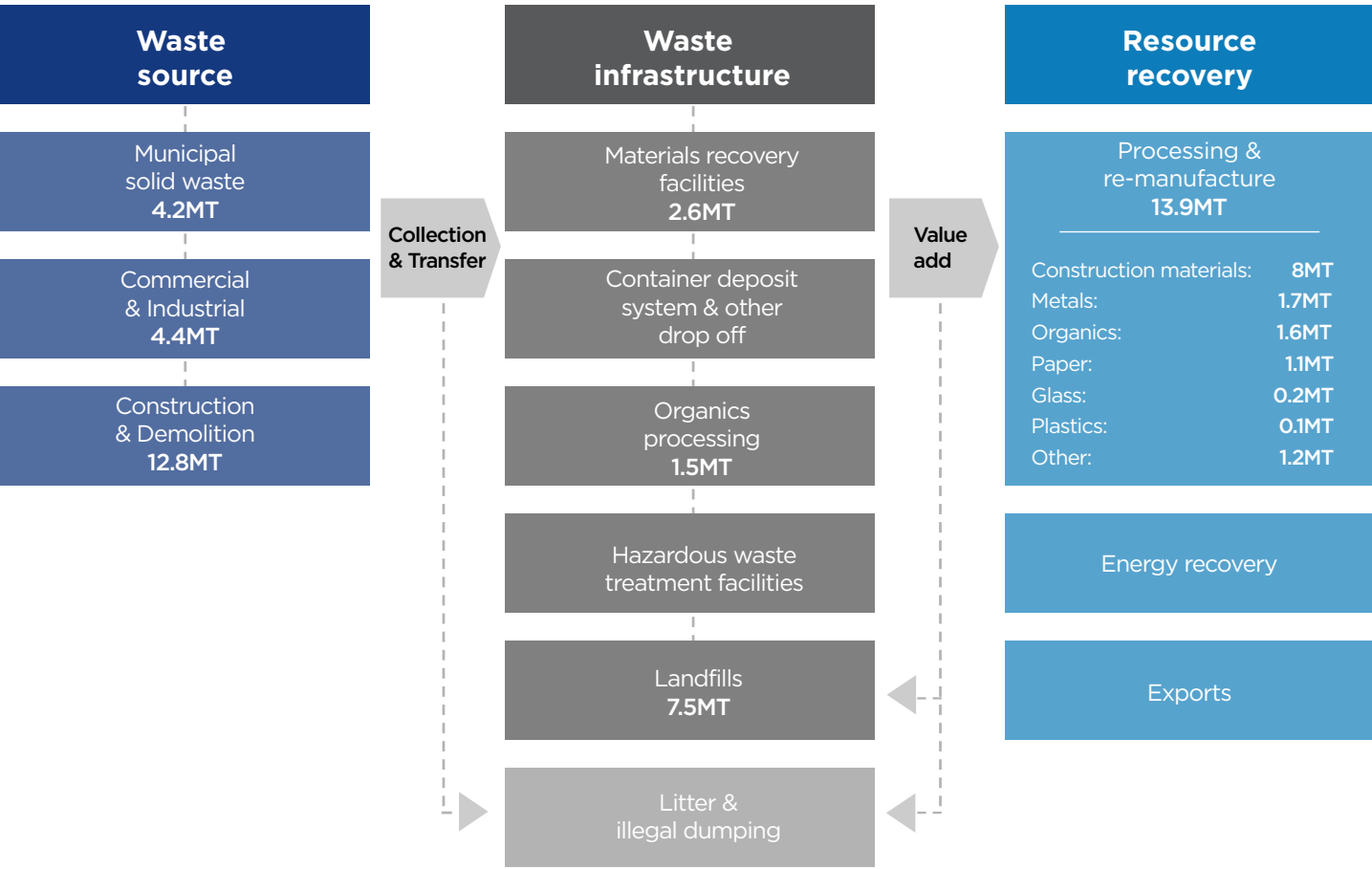
### We lose value by discarding goods that could have been reused or recycled

There are three main sources of waste:

- municipal solid waste: the items we use and throw away in our households and public places
- commercial and industrial waste: the waste generated by businesses, offices and industrial processes
- construction and demolition waste: all waste from construction and demolition activities.

In 2017-18, NSW generated 21.4 million tonnes of waste, and over the next 20 years this will grow to more than 31 million tonnes. Almost 20% or 4.3 million tonnes came from households and public places. Another 20% was generated by the commercial and industrial sector, with the largest share generated by the manufacturing, retail and health care sectors. The majority of our waste in NSW came from the construction sector, representing 60% or 12.8 million tonnes. This reflects the infrastructure boom in NSW.<sup>3</sup>

Figure 5. NSW waste flows (2017 - 2018)



Source: NSW Environment Protection Authority (2019), *Waste Avoidance and Resource Recovery Strategy Progress Report 2017-18*

<sup>3</sup> PwC (2019), *NSW Waste Sector: Key Findings Report*, Volume I

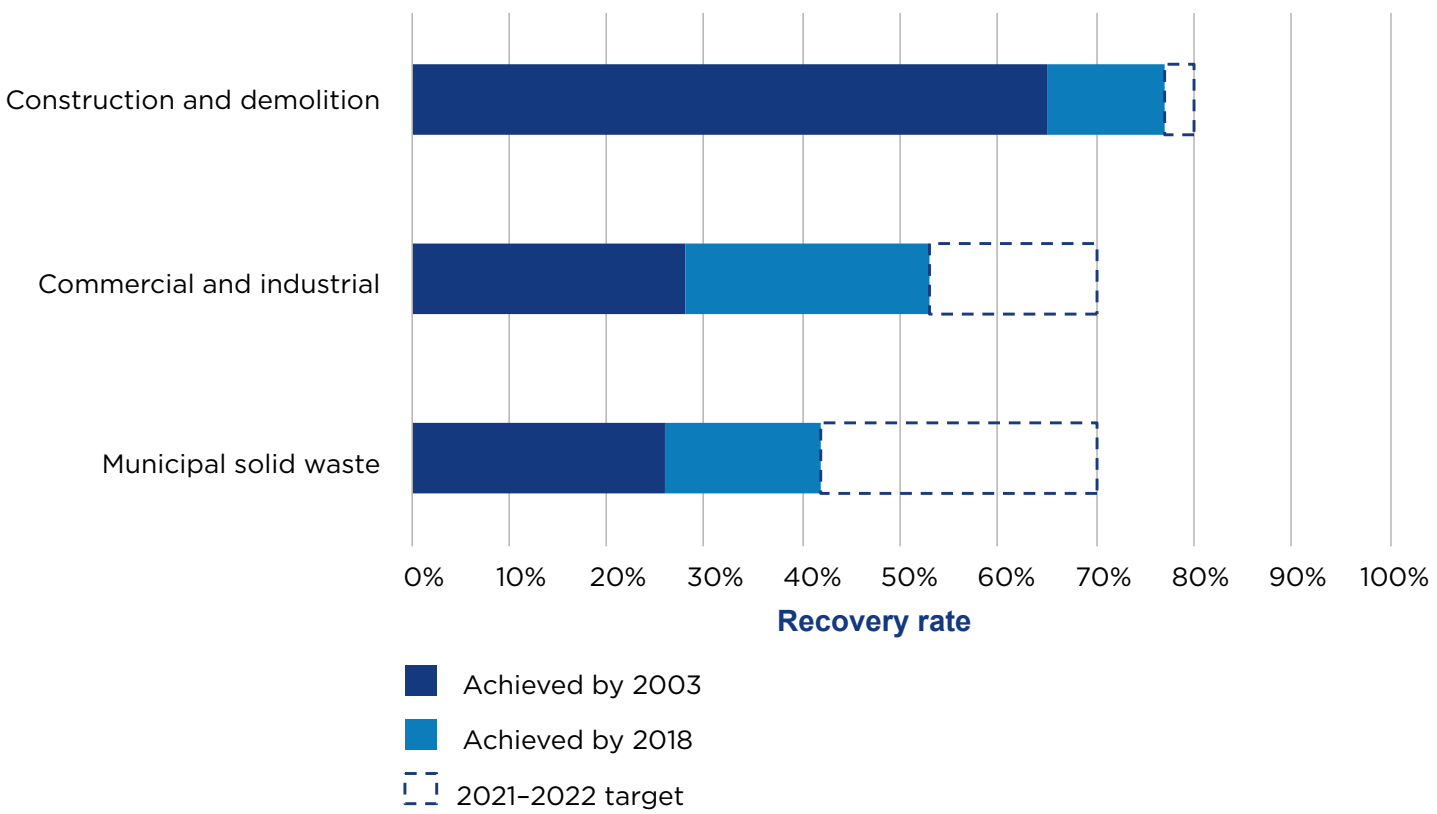
# Direction 1: Generate less waste

While generating waste is unavoidable, creating unnecessary waste can drain productivity and environmental resources. Major sources of unnecessary waste include food waste, some types of packaging like single use plastics (that are low in weight but high in volume), and material that is difficult to reuse or recycle such as composite plastics like insulated coffee cups that are not easy to separate into component parts. An Environment Protection Authority (EPA) survey in 2017 found that for 91% of respondents, packaging and food were the largest waste items in residential bins.<sup>4</sup>

If we are going to extract the maximum value from our resources, we should first minimise or eliminate the unnecessary waste we create.

While there is a high degree of recycling in the construction industry (where materials are returned to roads and buildings), recovery and recycling in household, commercial and industrial waste streams have plateaued. NSW is not on track to meet 2021 targets to divert waste from landfills. As shown in Figure 6, construction and demolition waste recovery is around 77% (on track to meet the 80% target), while commercial and industrial waste and municipal and solid waste recovery are each around 40-50% (below the 70% target).

Figure 6. NSW waste targets, resource recovery rates by stream



Source: NSW Environment Protection Authority (2019), *Waste Avoidance and Resource Recovery Strategy Progress Report 2017-18*  
NSW Environment Protection Authority (2010), *Waste Avoidance and Recovery Strategy Progress Report 2008-09*

<sup>4</sup> NSW Environment Protection Authority (2017), *Love Food Hate Waste Tracking Survey 2017*  
<https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/managewaste/18727love-food-hate-waste-tracking-survey-2017.pdf>

## Direction 1: Generate less waste

The second-hand economy for reusing goods is estimated to be worth \$43 billion to Australia and is growing. Each household has an estimated 23 unwanted or unused items with a total average resale value of \$5,300.<sup>5</sup> This presents an opportunity to avoid adding to waste.

### We waste a significant proportion of the food we generate

#### Nearly 75% of food waste occurs before food is sold or served

Nearly 75% of food waste occurs before the food is even sold or served.<sup>6</sup> Wasted food disposed in landfill impacts the environment by generating methane, a greenhouse gas 25 times more powerful than carbon dioxide and a major cause of climate change.

International research has found investment in food waste reduction can achieve a positive return on investment for businesses. A review of 1,200 business sites across 700 companies in 17 countries found that nearly every site evaluated achieved a positive return, and half saw a 14-fold or greater return on investment.<sup>7</sup> Reducing household food waste can also save money, with the annual cost of food waste estimated from \$2,200 to \$3,800 for Australian households.<sup>8</sup>

### We need to redirect the future of plastics in NSW

In 2017–18, NSW consumed approximately 1.1 million tonnes of plastic. We mostly used it for packaging (which is often used once and then discarded) and household items like furniture, clothing and footwear.<sup>9</sup> Plastics make up 45% of household recycling bin collections.

Plastic recycling rates are typically low, with only an estimated 10% of the plastic we consume every year being recycled.<sup>10</sup>

Plastic pollution is a major issue all over the world. Nearly one garbage truck of plastics enters the world's oceans every minute.<sup>11</sup>

The discussion paper *Cleaning Up Our Act: Redirecting the Future of Plastic in NSW*, released at the same time as this issues paper, is the first step in developing a new, comprehensive approach to managing plastic waste and pollution in NSW. The discussion paper will inform the development of the NSW Plastics Plan aimed at protecting the environment and human health from the impacts of plastic waste in NSW, while minimising impacts on consumers and maximising the economic opportunities available. It will be an important part of the NSW 20-Year Waste Strategy.

### The NSW Government has committed to producing a comprehensive NSW Plastics Plan that will address plastic throughout its lifecycle



<sup>5</sup> Gumtree (2019), *Second Hand Economy Report* prepared by YouGov Galaxy for Gumtree

<sup>6</sup> NSW Environment Protection Authority (2019), *Food waste in business* [www.lovefoodhatewaste.nsw.gov.au/in-business/food-waste-in-business](http://www.lovefoodhatewaste.nsw.gov.au/in-business/food-waste-in-business)

<sup>7</sup> Champions 12.3 (2017), *The business case for reducing food loss and waste*, March 2017

<sup>8</sup> Australian Government (2017), *National Food Waste Strategy* [www.environment.gov.au/system/files/resources/4683826b-5d9f-4e65-9344-a900060915b1/files/national-food-waste-strategy.pdf](http://www.environment.gov.au/system/files/resources/4683826b-5d9f-4e65-9344-a900060915b1/files/national-food-waste-strategy.pdf)

<sup>9</sup> NSW Department of Planning, Industry and Environment (2019), *Cleaning Up Our Act: Redirecting the Future of Plastic in NSW*

<sup>10</sup> NSW Environment Protection Authority analysis

<sup>11</sup> World Economic Forum (2016), *The New Plastics Economy, Rethinking the future of plastics*. January



## Direction 1: Generate less waste

### We can do more to design waste out of products

NSW has had some successful product stewardship initiatives. Schemes such as the NSW Container Deposit Scheme Return and Earn, funded by beverage suppliers, have been successful in reducing beverage container litter.<sup>12</sup>

Large producers or brand owners of consumer products with a gross annual income in Australia of more than \$5 million have legal obligations to reduce the environmental impact of packaging.<sup>13</sup>

However, most schemes are nationally-based to ensure they can effectively drive producer behaviour. These include:

- voluntary schemes accredited under the *Commonwealth Product Stewardship Act 2011* such as for mobile phones (MobileMuster)
- non-accredited voluntary schemes such as for tyres, mattresses, paints and microbeads<sup>14</sup>
- co-regulatory product stewardship, such as the National Television and Computer Recycling Scheme, which is regulated nationally and set up through industry-funded collection and recycling services (for televisions and computers, including printers and computer parts).

More can be done to reduce waste and improve materials recovery through producer-led initiatives to phase-out problematic materials and redesign products so they can be readily recycled.

Take-back schemes overseas have been an effective tool to drive producer behaviour. For example, since 1991 the German Government has had legislation requiring retailers to pay for recycling and disposal of packaging, motor vehicles, e-waste and petroleum products. In 2019 it introduced laws to mandate transparent reporting on the extent to which products are recyclable.

### Commercial circular economy initiatives

Global furniture and homewares brand IKEA has committed to a 2030 vision of 100% circular and climate positive operations. The company has set a 2020 target for 100% certified sustainable wood and paper products and has identified phasing out virgin plastic as the next challenge in material sustainability. As a result, it increasingly uses its own recycled waste and offcuts to produce new products.

IKEA has also launched a take-back service for customers to return unwanted furniture in exchange for a store credit voucher. It also has a take-back for unwanted mattresses that are taken apart and recycled.

**Source:** [People and Planet Positive – IKEA Sustainability Strategy June 2018](#)

Woolworths supermarkets have a goal of zero waste to landfill and work with partners such as OzHarvest, Foodbank and FareShare to use food that would otherwise be wasted. This has diverted over 55,000 tonnes of food from landfill and enabled over 10 million meals to be delivered by charitable partners over the past year. Food that can't be used for human consumption can be used as animal stock feed at local farms and zoos, or for commercial composting or energy production.

Woolworths is also working to contribute to the circular economy by reducing packaging and plastic waste. It recently announced a partnership with TerraCycle's reusable packaging solution Loop™ to deliver a new reusable packaging system for a range of products (such as washing detergent, shampoo, juice or ice cream) in customised, brand-specific, durable packaging that is delivered in a specially designed reusable shopping tote.

<sup>12</sup> Keep Australia Beautiful (2019), *Keep Australia Beautiful National Litter Index results 2018-19*

<sup>13</sup> *Product Stewardship Act 2011*. Most companies fulfil this responsibility by becoming a signatory to the Australian Packaging Covenant which requires action to optimise resource recovery of packaging (e.g. through packaging that uses less resources and is more easily recycled) and to prevent environmental impact of packaging litter.

<sup>14</sup> Since it was introduced in 2015, the voluntary scheme has led to 94% of cosmetic products and toiletries now being microbead free. Envisage Works (2018), *An assessment of the sale of microbeads and other non-soluble plastic polymers in personal care and cosmetic products currently available within the Australian retail market*, <https://www.environment.gov.au/system/files/resources/32eadeac-540f-49a7-8448-1059a1f67bd6/files/assessment-sale-microbeads-personal-care-cosmetic-products.pdf>

## Direction 1: Generate less waste

When the customer is finished with the product, it can be dropped back in-store (or collected) where Loop™ will clean, refill and reuse the packaging. A trial of the service will be run ahead of a full launch in 2021.

**Source:** [Woolworths 2019 Sustainability Report](#) and [Loop platform announcement](#)

### Environmental impacts of waste need to be managed

Landfill has a large environmental footprint and requires permanent management to avoid pollutants entering soils or waterways.

### Reducing emissions from waste will help deliver NSW's goal of net zero emissions by 2050

New waste types can also have unknown or unintended impacts on human health and the environment that will only become known over time. For example, solar PV systems are one of the largest growing electronic waste streams in Australia. The volume of solar PV systems reaching end-of-life (they typically have a 20–30-year lifespan) is expected to sharply increase in the coming years with an estimated 1,500 kilo tonnes of solar waste nationally by 2050.<sup>15</sup>

There are no dedicated solar panel recycling facilities in NSW and the hazardous parts in these systems (including lead-acid and lithium-ion batteries) means there is a significant risk of landfilling where there are no alternatives for their treatment and disposal.

Regulatory approaches to emerging waste risks need continuous monitoring and periodic reviews to ensure they stay up-to-date.

### Effective waste management can reduce greenhouse gas emissions

In NSW, waste accounts for 2.4% of greenhouse gas emissions annually, most of which come from solid waste disposal on land (landfill). Solid waste disposal on land accounts for 59% of waste emissions in NSW.<sup>16</sup>

Across Australia, about one million tonnes of NSW food and garden waste and 570,000 tonnes of textile waste are sent to landfill every year. The decomposing material releases methane that may not be captured. However, when this waste is managed effectively, through proper composting and recycling processes, methane emissions can be greatly reduced, soils can be regenerated to store carbon and biogas can be created to generate electricity.

Reducing emissions from waste will help deliver the NSW Government's goal of net zero emissions by 2050. Greenhouse gas emissions can be avoided by reducing waste (including plastics) and use of virgin materials in manufacturing, extracting value from waste through recycling, using energy efficient processes and pursuing carbon abatement opportunities within the waste sector. For example, using waste to create energy or waste organics to create biogas can result in lower economy wide emissions.

### Litter has avoidable consequences for the environment

Litter is one of the main sources of pollution entering our environment.

### Plastic ingestion will affect 99% of the world's seabird species by 2050

In 2015, litter management cost the NSW economy more than \$167 million, most of which was borne by local government (around \$123 million per year).<sup>17</sup>

<sup>15</sup> Steward, R (2019), *Research highlights potential solutions to looming solar panel waste crisis*, Griffith University News

<sup>16</sup> Australian Government Department of the Environment and Energy (2019), *State and Territory Greenhouse Gas Inventories 2017*, <https://www.environment.gov.au/system/files/resources/917a98ab-85cd-45e4-ae7a-bcd1b914cfb2/files/state-territory-inventories-2017.pdf>

<sup>17</sup> MRA Consulting Group (2016), *Litter costs to the NSW economy – a preliminary report*. Prepared for the NSW Environment Protection Authority

## Direction 1: Generate less waste

The NSW Government has invested \$50 million over nine years (2012-2021) in litter prevention and enforcement initiatives including through its NSW Litter Prevention Strategy 2017-20. The NSW Return and Earn scheme has contributed to a 57% reduction of beverage container litter since it was introduced in December 2017.

More than half the littered items in NSW are plastic.<sup>18</sup> Cigarette butts are the most littered single-use plastic item (the filters are made from plastic) and make up 34% of total littered items. Each year, an estimated 1.3 billion cigarette butts are littered in NSW. Coffee cups (which are lined with plastic and have a plastic lid) make up 11% of the total volume of litter.

Some 92% of the NSW community thinks that littering is socially unacceptable and damages the environment.<sup>19</sup> With the success of recent NSW litter reduction programs and the high level of community support, it is critical that we capitalise on the opportunity to reduce litter further.

### Illegal dumping poses particular risks and is costly to manage

Attempts to avoid the cost and effort of waste disposal can include criminal activity, including illegal dumping, mixing of materials like asbestos into other disposal, and misclassifying waste for disposal, such as classifying hazardous waste as general solid waste.

Illegal activity undermines the industry, with legally operating businesses finding it difficult to compete. Illegal dumping poses risks where the dumped waste contains contaminated materials, such as asbestos and other hazardous waste. Often local councils and affected communities have limited resources to effectively respond to such incidents, making the community and ecological risks even higher.

There are legacy illegal landfills where people have, over a long period, dumped rubbish in the absence of a more convenient option. These sites add to clean-up costs. Similar to litter, sites that are not cleaned up often attract further illegal dumping, thereby worsening the risks to the environment.

In 2016-17, the government introduced a state-wide target to reduce all types of illegal dumping incidents by 30% by 2020. This has been backed up by almost \$20 million in funding for illegal dumping programs and new online resources to help local councils record and manage dumping incidents.<sup>20</sup>

Another challenge in managing illegal dumping is the difficulty in identifying the perpetrators and prosecuting them. Where culprits cannot be identified, local councils, the state government and ultimately ratepayers bear the cost of cleaning up the illegally dumped waste. The issue is compounded by the operational and legal complexities of pursuing, identifying and recovering costs from perpetrators. In the UK, for example, the government is considering introducing compulsory electronic waste tracking to help combat the issue.<sup>21</sup>

## Options for reform

### Option 1.1 State-wide targets

The NSW *Waste Avoidance and Resource Recovery Act 2001* requires five-yearly targets aimed at diverting waste away from landfills.

Targets should go beyond diverting waste from landfill. They should encourage us to reduce waste and improve resource recovery over the long term. This could include targets that aim to reduce high-volume waste materials (such as food waste), or high-risk to the environment (such as unnecessary plastics and litter). It could also include targets to drive recovery of waste materials, such as the use of recycled content in areas like construction and packaging.

<sup>18</sup> Keep Australia Beautiful (2019), *Keep Australia Beautiful National Litter Index results 2018-19*

<sup>19</sup> NSW Environment Protection Authority (2017), *NSW Litter Prevention Strategy 2017-20*

<sup>20</sup> NSW Environment Protection Authority (2019), *Waste Avoidance and Resource Recovery Strategy Progress Report 2017-18*

<sup>21</sup> United Kingdom Department for Environment (2019), Food and Rural Affairs, *Environment Bill Policy Statement* [www.gov.uk/government/publications/environment-bill-2019/environment-bill-policy-statement](http://www.gov.uk/government/publications/environment-bill-2019/environment-bill-policy-statement)



## Direction 1: Generate less waste

Setting these types of targets would support NSW's response towards the *National Waste Policy Action Plan*, where there are targets to reduce waste by 10% per person, halving food waste to landfill by 2030 and achieving an 80% resource recovery rate.<sup>22</sup>

There will be broad considerations that inform how these targets should be met across NSW. For example, to reduce waste by 10% per person, it may make sense to exclude construction and demolition waste that is related to strong economic activity and more variable from year-to-year than other waste types. Targets to improve resource efficiency and resource recovery could also be more appropriate for managing waste, complementing waste reduction objectives. Twenty-year targets could have five-yearly milestones and be accompanied by an action plan. This could offer an opportunity for joint implementation by industry and local and state governments. Regular evaluations could offer an opportunity to identify and fix any underperformance, including through penalties.

### Targets under *Cleaning Up Our Act: Redirecting the Future of Plastic in NSW*

The NSW Plastics Plan discussion paper proposes several new targets relating to plastics:

- phasing out nominated single-use plastics by 2022
- tripling the proportion of plastic recycled in NSW across all sectors and streams by 2030
- reducing plastic litter by 25% by 2025
- mandating use of 30% minimum recycled content in plastic packaging in NSW by 2025.

These proposed targets aim to reduce plastic waste generation, make the most of our plastic resources, reduce plastic waste leakage, and improve our understanding of the future of plastics.

Source: [yoursay.dpie.nsw.gov.au/plastics-plan](https://yoursay.dpie.nsw.gov.au/plastics-plan)

### Question 1.1:

- What targets and metrics would be most effective in driving waste avoidance, reuse and the circular economy?
- How can these be implemented so they are most effective?
- What limitations should be considered?
- What additional targets and metrics could be used to drive emissions reductions from the waste system?
- What are other opportunities to reduce greenhouse gas emissions from waste, while supporting the economy?

Please provide examples and data where possible.

### Option 1.2 Designing out waste

Designing waste out of products can help to reduce waste generation. This could be introduced by industry or government in a similar way to requirements for product safety and consumer health, such as nutritional labelling, that encourages producers to carry out appropriate product testing and development.

While many such initiatives are best coordinated at a national level, there may be instances where it may be appropriate for NSW to initiate progress at a state level to begin with. With this in mind, NSW could increase incentives for producers and retailers to integrate waste disposal and environmental costs in their decision-making. This could include:

- considering how existing schemes such as the NSW Container Deposit Scheme can be further optimised to increase rates of plastics recovery as well as to reduce litter

<sup>22</sup> Ninth meeting of Environment Ministers (2019), *Agreed Statement - November 2019*, Adelaide

## Direction 1: Generate less waste

- identifying priority products that would benefit from mandatory extended producer responsibility. This will be informed by the NSW Plastics Plan and the Australian Government's priority product list for product stewardship, currently under consideration<sup>23</sup>
- considering the costs and benefits of restricting certain materials with limited recovery options (e.g. expanded polystyrene and single-use bags, straws and cups) or where lower emission alternatives exist.

### Question 1.2:

- How do we better design out waste?
- What priorities should inform product stewardship schemes and extended producer responsibility?
- How to we drive uptake of materials and products with lower life-cycle emissions?

### Option 1.3 Awareness and behavioural change

The NSW Government has had success with programs to drive behavioural change. 'Love Food Hate Waste', 'Bin Trim' and 'Sustainability Advantage' have successfully managed food waste and business waste. For example, improved public awareness about food waste, supported by programs such as Love Food Hate Waste, has reduced estimated average weekly food waste in NSW from 5.94 to 5.46 litres per household between 2015 and 2017.<sup>24</sup> This translates to a saving of \$61 per week. There is scope to further extend public awareness and action on unnecessary waste.

The 20-Year Waste Strategy could explore opportunities for consumer and industry engagement programs to promote valuing resources and addressing problematic behaviours (such as littering and dumping). Behavioural change driven by comparing individuals to a cohort can also be effective where information is available about peer waste generation and recycling rates. This could include star ratings for the commercial and industrial sector, like the NABERS waste rating tool.

Where possible, NSW could draw on 'rewards-based' systems for driving behaviour change. For example, as part of the NSW Return and Earn container deposit scheme the 10-cent refund on beverage containers has consumers recognising these as a commodity instead of waste, encouraging litter reduction.

### Question 1.3:

- What are new and innovative ways to engage consumers to reduce waste generation and increase recycling?
- How can these be implemented so they are most effective?

### Option 1.4 Targets for government agencies

Introduced in 2014, the NSW Government Resource Efficiency Policy is aimed at driving resource efficiency by NSW Government agencies in four main areas: energy, water, waste and air emissions from government operations.<sup>25</sup> Under this policy agencies must report on waste volumes and costs and are encouraged to set waste reduction targets.

One option to drive improved actions is to embed mandatory waste reduction targets and data reporting requirements for government agencies, as part of the broader state-wide targets discussed in Option 1.1. This could be similar to the requirements for agencies to implement and report on progress against energy targets under the NSW Government Resource Efficiency Policy.

### Question 1.4:

- Would mandating waste reduction targets and data reporting requirements be effective?
- What issues or limitations should be considered?

<sup>23</sup> <https://www.environment.gov.au/protection/waste-resource-recovery/product-stewardship/legislation/product-list-2017-18>

<sup>24</sup> NSW Environment Protection Authority (2017), *Love Food Hate Waste Tracking Survey 2017* [www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/managewaste/18727love-food-hate-waste-tracking-survey-2017.pdf](http://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/managewaste/18727love-food-hate-waste-tracking-survey-2017.pdf)

<sup>25</sup> See NSW Office of Environment and Heritage (2019), *NSW Government Resource Efficiency Policy*

## Direction 1: Generate less waste

### Option 1.5 Regulatory safeguards

The 20-Year Waste Strategy may have implications for the collection, processing, transport and reuse of waste and resources in NSW.

This will require ensuring the regulatory framework is flexible, adaptive and fit-for-purpose so the environment and human health are protected.

As part of the development of the strategy, a review of regulatory processes and safeguards could be undertaken to explore, for example:

- best-practice performance guidance and standards for waste collection points, waste

and resource recovery infrastructure and legacy landfills

- aligning and integrating environmental assessment requirements and pollution control requirements (including greenhouse gas emission requirements).

#### Question 1.5:

- What are the key opportunities for improving current waste regulations and regulatory processes in NSW?





The case for action

The more we contaminate our waste, the harder it is to recover value

Contamination of the waste we collect is a key problem. This contamination comes from individuals or businesses not putting the right waste in the right bin (e.g. putting plastic bags in the dry recyclables bin) or leaving other waste in containers for recycling (e.g. liquids left in capped bottles).

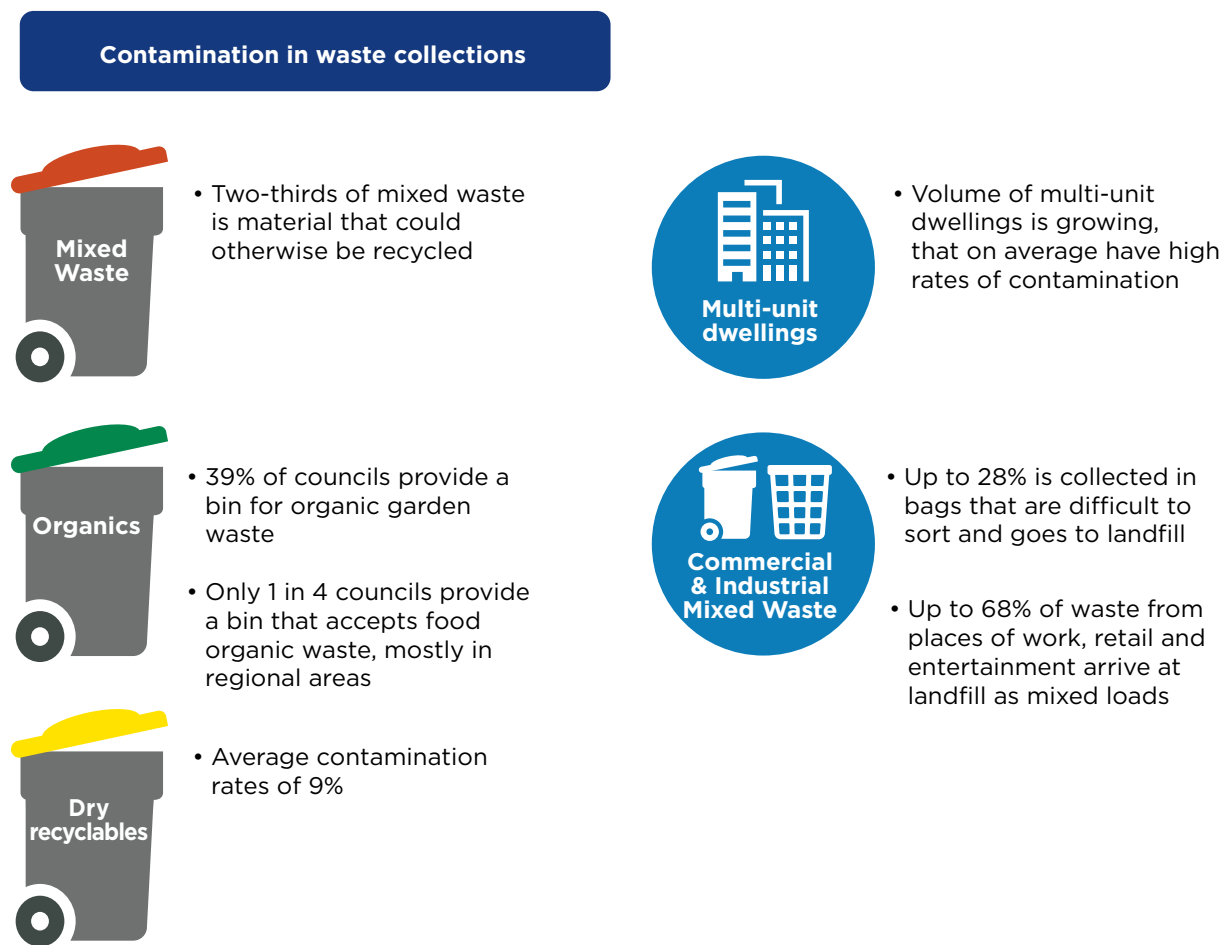
Our ability to recover materials that have low contamination and are valued by the market depends on the efficiency of our collection, sorting and pre-processing systems. Separate collection systems for different waste types (known as source separation) reduces contamination. For example, the NSW

Return and Earn container deposit scheme recovers high-quality, source-separated beverage containers that are sought after in recycling markets both domestically and overseas.

Well-separated waste also costs less to transport because it requires less stages of processing and so needs to make fewer trips between different facilities.

On the other hand, mixed waste (such as red-lid household bin collections) can be challenging to sort as the material is highly variable. Even after going through mechanical processing, residual waste can still have quantities of paper, metals, plastics and glass. In addition, most mixed waste contains a high volume of biodegradable waste from food and garden organics.

Figure 7. Overview of contamination in waste collections



Source: NSW Environment Protection Authority (2019), Waste Avoidance and Resource Recovery Strategy Progress Report 2017-18

Household collection systems are diverse

In 2017–18, NSW households paid \$1.3 billion in municipal waste charges (an average of \$391 per household) and these costs are estimated to reach \$2.5 billion by 2035–36, or around \$642 per household.<sup>26</sup> This is a growing cost with little choice, at the household level, of service providers. Households are not able to ‘shop around’ for waste services, which are contracted by local councils.

Currently, each local council specifies its own sorting requirements for collection, including bin configurations and the types of waste accepted for recycling. While all councils provide a red bin, 87% provide a co-mingled recycling bin and 63% provide a bin for garden organics or food and garden organics (Figure 8). What can go into the recycling bins (green-lid and yellow-lid bins) varies across local councils, depending on their individual waste processing arrangements. For example, some councils with green-lid bins accept both food and garden organics in the same bin, some only garden organics, and some have a separate food organics collection service.

There are several reasons for not having a ‘one-size-fits-all’ approach. These include space considerations (whether in single unit or multi-unit dwellings, or kerbside), the transport and traffic impacts of extra collections, concerns about community confusion about collection requirements, different community attitudes to separating waste and the balance

between resource recovery outcomes against collection and other costs.

However, this creates challenges for source separation as residents have diverse experience in what can and cannot be recycled as they move between areas. Lack of awareness, confusion over what goes in which bin, and limited opportunities for source separation in some councils, can increase contamination of the waste that is collected. There is opportunity to improve this, particularly as 82% of households are willing to recycle, even when it takes more effort.<sup>27</sup>

Almost 50% of illegally dumped waste is household waste

In addition, lack of awareness, unwillingness to pay disposal costs, and inconvenient access to drop-off and disposal points also have consequences for how waste is disposed. Not all illegal dumping is carried out by organised criminals. An estimated 35% of the community and 27% of waste-producing businesses dumped waste illegally in 2015. Almost 50% of illegally dumped waste is household waste, followed by garden waste, construction and demolition waste and tyres.<sup>28</sup>

Providing simple and easy to use collection systems may help reduce the incidence of household and small business dumping.

Figure 8. Number of local councils with each bin type



Source: NSW Environment Protection Authority (2020), Local Government Waste and Resource Recovery Data Report 2016-17

<sup>26</sup> NSW Environment Protection Authority (2020), Local Government WARR Survey 2017–18  
<sup>27</sup> NSW Environment Protection Authority (2015), Waste Less, Recycle More Community Benchmark Study  
<sup>28</sup> NSW Environment Protection Authority (2016), NSW Illegal Dumping Strategy 2017-21

## Direction 2: Improve collection and sorting

### Source separation in multi-unit dwellings

Apartments now account for around 30% of private dwellings in Greater Sydney. Medium- and high-density housing (known as multi-unit dwellings, or MUDs) have higher rates of occupancy and density, creating new logistical challenges for effective waste management. For example, waste management has often not been prioritised leading to not enough storage facilities for bins and limited space for source separation.<sup>29</sup> Without improvements, MUDs can contribute to higher rates of contamination in recycling, poor amenity outcomes and traffic hazards.<sup>30</sup>

Some local councils have proposed that MUDs require separate and innovative waste services that need to be considered as part of building planning requirements.

### Source separation in other countries

San Francisco, Slovenia, Scotland and the Netherlands all source-separate at least four types of waste. This is accompanied by a pay-as-you-throw system, where consumers are encouraged to better separate waste and recycle more.

For example, San Francisco requires residents and businesses to separate recyclables and compostable materials and keep them out of landfill. Building owners and food vendors must provide enough recycling and compost bins. San Francisco residents and businesses pay a flat rate but can reduce costs by opting to reduce their landfill service from a standard 32-gallon bin to a 20-gallon bin (for residents) or by reducing the size of their landfill bin or frequency of pick-up (for businesses). Under this system, San Francisco achieved an 80% landfill diversion rate by 2010.

The Netherlands, Slovenia and Scotland also inspect household bins and penalise residents for incorrectly sorting their waste.



Photo: Paints at a Community Recycling Centre. Lot 7 Studio/EPA

### Leveraging drop-off points for specific or problem wastes

Across NSW there are 640 Return and Earn stations collecting beverage containers and 92 community recycling centres for problem wastes including paint, gas bottles, smoke detectors and batteries. Partnering with the paint product stewardship scheme, Paintback collection sites have been established at 13 community recycling centres so far. Over 9,000 tonnes of problem waste have been dropped off for recycling or safe disposal at community recycling centres since 2014. Over 100 CleanOut events are held annually throughout NSW. More than 360,000 NSW residents have used the CleanOut service to safely dispose of over 16,000 tonnes of chemical waste.<sup>31</sup>

There are also multiple collection points for industry-led producer responsibility schemes for products such as mobile phones and soft plastics across retail outlets, supermarkets, community centres, and other locations.

There could be benefits from having these facilities working together to improve the ease and accessibility of drop-offs for specific or problem wastes, and in streamlining collection systems to improve consistency and build consumer awareness. This could include expanding materials collected by Community Recycling Centre operators.

<sup>29</sup> NSW Environment Protection Authority (2019), *Better practice guide for resource recovery in residential development*

<sup>30</sup> PwC (2019), *NSW Waste Sector: Situational Analysis Report*, Volume II

<sup>31</sup> NSW Department of Planning, Industry and Environment analysis



## Direction 2: Improve collection and sorting

### Businesses' waste management systems can be improved

There is a lot of variation in how businesses manage their waste. Some with the size and negotiating power to contract for specific waste management outcomes have advanced and sophisticated waste management systems.

However, for many businesses there can be limited incentives to participate in recycling when doing so may be more expensive, less convenient or require extra on-site floor space. Businesses that are tenants are also generally reliant on their property owners' and building managers' waste management arrangements, unless they have sufficient influence or separate waste management arrangements that provide them with more control.

In NSW, initiatives to improve business recycling have included the popular Bin Trim and Sustainability Advantage programs, and the National Australian Built Environment Rating System (NABERS) Waste benchmark.

#### Bin Trim: supporting NSW businesses manage their waste

Roughly 70% of a business' general waste could be reused or recycled. From cardboard, paper and plastic through to food waste, a significant portion of the waste ends up in the general waste bin, when it could be avoided, reused or recycled.

The NSW Government's Bin Trim program provides free help and support to NSW businesses with up to 400 employees, to maximise recycling and minimise waste to landfill. It also tracks how these initiatives can help save time and money for the business.

Since its inception in 2014, Bin Trim has provided free waste assessments to 27,000 small businesses under the EPA Waste Less, Recycle More program. The program includes rebates for equipment and so far has diverted 70,000 tonnes from landfill.

Businesses adopting recycling services under the program invested \$1.7 million and avoided \$5.9 million in collection costs. This translates to an average saving of 9% on their waste bills.<sup>32</sup>

### Benchmarking waste management in commercial properties: NABERS Waste benchmark

NABERS Waste was launched by the NSW Government in June 2018. The NABERS Waste rating assesses a building's recycling rate and compares this to NABERS' industry benchmark of performance. For an office building, a 6-star NABERS Waste rating would equate to over 74% of waste recycled, 5 stars for over 30% of waste recycled, and so on.<sup>33</sup> Each rating includes a Materials Recovery Score that reflects the quality of materials recovery in terms of its flow-on potential to add value through recycling.

In the scheme's first year, 23 buildings were rated as part of a trial for a broader roll out.<sup>34</sup> It was found that higher-rated buildings achieved better outcomes by providing a variety of source-separated waste collections to building occupants (including organics collections), and by ensuring that occupants, cleaners and building management worked together proactively to drive down contamination and reduce waste.

The fragmented nature of how businesses manage their waste has been a longstanding issue that calls for a better and more streamlined solution. There can be inefficiencies in service delivery when each business contracts its own services. For example, several different waste collectors may service the same area, collecting waste from adjacent businesses. This increases traffic congestion and road wear and tear. Also, managing large numbers of individual contracts increases the cost of service delivery for producers.

This challenge is not unique to NSW, and other jurisdictions have employed different ways to address this. For example, to improve service delivery for customers, the New York City Council introduced commercial waste zones that split the city into a small number of discrete collection zones with multiple collectors available for households to choose from.

<sup>32</sup> NSW Environment Protection Authority (2019), *Bin Trim*, [www.epa.nsw.gov.au/your-environment/recycling-and-reuse/business-government-recycling/bin-trim](http://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/business-government-recycling/bin-trim)

<sup>33</sup> NABERS Waste (2018), *Introduction to the new NABERS Waste Rating*

<sup>34</sup> NABERS Waste (2019), *NABERS Annual Report 2018/19*, [nabers.info/annual-report/2018-2019/](http://nabers.info/annual-report/2018-2019/)

## Direction 2: Improve collection and sorting

### New York City Commercial Waste Zones

Each year, New York City generates more than three million tonnes of commercial and industrial waste. In November 2019, New York City Council passed a bill to introduce a system in which waste collectors compete for the right to service businesses within 20 geographic collection zones.

Previously, a single neighbourhood could have had more than 50 different collectors, and an individual commercial block would have dozens of private waste collection trucks on a given night.

The commercial waste zone approach is anticipated to create a safer and more efficient collection system for commercial waste that provides a high-quality and low-cost service better equipped to achieve waste reduction goals. It is estimated that the adoption of zones will reduce truck traffic associated with commercial waste collection by more than 60%.<sup>35</sup>

### Smart solutions can revolutionise the way we manage our waste

The waste sector is transitioning to smarter technologies such as smart bins, data and analytics to improve efficiency, safety and productivity.

There are significant opportunities for data and analytics to drive improvements in waste avoidance and management. This includes making more waste and recycling data available online, applying artificial intelligence to sort and separate waste more effectively and safely, and using geographic information system (GIS) analytics to improve the efficiency of collection vehicle fleets.

Enabling all users of waste services—governments, businesses and citizens—to adopt and benefit from smart solutions is likely to improve waste management even further.

### ‘Closing the Loop on Waste’ in Canterbury Bankstown

In 2019–20, the City of Canterbury Bankstown is delivering a project called ‘Closing the Loop on Waste’, which will apply technological solutions to improve waste management in the local government area.<sup>36, 37</sup> It aims to improve residents’ experience of waste services while also reducing the number of waste enquiries, which as at May 2019 accounted for 31% of all customer service calls to the council.

Co-funded by the council and the Australian Government’s Smart Cities and Suburbs Program, the project is a collaboration with Western Sydney University, the Institute for Sustainable Futures at the University of Technology Sydney and Blue Chilli.

Through new data management systems, smart phone applications, hardware and IT systems, the project will, among other things:

- use advanced analytics to detect bin contamination, identify when bins have been missed, and investigate illegal dumping
- upgrade residents’ access to information about bin collections days and other services
- use GPS data and live traffic information to minimise potential delays on collection routes
- enable residents to request services or report incidents, and to upload images of dumped rubbish, which can be assessed before removal
- notify residents when jobs they’ve requested are completed.

<sup>35</sup> City of New York (2019), *Commercial Waste Zones Implementation* [www1.nyc.gov/assets/dsny/site/resources/reports/commercial-waste-zones-plan](http://www1.nyc.gov/assets/dsny/site/resources/reports/commercial-waste-zones-plan)

<sup>36</sup> Department of Infrastructure, Transport, Cities and Regional Development (2019), ‘Closing the Loop on Waste’, <https://www.infrastructure.gov.au/cities/smart-cities/collaboration-platform/Closing-The-Loop-on-Waste.aspx>

<sup>37</sup> City of Canterbury-Bankstown (2019), <https://www.cbccity.nsw.gov.au/smartcities/projects/closing-the-loop-on-waste>

## Direction 2: Improve collection and sorting

### Better public information can improve how we manage our waste

NSW citizens are highly engaged on waste issues, with almost 90% expressing concern with the amount of waste society produces.<sup>38</sup>

Feedback received from stakeholders has revealed a lack of knowledge on how waste is managed locally and nationally. With most of this information coming from media reports, there is limited confidence in what happens to our recycling. There is also confusion about 'what goes where' and which bin to use.

There is a need for better public awareness, tracking and reporting of waste flows, including littering and illegal dumping.

### Almost 90% of NSW citizens are concerned about the amount of waste we produce

NSW has one of the most robust waste reporting frameworks in Australia. The EPA collects detailed waste recovery and disposal data from regulated waste facilities and has a statutory requirement to report on this data every two years.<sup>39</sup> This data is also provided to other government bodies such as the Australian Bureau of Statistics and the Australian Government to inform their own statistical reporting. Local councils also report annually on their average domestic waste charges and performance against state waste targets. Waste charges and outcomes can vary by council area, but the link between the two is not always easily comparable across different council areas.

To meet industry and community demands for more and better information, we need to identify and take up opportunities to provide the public with better information on their waste, including what happens to their waste at the local, state and national levels.



### Local councils need the negotiating power to drive circular economy outcomes

Local councils are the backbone of waste management planning and services and will continue to play a critical role in shaping waste and resource recovery services.

The concentration of waste service providers, particularly in Greater Sydney, makes it difficult for councils to exert the purchasing power needed to drive improved outcomes.<sup>40</sup> There are an estimated 200 contracts between local councils and waste service providers, but the majority of these are held by a few large waste service providers.<sup>41</sup> While there can be benefits from scale, there is also the risk that concentration reduces value for money.

Growing consolidation in the waste industry over time has led the Australian Competition and Consumer Commission to note recently that any future merger or acquisition involving any large suppliers of waste management services would be closely investigated.<sup>42</sup> This partly reflects the effects of a decentralised market, where services are procured separately by each local council. A single council can lack purchasing power and, in some instances, the ability to effectively enforce contract terms.

<sup>38</sup> NSW Environment Protection Authority (2015), *Waste Less, Recycle More Community Benchmark Study*

<sup>39</sup> Section 53 of the *Waste Avoidance and Resource Recovery Act 2001*.

<sup>40</sup> PwC (2019), *NSW Waste Sector: Situational Analysis Report*, Volume II

<sup>41</sup> NSW Treasury analysis

<sup>42</sup> Australian Competition and Consumer Commission 920190, *ACCC will not oppose waste industry acquisition* [www.accc.gov.au/media-release/accc-will-not-oppose-waste-industry-acquisition](http://www.accc.gov.au/media-release/accc-will-not-oppose-waste-industry-acquisition)



## Direction 2: Improve collection and sorting

### Joint procurement could promote a more robust waste services sector

New entrants would increase competition in the sector and improve the robustness of waste services to external disruptions, such as the exit of any one operator. However, new market players can find it hard to enter the metropolitan waste collection and processing sector, hampered by the lack of economies of scale.

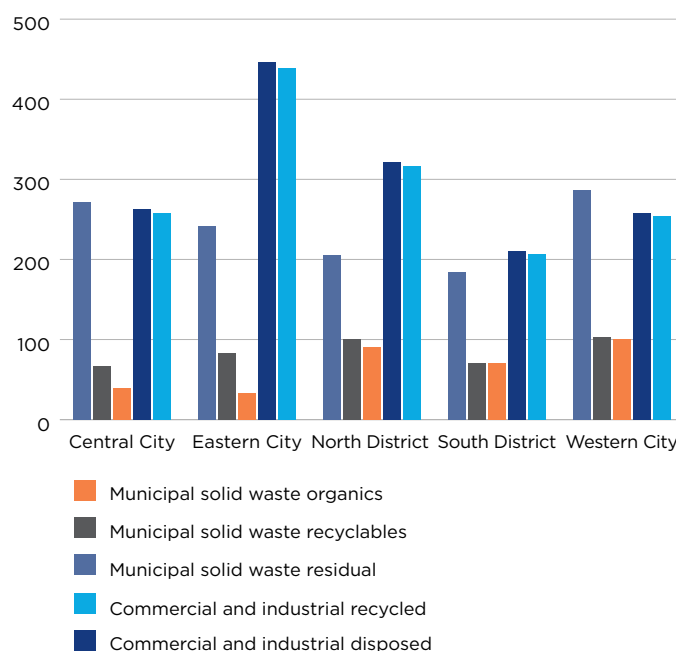
Commercial decisions on establishing or upgrading resource recovery facilities are dependent on the expected volume of demand for those facilities. Examples of resource recovery infrastructure from other states and territories suggest the following benchmark thresholds:

- 50,000 tonnes of food and organics waste for an organics processing facility
- 100,000 tonnes of food and organics waste for advanced tunnel composting or anaerobic digestion
- 100,000 tonnes of co-mingled recyclables for a material recovery facility
- 400,000 tonnes of residual waste for a thermal energy-from-waste facility.<sup>43</sup>

Most local councils on their own do not have the volume of waste to meet these thresholds. However, joint procurement by a group of local councils or combined commercial and industrial and municipal solid waste contracts could make investment in infrastructure viable.

Alternatively, combining municipal solid waste with commercial and industrial collection could create volumes of supply that encourage new entrants or improved services.

Figure 9. Waste volume by Greater Sydney district<sup>44</sup>



Source: NSW Treasury analysis 2019

### The waste levy is a key economic lever to divert waste from landfill

Economic levers play a critical role in both influencing behaviour and providing a source of funding for programs.

The waste levy is the key economic instrument used in NSW to discourage landfilling and stimulate resource recovery. Importantly, it makes recycling more cost-competitive relative to landfill disposal. The levy rates in 2019–20 are \$143.60 for the Metropolitan Levy Area and \$82.70 in the Regional Levy Area.<sup>45</sup>

<sup>43</sup> NSW Treasury analysis

<sup>44</sup> NSW Treasury analysis. Note that municipal solid waste volumes are based on WARR performance data for 2016–17 and likely to increase over time. Commercial and industrial waste volumes are estimated from aggregate PwC modelling allocated by LGA according to ABS data on number of businesses. Greater Sydney district boundaries can be viewed at [www.greater.sydney/district-plans](http://www.greater.sydney/district-plans)

<sup>45</sup> The Metropolitan Levy Area includes the Sydney metropolitan area, Hunter region, Central and North Coast regions extending to the Queensland boarder, Illawarra region and Blue Mountains, Wingecarribee and Wollondilly Local Government Areas. The waste levy increases each financial year by the Consumer Price Index only.

## Direction 2: Improve collection and sorting

The levy has been highly successful in diverting materials back into the economy. However, as with most such economic levers, it can also experience 'leakage' where waste is transported over long distances to low- or no-levy areas, or illegally dumped. For example, regional councils have reported an increase in the funding needed to clean-up and dispose of illegal waste piles since the introduction of the NSW waste levy.<sup>46</sup>

Stakeholders have raised concerns about the continued appropriateness of levy boundaries (see figure 10) for the metropolitan, regional and non-levied areas (unchanged for the last 10 years) and

different levy rates between regions (both within the state, and across state boundaries). In response to stakeholder concerns around levy settings, NSW has also committed to investigating amendments to the regulatory framework to make separated, bonded asbestos waste exempt from the levy.<sup>47</sup>

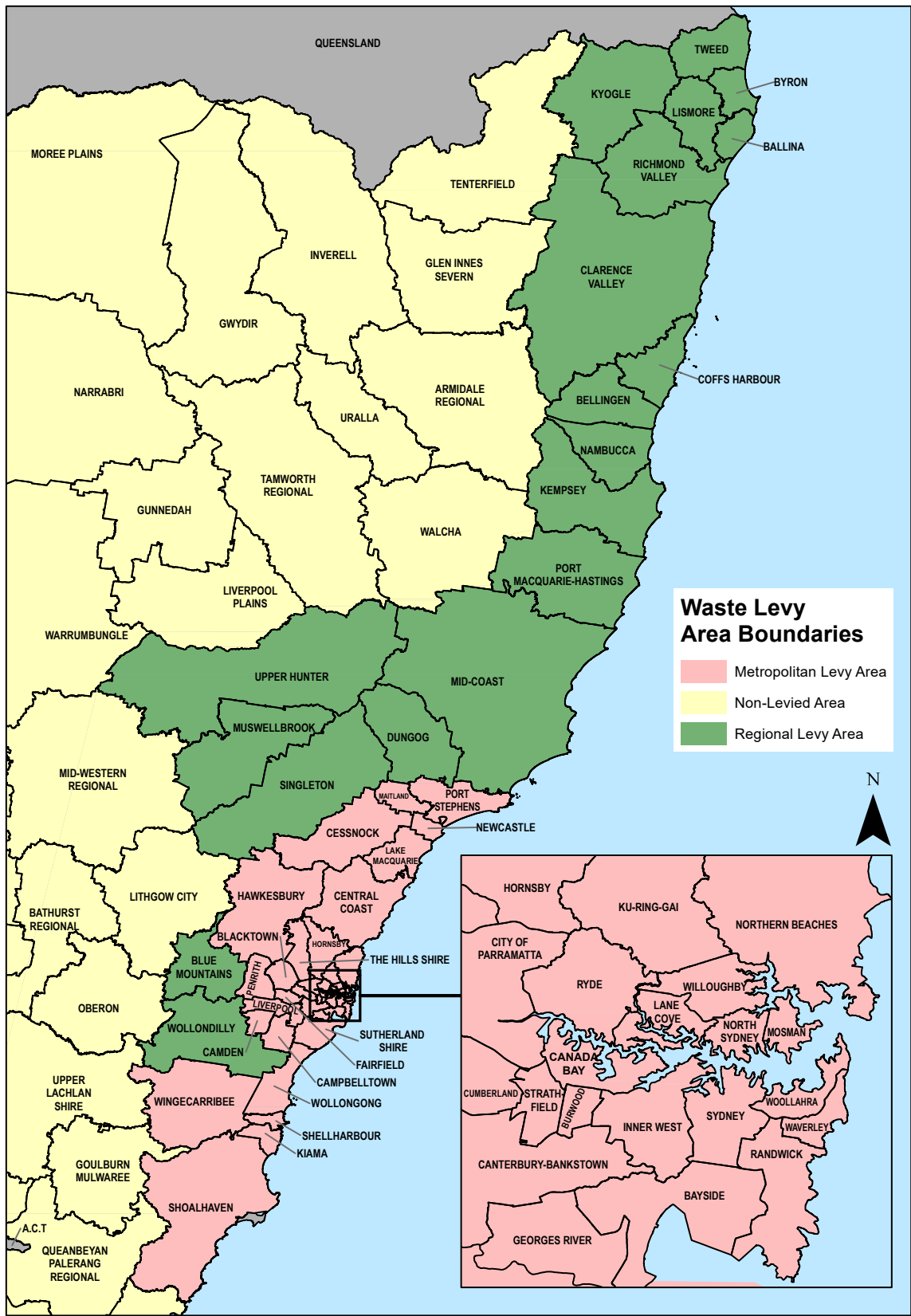
About one-third of the levy has historically been returned to the environment portfolio, including to fund programs such as Waste Less, Recycle More, the largest waste and recycling program in Australia. The future allocation of levy proceeds is a decision that could be informed by the 20-Year Waste Strategy.



<sup>46</sup> LGNSW (2017), *Submission to the Inquiry into the waste and recycling industry in Australia*, 19 Oct 2017

<sup>47</sup> NSW Environment Protection Authority (2019), *NSW Asbestos Waste Strategy 2019–21*, p. 15

Figure 10. NSW waste levy areas



Source: Prepared by the NSW Environment Protection Authority 2020



## Direction 2: Improve collection and sorting

### History of the NSW waste levy

There has been a waste levy in NSW since the 1970s when a \$0.51 per tonne levy was introduced in the Sydney Metropolitan Area. Both the rate and coverage has increased over time.

In 1996 a new levy area, the Extended Regulated Area, was created. The levy rate for this area was initially set at \$4.00 per tonne in 1996–97. A third levy area, the Regional Regulated Area was introduced in 2008. The levy for this area was set at \$10.00 per tonne.

In 2013–14 the levy rates for the Sydney Metropolitan Area and Extended Regulated Area had reached parity and these two levy areas were combined and renamed the Metropolitan Levy Area under the Protection of the Environment Operations (Waste) Regulation 2014. The Regional Regulated Area was also renamed to the Regional Levy Area.

### New economic incentives could empower households and businesses

For households and businesses, waste collection charges do not always provide strong incentive to reduce or recycle waste, to place wastes in the right bins, or to prevent contamination in recyclable materials.

Households are generally charged a fixed waste fee by local councils, regardless of how much waste they generate. For the commercial and industrial sector, the collection of waste is usually charged per bin collection based on the volume of the bin, regardless of whether it is full or not.

To provide more direct incentives to reduce waste, a number of other jurisdictions have employed economic incentives such as volume-based charging or ‘pay-as-you-throw’ schemes to reduce waste generation and encourage more recycling.

### ‘Pay-as-you-throw’ schemes

‘Pay-as-you-throw’ or ‘save-as-you-throw’ schemes involve variable pricing rates based on how much waste councils are required to collect, based on either weighing waste in bins, pre-paid bags or pricing based on different bin volumes.

Since the 1990s, towns in the US state of New Hampshire have embraced ‘pay-as-you-throw’ programs, charging locals \$1–2 for their rubbish bags. The bags come in different sizes and they are the only bags service providers will collect. This pricing and collection mechanism is designed to encourage residents to generate less waste.

The University of New Hampshire recently studied 34 programs across the state and found that they significantly reduced waste disposal rates, in some cases by more than 50% compared to areas without these programs.

Source: [www.colsa.unh.edu/nhaes/article/2018/11/trash](http://www.colsa.unh.edu/nhaes/article/2018/11/trash)

## Options for reform

### Option 2.1 Recovering food and garden organics

Organic waste, such as food scraps and garden trimmings, makes up about 40% of red-lidded kerbside bins. Mandating source separation of food and garden organics will drive down the putrescible component of mixed waste collections. Removing organics from mixed waste collection has the benefits of:

- realising the intrinsic value of organic waste by harnessing its nutrient or energy components (by regenerating soils to store carbon, and using biogas to generate electricity)
- reducing methane emissions from organic waste that would otherwise go to landfill, contributing to NSW’s goal of net zero emissions by 2050
- reducing mixed waste volumes and putrescence, allowing mixed waste to be collected less frequently.

More local councils could transition to combined food and garden organics for households.

## Direction 2: Improve collection and sorting

Similarly, mandatory source separation could be considered for major generators of organic waste – such as food manufacturing, preparation and retail industries (including supermarkets, cafés and restaurants).<sup>48</sup> Many of the large food and grocery chains are already doing this. Mandating this for larger businesses can be used as a starting point to test the effectiveness of the policy, with a possibility of extending the requirement to a wider range of businesses if successful.

Separation of food and garden organics would assist in developing markets by enabling industry to explore options for food waste donation, recovery and on-site treatment, such as small-scale anaerobic digestion to provide energy for industrial precincts, housing estates or large businesses.<sup>49</sup> It has been argued an average council in Sydney could save \$2 million per year by removing 50% of food organics from mixed waste collections.<sup>50</sup> However, it is likely that a transition period would be needed to realise such savings.

Some practical considerations in implementing source separation of food and garden organics include:

- availability of large enough collection areas and kerb space for extra bins (particularly in inner city areas)
- the impact of extra collections on traffic flow
- negotiating contracts with waste service providers
- building capacity within reasonable distance to process the source-separated organic waste.

Different communities may face different issues in managing their organic waste. This may call for different or innovative methods of sorting and collecting organic waste to ensure that the objectives are met, and contamination is kept to a minimum. For example, the Department of Planning, Industry and Environment is already partnering with selected inner-city councils to trial food organics collections in multi-unit dwellings. The lessons from these trials will inform the final 20-Year Waste Strategy.

### The NSW Government is also setting a target for net zero emissions from organic waste by 2030

As part of its commitment to reach net zero emissions by 2050, the NSW Government will set a target of net zero emissions from organic waste by 2030. The 20-Year Waste Strategy will consider opportunities to minimise emissions from food and garden waste and offset residual emissions.

#### Question 2.1:

- What are the key opportunities and challenges associated with mandating food and garden organics source separation?
- What other options could be considered for recovery of food and garden waste?
- What are the key opportunities and challenges with reducing emissions from food and garden waste to achieve net zero emissions from organics by 2030?

### Option 2.2 Standardise collection systems for households and businesses

Evidence from other states and territories shows that standardising the types of waste that are separated at source is associated with high recovery rates.<sup>51</sup> Submissions from local councils have indicated that greater standardisation of collection systems and the materials they take across the state would greatly help address community confusion over what goes into which bin. It would also simplify community engagement activities to support a circular economy and allow for consistent materials standards to be delivered at a state-wide level, including what can and cannot go in each bin.

<sup>48</sup> For example, in Scotland, a policy was introduced in 2012 requiring businesses with a threshold of 50kg of food waste per week to source separate this waste stream. This threshold increased to 5kg by 2016. See PwC (2019), *NSW Waste Sector International Benchmarking Report*, Volume II

<sup>49</sup> MRA Consulting Group (2019), *Review of Separate organics collection legislation: A submission to the NSW EPA 8 May 2019*

<sup>50</sup> MRA Consulting Group (2017), *Laying out the FOGO benefits and challenges* (press release 21 July 2017)

<sup>51</sup> PwC (2019), *NSW Waste Sector International Benchmarking Report*, Volume III

## Direction 2: Improve collection and sorting

This in turn will help maximise the benefits from recycling of the waste being collected. Resource recovery facilities can sort, process and treat the waste more effectively if they are dealing with lower contamination levels.

### Question 2.2:

- How could collection systems (including bins and drop-off facilities) be designed to improve the separation of materials for recycling in your area and/or business?
- Should some sources of waste, e.g. multi-unit dwellings and small business, be considered separately? If so, why?
- What would work best for multi-unit dwellings and small business and why?

### Option 2.3 Network-based waste drop-off centres

Easy consumer access to drop-off points is needed to drive effective collection of bulky and problem wastes. For example, the NSW Government and local councils operate an extensive network of collection points and community recycling centres. There is scope to consider how this can be optimised to achieve greater reach and efficiencies in metropolitan and regional areas.

This could include free pick-up services for elderly or disabled residents such as in San Francisco.<sup>52</sup> It could also include extending the types of waste that can be collected at community recycling centres (e.g. chemicals and any wastes subject to product stewardship schemes).

Other options that could be considered include expanding the network of drop-off points at libraries and shopping centres for smaller waste items such as batteries and lightbulbs. These items can then be aggregated and taken to a community recycling centre.

### Question 2.3:

- How do we further optimise NSW's network of waste drop-off centres and collection points?

### Option 2.4 Waste benchmarks for the commercial sector

Commercial buildings can leverage the NABERS (National Australian Built Environment Rating System) ratings to foster better source separation and waste processing outcomes. These policies aim to benefit building owners and managers by driving increased business, while increasing the incentives for waste diversion.<sup>53</sup>

Government agencies (at the federal and state levels) occupy 25-30% of office space in Australia.<sup>54</sup> They can use their collective procurement power and market share to drive major waste diversion in the commercial and building sector.



<sup>52</sup> Recology (2019), *Household Hazardous Waste Facility*, <https://www.recology.com/recology-san-francisco/hazardous-waste/>

<sup>53</sup> This approach has been highly effective in the energy space, where since 2004 all Australian jurisdictions have introduced NABERS Energy requirements to drive energy efficiency across the office sector. NABERS-rated centres are now reducing energy use and carbon emissions faster than any other sector in Australia. NABERS (2019), *NABERS Annual Report 2018-19*

<sup>54</sup> Australian Government, Department of Finance (2018), *Australian Government Office Occupancy Report*, <https://www.finance.gov.au/government/property-construction/leased-office-accommodation/australian-government-office-occupancy-reports>



## Direction 2: Improve collection and sorting

The NSW Government can play a lead role by assessing the evidence from its own early trials, with a view to introducing minimum NABERS Waste requirements for buildings owned and rented by the government. This could include:

- minimum leasing requirements—agencies will only rent space within an office building that has a certified NABERS Waste rating and with a minimum waste performance
- targets for owned buildings—setting NABERS Waste performance requirements for the portfolio of government office buildings owned.

### Question 2.4:

- How can National Australian Built Environment Rating System (NABERS) Waste ratings be used as an effective tool to drive better waste management practices in the commercial sector?
- What opportunities and challenges do you anticipate if the NSW Government were to introduce minimum NABERS Waste requirements for the buildings it leases and owns?
- Are there opportunities to roll out similar requirements to other sectors?

### Option 2.5 Innovation and ‘waste-tech’

Innovation is critical to the circular economy. As waste management practices evolve, emerging science and technologies provide new solutions to managing our waste and responding to end-market demands for recovered materials.

We need to engage actively with research organisations, universities, start-ups, industry and the general community to accelerate innovation and the adoption of new technologies. NSW has world leading research, technical and translational capabilities that could be leveraged to solve technical and non-technical challenges. Collaboration is already happening through, for example, the NSW Circular Economy Innovation Network and CSIRO, and some councils have ‘smart city’ initiatives.

But more can be done to commercialise technologies as well as develop new waste-tech solutions. For example, circular economy incubators could help develop potentially disruptive solutions to waste issues. These could eventually be commercialised through partnerships with investors, business and governments.

### Question 2.5:

- What are the key barriers to innovation in the waste and resource recovery sector?
- How can the NSW Government help to foster innovation and partnerships in waste management?

### Option 2.6 Joint local council procurement

There is significant scope for local councils to make greater use of their collective purchasing power to provide more effective waste management services. Councils could be encouraged to jointly procure and manage waste services to support long-term outcomes, including regional infrastructure planning and economic development opportunities.

This approach could encourage the waste industry to invest in new infrastructure as a result of securing greater volumes of waste material combined from several local councils using long-term contracts.

There are many ways to encourage joint procurement. One option is to use a specialist entity to facilitate and support joint procurement of waste services on behalf of local councils to support commercial partnerships. This could give local councils access to the expertise necessary to engage with the market to drive innovation and investment in waste outcomes and reduce price disparities.

### Question 2.6:

- How can local councils best be encouraged or supported to collectively procure waste services?
- What are the key issues that should be considered?

## Direction 2: Improve collection and sorting

### Option 2.7 Combining commercial and industrial waste collection services

There is an opportunity to explore mechanisms to combine commercial and industrial waste collection services to support Option 2.6.

Solutions could include exploring a model similar to the New York City Council's commercial waste zones, where waste service providers compete for the tenders to provide waste services to commercial buildings within predefined collection zones.

Another option could be to integrate municipal solid waste and commercial and industrial waste streams. This could address the problem of disaggregated commercial waste services as well as bolster local council collection services to cover both waste streams.

Some councils already provide services for small and medium-sized businesses that have similar requirements to households, but most local councils have limited incentive to take on commercial and industrial waste services. A body acting on behalf of councils could leverage the additional waste volumes available from commercial and industrial collections to improve system-wide regional services and enable councils to tender for contracts to collect both municipal solid waste and commercial and industrial waste across specific geographic zones.

#### Question 2.7:

- What are your views on the opportunities and challenges of combining commercial and industrial waste streams?
- What are your views on the potential solutions of creating commercial waste zones, or combining municipal solid waste and commercial and industrial waste collections?

### Option 2.8 Economic incentives and the waste levy

The waste levy and complementary economic incentives such as waste charges and penalties are some of the most powerful tools we have to reduce waste and improve recycling rates.

It is timely to review existing and potential new economic levers to ensure the settings remain fit-for-purpose, reflect population growth, are aligned with circular economy objectives, and consider new waste materials and processing capabilities. The review could consider:

- waste levy boundaries within NSW to ensure they remain fit for purpose
- the removal of the waste levy on 'problem wastes' with limited feasible alternatives, such as hazardous and liquid wastes
- national harmonisation of waste levies to mitigate unnecessary cross-border movements of residual waste
- complementary price-based instruments to promote waste reduction and recycling. This may include pay-as-you-throw initiatives where councils or waste operators could charge a fee upfront to large generators of waste, or volume-based charging to encourage waste reduction
- reviewing penalties for littering or other mechanisms to maximise the value of materials put into the waste stream.

#### Question 2.8:

- What are your views on the right settings for these waste levy parameters?
- What other price-based incentives should be considered?
- Which would work best in practice?
- Please provide evidence for your response, if possible

## Direction 3: Plan for future infrastructure



### The case for action

#### Additional waste and resource recovery capacity is needed

Additional landfill capacity will be required in the next 20 years to respond to growing waste generation. The pressure on landfills can be managed, and the life of landfills extended, where efforts are made to slow the rate of landfilling. However, new and expanded recycling infrastructure will be key to enabling more resource recovery and landfill diversion.

Often it can take many years to plan, seek necessary approvals and construct high impact facilities such as landfills and hazardous processing facilities. Therefore, it is critical to plan and prepare early for all types of waste and resource recovery infrastructure including:

- drop-off points including local community recycling centres
- transfer and sorting stations
- precinct and place-based treatment/composting of food and garden organics
- recycling and remanufacturing facilities to turn waste into a valued commodity
- energy from waste facilities to provide an option for treating residual waste
- landfill capacity to address residual waste where there are no economically feasible alternatives.

Figure 11 shows the location of waste facilities in NSW. If waste infrastructure is not resilient to change and cannot keep pace with demand for waste and resource recovery services, there is a risk that the cost of these services may increase, placing pressure on households and businesses.

#### Infrastructure and systems need to be able to respond to disaster and emergencies

Emergencies, natural hazards and environmental disasters can generate large amounts of waste that can pose risks to human health, businesses and the environment. Managing that waste safely and quickly is a key factor in accelerating the re-establishment of affected communities and businesses. In the absence of contingency planning, waste from an emergency, natural hazard or environmental disaster can overwhelm local waste management and resource recovery infrastructure and place additional burden on local governments.

During the 2019-2020 bushfire season, bushfires have burned over 5.5 million hectares in NSW and over 8,000 buildings were damaged or destroyed. This resulted in a substantial amount of waste (from damaged infrastructure, trees, roads etc) that needed to be identified, safely removed and managed. As the frequency and intensity of some types of natural hazards such as bushfires, heat waves and heavy precipitation increase, there will be a correlated increase in volumes of wastes generated from these events that needs to be appropriately managed.

It is critical that the management of waste is also resilient to respond to emergencies and disasters and therefore long-term planning for waste is needed at a local, regional and the state-level. A key part of this planning is in relation to provisioning the capacity of infrastructure and planning transport and logistics to accommodate large amounts of waste generated over a short timeframe.



## Direction 3: Plan for future infrastructure

### Waste and resource recovery lands need to be planned, retained and managed

Just as households and businesses expect water, energy and transport services to be in place when new developments are established, so too should well-planned waste and resource recovery services. These are essential services and need to be embedded into city and regional planning.

Waste and resource recovery infrastructure planning is complicated by high land costs, poor availability of suitable sites, the need for access to freight transport links and difficulties in obtaining a social licence to operate for high impact developments.

Submissions to the 2018 NSW Portfolio Committee Inquiry into Energy from Waste Technology indicated that there is limited strategic planning for waste infrastructure, which contributes to 'ad hoc' infrastructure developments.<sup>55</sup>

Industry and local councils have reported it is becoming increasingly difficult to find appropriately zoned land to build waste and resource recovery infrastructure including transfer stations, replacement landfills and energy-from-waste facilities (including fuel manufacture, thermal and electricity generation).<sup>56</sup>



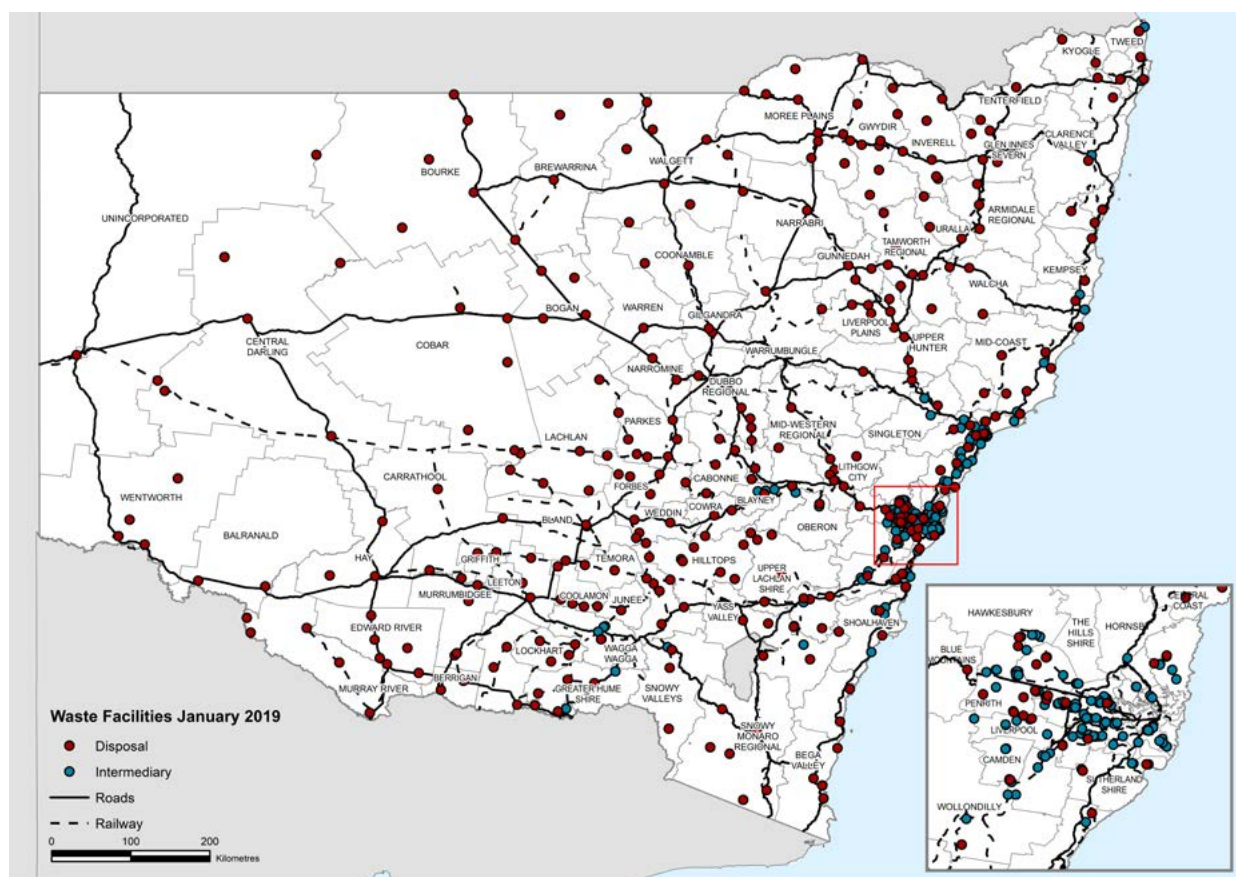
Even when land is identified, urban encroachment, negative public sentiment towards facilities, and competition for commercial and industrial sites make it increasingly difficult and expensive to secure land for waste and recycling facilities, particularly in Greater Sydney. Existing facilities are similarly under threat from urban encroachment and competition for higher value uses of land.

<sup>55</sup> NSW Legislative Council (2018), 'Energy from waste' technology <https://www.parliament.nsw.gov.au/lcdocs/inquiries/2436/Final%20-%20Report%2028%20March%202018.pdf>

<sup>56</sup> PwC (2019), *NSW Waste Sector Final Key Findings Report*, Volume II

## Direction 3: Plan for future infrastructure

Figure 11. Waste facilities in NSW



**Source:** NSW Environment Protection Authority (2019), Waste facility locations.

**Note:** An intermediary facility includes recovery facilities and transfer stations.

Hazardous waste collection and processing (such as contaminated soil and liquid waste) needs specialised and appropriately located facilities. These developments are complex and finding appropriate sites is not easy. However, if such facilities are not planned there is the risk of illegal stockpiling, which could lead to contamination and pollution.<sup>57</sup>

The *Greater Sydney Region Plan: Metropolis of Three Cities* provides principles to retain, grow and enhance these lands reflecting Greater Sydney's three cities, and their local context. These principles are applied to District Plans and are being implemented through Local Strategic Planning Statements.

Building on this foundation, it is important that we ensure these lands are protected and explore their strategic use to support future infrastructure needs and facilitate investment, innovation and economic development. To this end, Place-based Infrastructure

Compacts (PIC) and precinct could more actively embrace waste and resource infrastructure planning.

The PIC is a new collaborative model developed by the Greater Sydney Commission that looks holistically at a place to identify the most cost-effective sequencing for growth in jobs and homes with providing infrastructure and services at the right place and at the right time. By better aligning growth with infrastructure and services, government can deliver quality outcomes for people and the environment. The PIC has been piloted in the Greater Parramatta to Olympic Peninsula area. Feedback from public consultation in late 2019 found that there are opportunities to include further infrastructure, beyond that provided by state agencies and utility providers, including waste and resource recovery infrastructure. The PICs in the Western City will consider these opportunities.

<sup>57</sup> For example, in late 2018 in Victoria over 19 million litres of illegally stored waste solvent in multiple industrial sites was discovered. The illegally stored volumes far exceeded the treatment capacity for waste solvents in Victoria

## Direction 3: Plan for future infrastructure

The benefit of shared utility corridors would enable greater opportunities for integrating potable water, wastewater, solid and organic waste, recycled water and energy to meet circular economy objectives.

### Transport needs to be integrated into infrastructure planning

Transport is one of the largest costs in managing waste and resources. It costs an estimated \$10.40 per tonne per hour to transport non-hazardous waste.<sup>58</sup> The volume of waste and recycled materials transported in NSW is projected to increase by 43% (from 12.8 tonnes to 18.0 tonnes) between 2016 and 2036.<sup>59</sup> This increase could have significant impacts on the amenity of neighbourhoods and the environment unless waste and resource recovery infrastructure planning is integrated with the NSW freight and logistics network.

As the city's existing landfills reach capacity, waste increasingly will need to be transported to consolidation points, such as transfer and sorting stations, within Greater Sydney before being transported to resource recovery or disposal facilities.

Regional areas also face unique transportation challenges as trucks must travel a significantly longer distance to collect a smaller amount of waste.<sup>60</sup>

### The volume of waste and recycled materials transported in NSW is projected to rise by 43% by 2036

Access to rail transfer terminals (and capacity on rail lines) could support the development of processing capacity outside metropolitan areas. However, industry feedback suggests that there are still significant challenges in securing both suitable regional sites as well as capacity on rail lines for transporting waste, compared to other higher-value commodities from, for example, the mining,

manufacturing and agriculture sectors.

Effective transport links are particularly important if NSW is to attract large-scale waste and resource recovery facilities. Large-scale facilities could provide more efficient, co-located services that can combine waste from different regions and areas.

### Parkes Special Activation Precinct

The NSW Government is leading the development of the Parkes Special Activation Precinct (SAP), which will connect global freight markets to local businesses and agricultural producers. It will create a thriving regional hub that facilitates business development opportunities and regional employment growth.

Environmentally sustainable design is central to the Parkes SAP, including measures to implement a sustainable, carbon-neutral and climate-resilient precinct. The circular economy will be supported by a centralised resource recovery precinct incorporating an energy-from-waste facility, in-depth understanding of precinct waste outputs and continuous innovation to reduce precinct waste generation.

It is critical to identify suitable sites that have good transport links with the generators of waste. This can be complemented by smart solutions to track waste flows, including by optimising transportation of waste, such as through smart sensors on bins to identify when and where bins need to be collected. There are now a number of examples of such smart bins emerging over recent years, such as those deployed in the City of Sydney, City of Newcastle and City of Canada Bay.<sup>61, 62, 63</sup> These can improve urban amenity, as well as reduce vehicle kilometres travelled and generate useful data on use and waste generation to assist local government in planning its services and contracts.

Current planning requirements already call for new developments to have their own waste management plans. This planning could evolve so that site-

<sup>58</sup> The Centre for International Economics (2017), *Headline economic value for waste and materials efficiency in Australia*

<sup>59</sup> Transport for NSW (2018), *NSW Freight Commodity Demand Forecasts, 2016 – 2056*

<sup>60</sup> PwC (2019), *NSW Waste Sector Key Findings Report, Volume I*

<sup>61</sup> City of Canada Bay (2019), *City of Canada Bay bins get smart* [www.canadabay.nsw.gov.au/news/city-canada-bay-bins-get-smart](http://www.canadabay.nsw.gov.au/news/city-canada-bay-bins-get-smart)

<sup>62</sup> Newcastle City Council (2017), *Smart Cities Strategy 2017- 2021* [www.newcastle.nsw.gov.au/Living/Our-City/Smarter-Living/Strategy-and-Actions](http://www.newcastle.nsw.gov.au/Living/Our-City/Smarter-Living/Strategy-and-Actions)

<sup>63</sup> City of Sydney (2015), *Underground waste trial* [www.cityofsydney.nsw.gov.au/vision/better-infrastructure/buildings-and-facilities/completed/underground-waste-trial](http://www.cityofsydney.nsw.gov.au/vision/better-infrastructure/buildings-and-facilities/completed/underground-waste-trial)



## Direction 3: Plan for future infrastructure

by-site developments encompass a strategic place-based context where waste avoidance and resource recovery outcomes (or even targets) are incorporated into the design and planning process, particularly for commercial and medium- and high-density developments and precinct developments to drive real change in waste and recycling behaviours into the long term.

### Well-planned infrastructure is a long-term investment

Waste and resource recovery infrastructure can be an attractive long-term investment for the private sector and institutional investors such as superannuation funds. As a key service, it can provide steady rates of return through different economic cycles. The returns from recycling and other waste treatment methods and technologies may also increase over time, as volumes increase and productivity gains from technology grow.

To optimise investment opportunities and outcomes, strategic economic development programs in both metropolitan and regional areas should consider the role of circular economy infrastructure as a long-term economic driver.

Such programs could include innovative ways to attract long-term investment in waste and resource recovery infrastructure. Potential innovative financing models could include co-investment in new infrastructure, sustainability financing and other outcomes-based investment models.

### Sustainability financing

Demand for sustainability financing, where sustainability issues are considered in the decisions made by financial market participants (including governments), has grown rapidly over the last decade. In Australia, the number of green bonds has nearly doubled from \$3.3 billion in 2017 to \$6 billion in 2018. Over \$3.9 billion in green bonds was raised in the first half of 2019 alone.<sup>64</sup>

AusTCorp (2019), Australia is the third-largest issuer of green bonds in the Asia-Pacific region, behind China (US\$91.5 billion) and Japan (US\$12.4 billion) and was ranked tenth internationally as of 30 June 2019.

In November 2018, NSW Treasury Corporation issued a record-breaking \$1.8 billion 10-year green bonds. The proceeds were allocated to low-carbon transport and sustainable water projects. This was the first transaction under the NSW Sustainability Bond Programme <https://www.tcorp.nsw.gov.au/html/sustainabilitybonds.cfm> for issuing green, social and sustainable bonds, providing a mechanism for investors to contribute capital towards environmental and social goals. The market for sustainability-linked financing and green bonds is developing globally. Criteria for waste management low carbon investments is under consideration as part of the Climate Bonds Standard.<sup>65</sup>

## Options for reform

### Option 3.1 Long-term waste and resource recovery infrastructure needs

To provide predictability and certainty, the 20-Year Waste Strategy will consider the following:

- assessing infrastructure needs across NSW within a systems-based framework, including mapping waste flows and the industrial and urban services land that could be appropriate for waste and resource recovery infrastructure that is integrated with freight and logistics networks<sup>66</sup>
- ensuring new residential and commercial developments have adequate waste drop-off and collection points with enough space to accommodate larger vehicles, or vacuum systems that transport waste from high-density developments to a hub with vehicle access

<sup>64</sup> TCorp (2019), *Creating a sustainable future, NSW Sustainability Bond Program Annual Report 2019*

<sup>65</sup> Climate Bonds Initiative (2019) <https://www.climatebonds.net/standard/waste>

<sup>66</sup> This refers to land identified in the NSW Government's Environment's Employment Lands Development Monitor. The term 'urban services' is used to describe a wide range of industries that enable a city to develop and its businesses and residents to operate

## Direction 3: Plan for future infrastructure

- place-based design principles for different types of waste and resource recovery infrastructure and collection facilities, especially for medium and high-density developments
- facilitating onsite or mobile solutions to reduce the volume of waste being transported. This may include equipment such as shredders and balers to pre-process waste into more compact forms for transport, or small-scale onsite treatment facilities for organic waste (e.g. anaerobic digesters) where feasible
- reviewing waste and resource recovery facility operations and licensing to minimise truck movements in peak hours. This could include options to extend night-time collection and facility operations in areas that are not primarily residential, combined with increased use of quieter vehicles
- accelerating the use of smart sensors on bins to alert councils or waste collectors when bins need to be collected, and optimising transport logistics (e.g. scheduling 'milk runs' or multi-stop collections along a route that optimises truck use and minimises logistics costs)
- facilitating the adoption of new infrastructure or technology that can reduce greenhouse gas emissions from waste collection (for example, electric garbage trucks), processing, recovery and disposal
- making better use of existing and exploring new open data sources to support infrastructure planning and investment decisions
- investigating the potential for one or more integrated utility corridors that deliver multiple services.

### Question 3.1:

- What data and information needs to be included in a waste infrastructure needs assessment to ensure it will effectively support planning and investment?
- What role should the NSW government, local councils and industry play in meeting landfill and recycling capacity needs?

- How can government and industry better encourage innovation in waste infrastructure, to ensure it is sustainable, adaptive and responsive over time?
- What are the barriers and opportunities to reducing greenhouse gas emissions from waste collection, processing, recovery and disposal?
- What are the barriers and opportunities to improve waste transportation and logistics issues?

### Option 3.2 Place-based developments

To better utilise land, minimise transportation costs and promote innovation through joint and complementary uses, the feasibility of and the barriers to place-based waste management developments should be explored. Issues that could be considered include:

- ensuring residential waste drop-off and collection points (e.g. apartment loading bays, front yards or kerbside space) can accommodate the required number of separate bins for collection
- co-locating community recycling centres with processing facilities
- onsite treatment facilities for organic waste (e.g. small-scale anaerobic digester plants) where it will not cause significant impacts to surrounding areas, people or industries
- co-locating major industrial facilities (including waste water treatment facilities) that provide feedstock to waste processing or recycling facilities as well as material recovery facilities that provide feedstock to major industrial facilities
- co-locating industrial facilities with technologies that convert energy from waste, which is then delivered back into the precinct
- investigating shared utility corridors to make more efficient use of land and better manage the disruptive impacts of utility maintenance on people, roads and other assets

## Direction 3: Plan for future infrastructure

- piloting a requirement for new major housing developments or precincts to embed waste and recycling targets in their design. This should include both how waste is managed during the construction phase, as well as how waste can continue to be managed and tracked beyond the completion and occupation of the precinct.

### Question 3.2:

- What are the key opportunities and barriers to developing place-based waste infrastructure?
- What would a modern waste precinct look like and where in NSW could this work?
- What is the role for government in achieving the desired outcomes and what are the most effective levers it can apply?

### Option 3.3 Making it easier to do business

Our waste infrastructure needs will change as we transition to a circular economy. Long-term private capital investment will be critical for NSW to manage waste flows sustainably, including a shift towards higher-value resource recovery.

Any form of investment needs a suitable regulatory policy and financing environment. Clear, consistent and robust environmental and planning rules are needed to support waste and resource recovery infrastructure investment. Areas that could be explored include:

- integrating waste and resource recovery infrastructure planning with regional, district and local strategic planning
- ensuring waste and recycling services are considered up-front in planning processes by setting targets and outcomes, particularly for medium- and high-density developments
- reviewing statutory instruments (such as the Infrastructure State Environmental Planning Policy 2007) to ensure they effectively support waste and resource recovery infrastructure provision in NSW
- providing a concierge industry attraction service to facilitate infrastructure investment opportunities

- making regulatory decision-making and compliance expectations clearer and simpler, particularly for complex regulatory matters such as the Energy from Waste policy, and the EPA's Resource Recovery Orders and Exemptions framework
- simplifying regulatory communications, and making them more customer-focused
- setting up a regular dialogue between the regulators and industry through an industry reference group.

### Question 3.3:

- What mechanisms could be used to improve regulatory and financial certainty for investors and how could these be implemented?
- What are the priority measures that could be introduced to make it easier to do business?

### Option 3.4 Innovative financing models

Commercial and government sectors could look at innovative ways to attract long-term investment in new circular economy infrastructure, including through sustainability financing, that incorporates specified social and environmental criteria and reporting requirements.

### Question 3.4:

- What are your views on the opportunities for innovative financing models in the waste and resource recovery sector?
- How can government best facilitate investment in infrastructure and services that contribute to circular economy objectives?



## Direction 4: Create end markets

### The case for action

#### There is scope to significantly improve our resource recovery rates

There is scope for NSW to accelerate its transition to a system that adds value to recovered materials. In NSW, construction and demolition waste accounts for over half of all waste generated. The 77% recovery rate for the state's construction and demolition waste is a good outcome but could be even further improved.<sup>67</sup> In Europe, 16 countries including the United Kingdom, Slovenia, Belgium and the Netherlands reported recovery rates for construction and demolition waste in excess of 90%.<sup>68</sup> If NSW increases recovery of its construction and demolition waste to 90%, this will push the state's total waste recovery rate for all streams from 65% to 73%.

For the municipal solid waste and commercial and industrial waste streams, the current 42% and 53% recovery rates respectively offer significant room for gains. Some 35% of residual municipal solid waste going to landfill is made up of food organics, despite the potential to convert this to compost and energy.<sup>69</sup>

Municipal solid waste food organics are estimated to make up 11% of annual waste volumes to landfill. This represents a major opportunity for recovery into compost and other applications.

#### We need to increase our resilience to external shocks

In 2016–17, some 240,000 tonnes of waste in NSW that could be recycled was exported overseas.<sup>70</sup> In 2018, China and other Asian export markets began to reject some waste materials that exceeded their new contamination thresholds (0.5% to 1%). In August 2019, the Council of Australian Governments agreed to set a timetable to stop exports of glass, tyres, paper and cardboard, and plastic.

Although exports make up only 7% of NSW's total recycled waste, the shift in global policy has reduced prices for recovered paper, plastic and glass. It has been argued that this has put at risk the financial viability of materials recovery, increasing the costs to local councils to dispose of waste materials into landfill.<sup>71</sup>

#### There is low demand for many recycled materials

Greater recovery of resources from waste is unsustainable without access to a pipeline of demand for such input-ready materials, either in domestic or global markets.<sup>72</sup>

There are established or growing markets for some products that are recovered from waste, such as compost (from recovered organics), paper and steel. But demand for other recovered materials like plastics, textiles and glass is less than the volume of waste we generate.<sup>73</sup>

<sup>67</sup> NSW Environment Protection Authority (2019), *Waste Avoidance and Resource Recovery Strategy Progress Report 2017–18*

<sup>68</sup> Eurostat (2019), *Recovery rate of construction and demolition waste*, <https://data.europa.eu/euodp/en/data/dataset/uCZdo4Z1o5qcLlbdtkbHQn>

<sup>69</sup> MRA Consulting Group (2018), *China National Sword: The role of Federal Government, A discussion paper prepared for the Australian Council of Recycling*

<sup>70</sup> NSW Environment Protection Authority (2018), *Too Good To Waste Discussion paper on a circular economy approach for NSW*

<sup>71</sup> MRA Consulting Group (2019), *Review of Separate organics collection legislation: A submission to the NSW EPA 8 May 2019*

<sup>72</sup> PwC (2019), *NSW Waste Sector: Key Findings*, Volume I

<sup>73</sup> PwC (2019), *NSW Waste Sector: Key Findings*, Volume I

## Direction 4: Create end markets



There are opportunities to use recovered materials on a larger scale than is currently the case. For example, while clean, colour-sorted glass can be remanufactured into containers, an increased volume of mixed glass waste could also be recovered into glass sand and used as an input into products such as road base.

However, in many cases recycled materials can be more costly than their non-recycled counterparts. The lack of consistent standards for recycled content and materials can also be a barrier to greater uptake of these products. Without stronger demand for 'input ready' materials, there are few incentives for the waste industry to invest in recovering these materials.

Improving markets for recycled materials will require collaborative efforts by consumers, business and state and local governments. Consumers (including governments) play a large role in determining what is on the market shelf and can exercise buying power to demand products with recycled content. Businesses are also key to innovation in manufacturing and product development, to provide opportunities for recycling more waste materials.

The more of these materials could be recovered, the greater the benefits for sustainable industry growth and jobs.

### Supporting environmentally sustainable procurement

In 2010 the Danish Government established the Partnership for Public Green Procurement, which involves a community of municipalities, regions and public organisations that promotes sustainable purchasing to drive markets to use less environmentally harmful products. The partnership accomplishes this by developing common procurement goals aimed at addressing key environmental issues. These form the basis for the members' individual purchasing policies and procurement agreements.

Each year the partnership develops new procurement targets and regularly reviews the existing targets and updates the environmental requirements if something new happens. Procurement goals include purchasing:

- seasonal fruits and vegetables
- recycled paper
- reused bricks in new developments (e.g. new public buildings)
- sustainable wood.

Source: [ansvarligeindkob.dk/om-os](https://ansvarligeindkob.dk/om-os)

### There are opportunities to use recycled material in infrastructure projects

NSW has the largest infrastructure pipeline in Australia. There are substantial opportunities for state and local governments, which are the major investors in infrastructure, to use more recycled materials in major projects.

Some of the common challenges encountered in incorporating recycled content as part of infrastructure construction include:

- appropriate standards and specifications across a wide range of products and uses
- the process and timeframe needed for pilots when using novel materials
- the cost of recycled material is sometimes higher than virgin material, for example plastic packaging and glass sand.

## Direction 4: Create end markets

Both the NSW Government and local councils are actively investigating the use of recycled content in infrastructure development. This includes using recycled content in road base, pavements, construction materials, landscaping and sound insulation among many other applications.

Transport for NSW is using crushed concrete, brick and reclaimed asphalt in road base, bedding materials and drainage structures, and has successfully trialled the use of recycled glass in concrete mix for pavements.

Moving forward, there are opportunities to develop or update specifications for other recycled content, such as the use of plastic in construction and road base, which will allow for greater uptake of a wider range of recycled materials.

### Delivering recycled content in construction projects

The United Kingdom Government has established procurement guidance on meeting targets for using recycled content in construction projects. The targets aim for at least 10% of the total value of materials from recycled and reused content. Where materials are available and cost-competitive with alternatives, recycled content of 15% to 20% is considered 'good practice'.

There are several examples where these targets apply:

- The Scottish Government has asked all public bodies in Scotland to set 10% recycled content as a minimum standard in major public sector projects
- The Welsh Assembly Government has set a 10% recycled content target in major regeneration projects and Welsh Health Estates applies a key performance indicator and target in health sector procurement
- The Olympic Delivery Authority adopted minimum standards of at least 20% (by value) recycled content for permanent venues built for London 2012.

- Minimum recycled content standards have been adopted for regeneration by South West England and Yorkshire Forward Regional Development agencies, Leeds Holbeck and Raploch Urban Regeneration Company.

Source: [www.wrap.org.uk](http://www.wrap.org.uk)

### Energy recovery can be an option for materials that have limited further market value

Even after fostering markets for recycled materials, there will still be residual waste materials that cannot be recycled.

Energy recovery is recognised in the NSW waste hierarchy and in the *NSW Energy from Waste Policy Statement* as a valid alternative to landfilling where it is not financially sustainable or technically achievable to reuse or recover residual waste.<sup>74</sup>

However, in feedback provided to the 2018 NSW Portfolio Committee Inquiry into Energy from Waste Technology, many stakeholders said the policy statement could be improved by providing more specific guidance about energy from waste project requirements, including:

- resource recovery criteria, to ensure waste is appropriately sorted
- guidance around the siting and size of energy from waste facilities, noting that unlike in Europe, smaller energy from waste projects may not be viable in Sydney, but may have a higher rate of community acceptance
- more detailed information on expected community engagement practices and outcomes.<sup>75</sup>

<sup>74</sup> The *NSW Energy from Waste Policy Statement* (2015) sets out the policy framework and overarching criteria that apply to facilities in NSW proposing to thermally treat waste or waste-derived materials for the recovery of energy. The policy includes resource recovery criteria to ensure recyclables are not included in the fuel mix.

<sup>75</sup> NSW Legislative Council (2018), 'Energy from waste' technology, <https://www.parliament.nsw.gov.au/lcdocs/inquiries/2436/Final%20-%20Report%2028%20March%202018.pdf>



## Direction 4: Create end markets

### Option 4.1 Recycled content in government procurement

Expanding the use of recycled content in the construction of infrastructure projects could contribute significantly to diverting waste from landfills. State and local governments could foster markets for recycled materials through procurement standards for recycled content.

Building on the specifications and trials established by Transport for NSW, further trials for unfamiliar or untested materials could be carried out. Following this work, minimum and best practice targets could be established.

There are opportunities to explore the use of recycled content in major projects. Some already have targets in place; for example, the Sydney Metro project already has a target to source 100% of timber from reused, recycled or responsibly managed sources, and committed to use recycled materials or materials sourced from environmentally accredited bodies where possible throughout its construction and operation.<sup>76</sup>

New developments like the Western Parkland City, Australia's largest greenfield development area, could provide an opportunity to increase recycled content in construction. Work is expected to start in 2020, and requirements for recycled content will be outlined as part of master plans and procurement. The early lessons from this process could be used to inform other projects and development areas.

#### Question 4.1:

- What are the main challenges and opportunities for using recycled content in state and local infrastructure projects and major development areas?
- Should procurement targets be established and what is the best way to develop and implement them?

### Option 4.2 Standards for recycled content and materials

Manufacturers and the government could work together to develop and disseminate standards for recycled content and materials. Setting standards for the quality of recycled materials can set clear market expectations for waste processors to develop 'input-ready' materials. It will also help overcome market uncertainty and encourage the development of markets for recycled products.

Certification and labels could provide buyer assurance and improve transparency and awareness around products that include recycled content. This could drive product innovation, where it provides an opportunity for business differentiation.

Any scheme would likely need to be implemented nationally, have broad industry support and include clear requirements for certification to avoid false and misleading claims.

To drive these efforts, NSW could consider mandating product standards for priority items using recycled content. Packaging may be considered as a starting point. Australian packaging companies have already signed up to the Australian Packaging Covenant Organisation (APCO) industry target to shift to 10% recyclable, reusable or compostable packaging by 2025, and a mandated target in NSW could substantially support progress towards this target nationally.

#### Question 4.2:

- What are the priority areas that standards and certifications should focus on?
- How critical do you think standards and certification are to developing markets for recycled content?

<sup>76</sup> Transport for NSW (2019), *Sydney Metro City and Southwest Sustainability Strategy 2017-2024*, June 2019 update, [www.sydneymetro.info/sites/default/files/document-library/CSW-Sustainability-Strategy-June-2019\\_0.pdf](http://www.sydneymetro.info/sites/default/files/document-library/CSW-Sustainability-Strategy-June-2019_0.pdf)

## Direction 4: Create end markets

### Option 4.3 Match suppliers with markets

There are a number of services that can help match waste processors and re-manufacturers with markets for their input-ready products. These connections are important in overcoming the information imbalance between suppliers of recycled content and manufacturers.

Services provided specifically for the resource recovery industry include CSIRO ASPIRE, Planet Ark's National Circular Economy Hub and Marketplace (planned for launch in 2020), and the NSW Circular Economy Network, a NSW Government program to support research and development and innovation for businesses looking to improve materials recovery through advanced re-manufacturing.

Addressing information barriers, particularly around materials supply, could provide businesses greater confidence in adapting manufacturing processes or introducing new processes to replace virgin materials. Initiatives could include:

- creating a better flow of information on new suppliers and technologies to create greater awareness of the circular economy supply chain
- leveraging existing networks to provide larger, more integrated and well-informed connections between suppliers and markets for recycled material, including through using government procurement platforms such as:
  - the Industry Capability Network—an independent organisation supported by New Zealand and Australian state and territory governments that provides a digital platform and direct capability-matching services to assist Australian producers find local suppliers
  - Local Government Procurement—a subsidiary of Local Government NSW that provides a fully-integrated procurement service to local councils and associated organisations in NSW
  - ProcurePoint—a one-stop portal for NSW Government procurement that matches suppliers with markets.

#### Question 4.3:

- How can industry and government best work together to foster partnerships and address information barriers to the uptake of recycled materials?

### Option 4.4 Best-practice regulatory environment for energy from waste projects

Energy from waste can play an increasingly important role as an alternative to landfilling over the next 20–30 years, as a means of recovering some value from residual waste where other higher-order methods of recovery are not financially or technically feasible.

The 20-Year Waste Strategy presents an opportunity for stakeholders to work with the Department, the EPA and the Office of the NSW Chief Scientist & Engineer to review the *2015 NSW Energy from Waste Policy Statement* to ensure it is aligned with international best practice as well as consider:

- new mechanisms for approving emerging or innovative energy from waste technologies that present a low-risk of harm to the environment or health and present a market opportunity for residual waste<sup>77</sup>
- landfill requirements, including potential restrictions on certain wastes to landfill, to further drive market development.

#### Question 4.4:

- Are there policy and regulatory improvements that can be made to facilitate innovation and market development in the energy from waste sector, that do not compromise best practice environmental standards?

<sup>77</sup> As raised by stakeholders during the 2018 Legislative Council Inquiry into Energy from Waste Technologies NSW Legislative Council (2018), 'Energy from waste' technology <https://www.parliament.nsw.gov.au/lcdocs/inquiries/2436/Final%20-%20Report%2028%20March%202018.pdf>

Implementation of the 20-Year Waste Strategy will benefit from system-wide data, monitoring and reporting. Such a framework should cover all parts of the waste and resource recovery system – waste avoidance, collection, sorting, processing, recycling and disposal. Such a framework would also help drive circular economy outcomes.

## Integrated data management

Better information to inform action by households, businesses and regulators will facilitate innovation and investment in solutions to waste challenges.

To this end, an integrated waste data framework could be developed, with access to real-time information for households and industry. Such a framework could include:

- materials flows, prices, forecasts and focused dashboard-style monitoring of waste generation and recovery region by region
- greater use of technology such as smart phone apps, QR (quick response) codes, sensors on bins, weighbridges and real-time tracking tools on vehicle movements, to monitor materials flows, improve traceability and enhance industry's ability to demonstrate product stewardship<sup>78</sup>
- improved data on local area waste generation, facility capacity and utilisation, waste composition and contamination, to allow better monitoring of waste patterns by local area, localised waste infrastructure capacity constraints, and emerging pressures
- increased frequency of waste data collection and reporting.

The costs and benefits of extra data collection and reporting activities would need to be considered as part of the framework.

Data consistency across different states and territories is also critical to help better inform business and policy decisions. The NSW Government is partnering with the Australian Government and other states on the development of national waste accounts in line with international guidelines that will be available to consistently measure, monitor and track waste generation and use across different states and territories.

## Monitoring and reporting

The 20-Year Waste Strategy needs an ongoing monitoring and evaluation plan. Key elements of that plan could be:

- annual monitoring that captures the whole system so that we can see whether waste management and circular economy outcomes are tracking in the right directions
- five-yearly strategy reviews to ensure the strategy is updated for changing circumstances
- a research plan for those areas where we have knowledge gaps
- enhanced performance metrics to track progress in infrastructure plans, product design and recycled content in products.

There is further work that can be done on metrics to help with monitoring and assessing progress and outcomes. Beyond the existing metrics on waste generation, recycling and disposal, circular economy metrics could be also developed that recognise waste as a resource.

These metrics would need to align with the monitoring, reporting and compliance requirements of the *National Waste Policy Action Plan*.

## We want to hear your views

You can make written submissions via an online response form at [yoursay.dpie.nsw.gov.au](https://yoursay.dpie.nsw.gov.au).

We look forward to receiving your submission to help shape the future of waste and resource recovery in NSW.

<sup>78</sup> The NSW Government launched an IoT policy in October 2019. Refer to <https://www.digital.nsw.gov.au/policy/internet-things-iot>



## Glossary of terms

<b>Anaerobic digestion</b>	A natural process by which microorganisms break down organic material in the absence of oxygen. The process can be used to manage waste or produce fuels, such as biogas.
<b>China's National Sword Policy</b>	Until recently China imported over 30 million tonnes of recyclable materials per year from other international jurisdictions. Australia sent 1.25 million tonnes of recyclable materials to China from 2016-17. At the beginning of January 2018, China implemented restrictions on the importation of recycled materials, impacting the global market for recyclable material. The collective policies and restrictions are referred to as China's National Sword Policy.
<b>Circular economy</b>	A circular economy values resources by keeping products and materials in use for as long as possible. Maximising the use and value of resources brings major economic benefits, contributing to innovation, growth and job creation.
<b>Commercial and industrial (C&amp;I) waste</b>	Waste from commercial and industrial activities.
<b>Construction and demolition (C&amp;D) waste</b>	Waste from construction and demolition activities.
<b>Energy from waste (EFW)</b>	Various technologies that convert non-recyclable waste into usable forms of energy including heat, fuels and electricity. EFW can occur through several processes such as incineration, gasification, pyrolysis, anaerobic digestion, and landfill gas recover.
<b>Extended producer responsibility (EPR)</b>	An environmental policy approach where the producers' responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life-cycle.
<b>Materials-recovery facility (MRF)</b>	A facility that sorts and processes recyclable materials from yellow-lidded bins owned by households and businesses. The recovered resources typically include various types of paper, plastic, glass and aluminium.
<b>Municipal solid waste (MSW)</b>	Solid waste from households and public places.
<b>Organics processing facility</b>	A facility that sorts and processes organic material, such as the waste deposited in household green-lidded bins. The recovered resources are typically various grades of compost.
<b>Putrescible</b>	The component of the waste stream liable to become putrid. For example, organic matter that has the potential to decompose with the formation of malodorous substances, usually refers to vegetative, food and animal products.
<b>Resource recovery facility</b>	A generic term for a facility that sorts and processes waste materials.
<b>Scheduled activity</b>	An activity listed in Schedule 1 of the <i>NSW Protection of the Environment Operations Act 1997</i> .

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