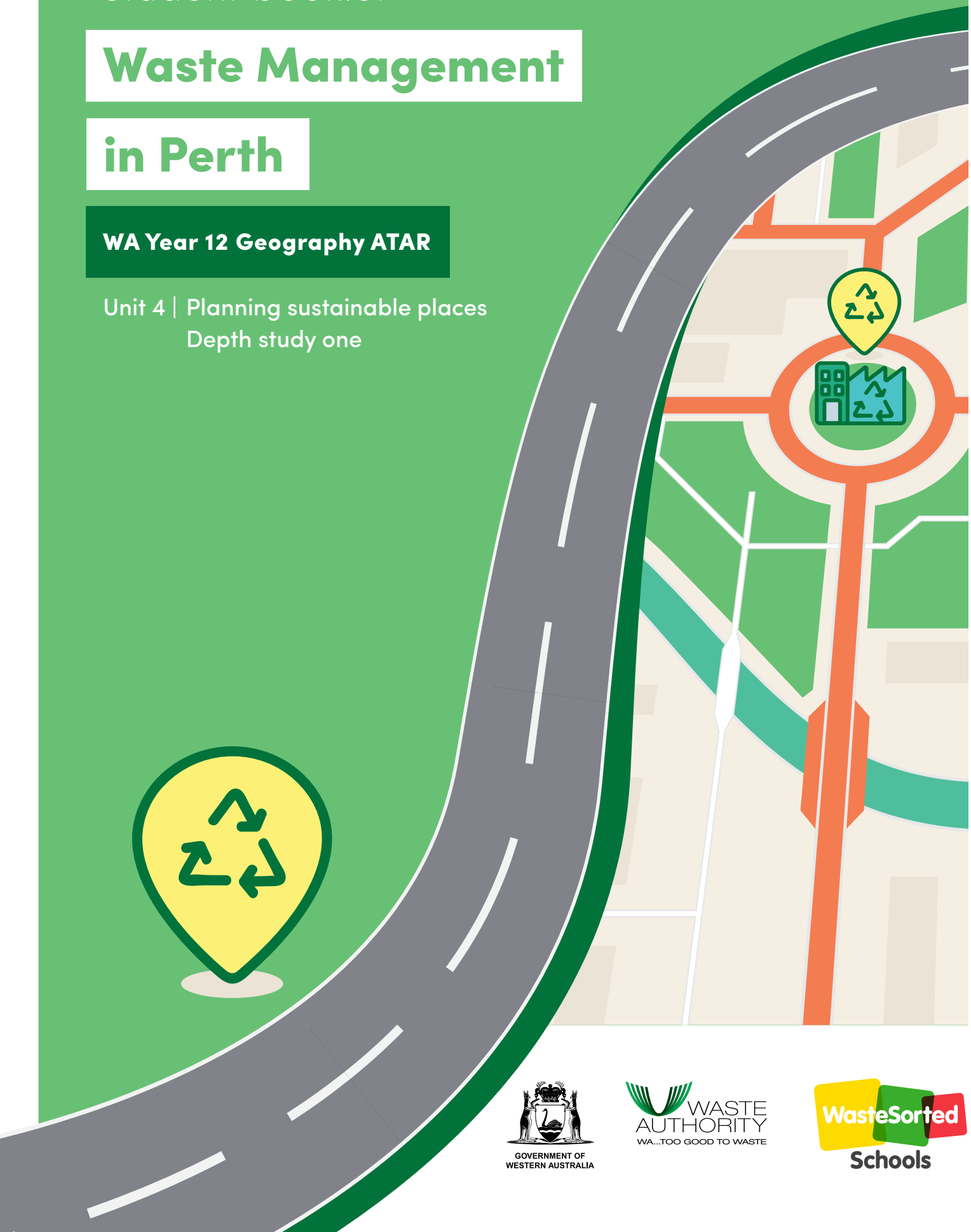
Student booklet

Waste Management in Perth

WA Year 12 Geography ATAR

Unit 4 | Planning sustainable places
Depth study one



GOVERNMENT OF WESTERN AUSTRALIA

WASTE AUTHORITY
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WasteSorted Schools

Acknowledgements

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Contents

Section 1

The nature, scope and causes of the waste management challenge and the implications for Perth

Waste challenge 1: We produce a lot of waste in Western Australia.
Over 5.8 million tonnes of solid waste is produced per year in WA. Only 58 per cent is diverted from landfill (recycled or composted). The remaining 42 per cent of waste produced goes to landfill.

1) *Study Source 1: Overview of waste in Perth.* Write down key notes about the following:
   a) How many tonnes of waste did Perth produce in 2019-20?
   b) What percentage of waste ended up in landfill?
   c) What are some of the implications of landfill in Perth?
   d) What does waste diversion mean?
   e) What percentage of waste was diverted in Perth?

Source 1: Overview of waste and recycling in Perth

Like many of the world's nations, Australia has a strong dependence on landfill as a form of waste management.

> Landfills require large amounts of space and land needs to be cleared to build a landfill. Landfills can also impact air, water and land quality. Landfill gas, mainly methane, is produced by decomposing organic waste which contributes to global warming when released to the air. Water moving from, or through, landfill waste forms leachate, which has the potential to contaminate nearby surface and ground water.
>
> Australian Bureau of Statistics, *Measures of Australia's progress 2010.*

Australia's dependence on landfill is concerning because we produce a lot of waste. Table 1 shows that in 2019-20, 4.4 million tonnes of waste was generated in the Perth and Peel regions (*Waste and recycling in Western Australia 2019-20*). Of this, 35% ends up in one of 14 landfills in the metropolitan outskirts. The rest of the waste is diverted from landfill. This means waste is recycled, composted or incinerated and converted to energy instead of being sent to landfill.

Waste diversion
Waste diversion refers to any waste that is diverted from landfill (does not end up in landfill). In Western Australia, this includes materials that are recycled (glass, plastics, metal paper and more) as well as materials that are composted or incinerated using waste-to-energy technologies.

Landfill at Tamala Park. Image courtesy of Mindarie Regional Council.

Table 1. Annual recycling and overall waste diversion, WA 2019-20

	Perth and Peel regions	WA total
Recycling (tonnes)	2,864,381	3,387,693
Waste to landfill (tonnes)[1]	1,552,645	2,402,770
Total waste generation (tonnes)	4,445,340	5,825,011
Landfill diversion rate	64%	58%
Population[2]	2,151,420	2,690,715
Per capita recycling (kg/person)	1,331	1,259
Per capita landfill (kg/person)	722	893
Per capita total waste (kg/person)	2,066	2,165

Notes:

1. All metropolitan landfill data provided by DWER, which includes tonnes of waste directly reported and estimated. Non metropolitan landfill data was calculated by extrapolating data provided by ten non-metropolitan landfills on a per capita basis across the entire non-metropolitan area.
2. 2019-20 population data is derived from the Western Australian Planning Commission publication, Western Australia tomorrow: Medium-term population forecasts, Population Report No. 11 (Department of Planning, Lands and Heritage, 2018).

Source: *Waste and recycling in Western Australia 2019-20.*

For more information on WA's waste statistics, refer to the *Recycling Activity in Western Australia* report which contains past and present trends. This report, or more recent versions, can be accessed on the Waste Authority website and by searching for 'recycling activity review.'

How much waste do you produce at home?

Each year households in WA generate about 1.49 million tonnes of waste, or about 534 kilograms of waste per capita.

Waste challenge 2: Landfill sites are reaching capacity and it is the State Government policy position not to create new landfills on the Swan Coastal Plain. Landfills have traditionally been the main method of disposing of waste around the world. They are still a key method of waste disposal in WA.
www.cleanaway.com.au/sustainable-future/what-is-landfill

1) Significant waste production in Perth means landfills are reaching capacity.

   a. Watch the clip ***Perth Waste*** from ***Ten News*** (2 minutes) as an introduction to the challenge: www.youtube.com/watch?v=lOpiytcpzEY or alternatively watch the ***Behind the News*** clip on ***Landfill*** (3.07 minutes). www.abc.net.au/btn/classroom/landfill/10528822

2) Study the map ***Source 2: Perth's landfill sites***.

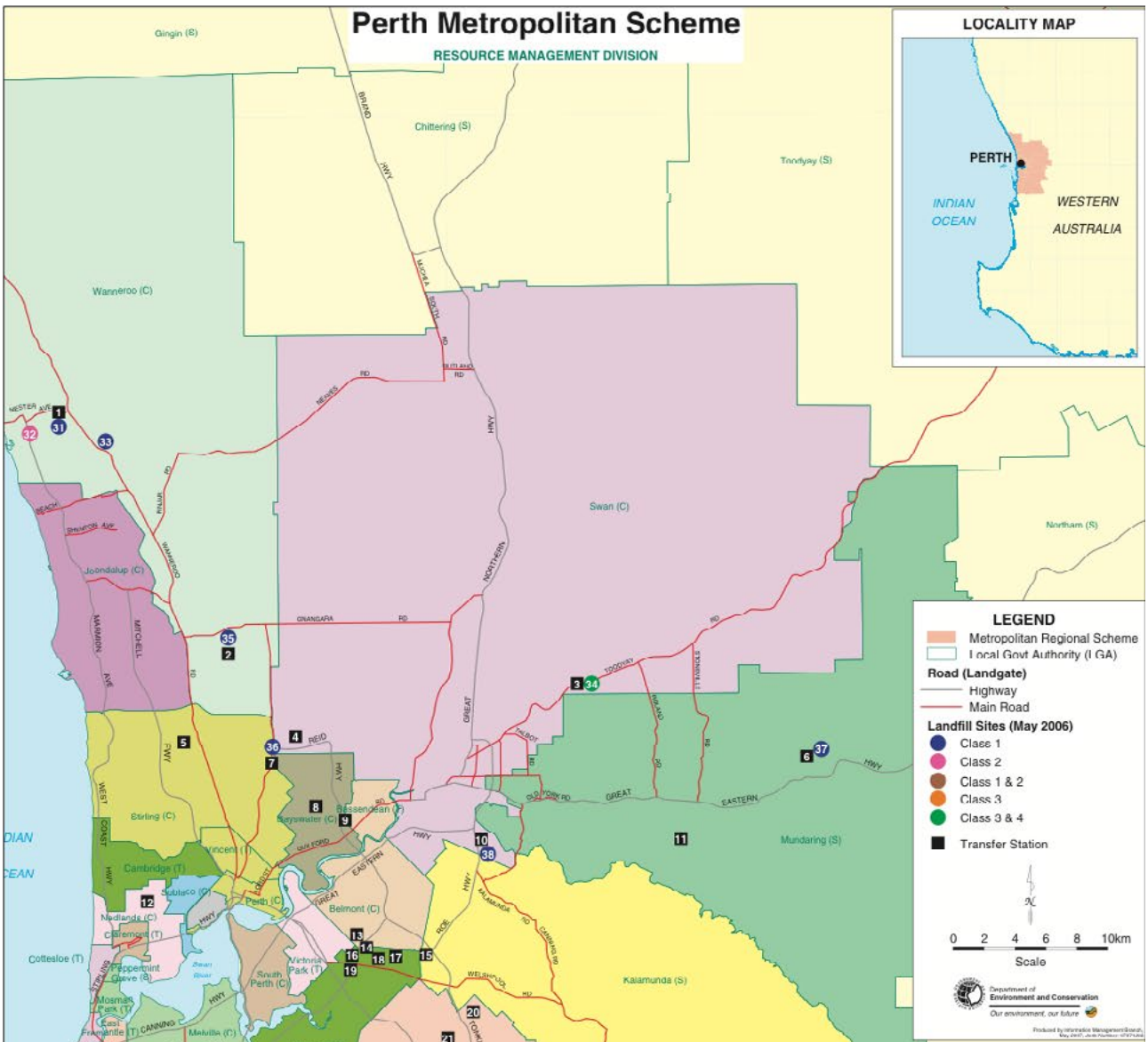
   a. Most of Perth's municipal waste that is landfilled goes to Tamala Park (MRC), Red Hill (EMRC), Millar Road (City of Rockingham), Hopkinson Park (City of Armadale) and Henderson (City of Cockburn). Circle/highlight these on the map.

   b. What is the relationship between the locations of these landfill sites?

   c. Which landfill site do you think your household (municipal) waste would go to? Use Google Maps (or other application) to calculate how far your waste is transported to get to the landfill site.

3) Highlight on the map the location of at least three past landfill sites (for example Elizabeth Quay, Riverside Park at Bayswater and Adenia Road in Riverton). How do these compare in location to current landfills? Predict where future landfill sites might be located.

Source 2: Perth's Landfill Sites



ID	Waste Facility
	Transfer Stations
1	Quinns Quarry
2	Non-Organic Disposals
3	Red Hill Waste Management Facility
4	Redoak Corporation
5	Balcatta Waste Transfer Station
6	Mathieson Road Transfer Station
7	Atlas Group Pty Ltd
8	Bayswater Transfer Station
9	Waste Care WA
10	Midland Road Landfill
11	Coppin Road Transfer Station
12	Brockway Transfer Station
13	Waste Stream Management-Welshpool Central Waste
14	Total Waste Management
15	Smorgon Steel Recyclers
16	Nationwide Oil Pty Ltd
17	Welshpool Tranfer Station-West Australian Landfill Services
18	Brambles Trading as Cleanaway
19	The Laminex Group-Welshpool Plant
20	Kevlin Road Waste Disposal Site
21	Resource Recyclers and All Earth Contracting
22	Regional Resource Recovery Centre
23	Amcor Packaging Australasia
24	DSL
25	Perthwaste Recycling Transfer Station
26	Simsmetal Limited
27	Jandakot Transfer Station
28	Cockburn Cement Limited
29	Abercrombie Road Resource Recovery Centre
30	Waste Stream Management
	Landfill Facilities
31	RCG Pty, Quinns Road
32	Mindarie Regional Council, Tamala Park
33	Eclipse Resources, Flynn Drive
34	EMRC, Red Hill
35	Non-Organic Disposals, Driver Road
36	Atlas Group, Alexander Drive
37	Shire of Mundaring, Mathieson Road
38	Happy Valley Landfill Pty Ltd, Midland Road
39	City of Fremantle, Lefroy Road Quarry
40	Moltoni Corporation Pty Ltd, Bibra Lake Landfill
41	City of Cockburn, Henderson
42	RCG Pty, 9 Mile Quarry
43	Eclipse Resources, Abercrombie Road
44	City of Armadale, Hopkinson Road
45	Waste Stream Management, Ratcliffe Road
46	West Australian Landfill Services, Cardup Landfill
47	City of Hockingham, Millar Road

Landfill Classes

Different classes of landfill accept different types of waste.

Class I landfill	An unlined landfill designed to accept inert wastes like building and demolition waste (inert landfill) for burial.
Class II landfill	An unlined landfill designed to accept putrescible and inert wastes (putrescible landfill) for burial. Putrescible waste includes all materials that are likely to become putrid such as food and organic waste from plants and animals.
Class III landfill	A lined landfill, which may include leachate collection, designed to accept putrescible and inert wastes (putrescible landfill) for burial.
Class IV landfill	A double-lined landfill with leachate collection, designed to accept contaminated soils and sludges (including encapsulated wastes - secure landfill) for burial.
Class V landfill	An intractable landfill site on which waste is accepted for burial ('waste' is determined by reference to the waste type set out in the document entitled "Landfill Waste Classification and Waste Definitions 1996" published by the Chief Executive Officer and as amended from time to time).

For more information visit: www.der.wa.gov.au/images/documents/our-work/licences-and-works-approvals/WasteDefinitions-revised.pdf

Tamala Park landfill site is expected to reach capacity in 2028.

"Ensuring that waste is disposed of appropriately is an area of concern for governments, and for communities. When the amount of waste generated increases, it challenges the capacity of current facilities to cope and creates pressure for land on which to locate new waste disposal facilities. The location and social acceptance of new facilities, such as landfills, is also an issue, especially if it is perceived that such facilities may affect the lives of people situated nearby. The decomposition of organic waste releases methane into the atmosphere, adding to the increasing levels of greenhouse gases that contribute to global warming and climate change."

Australian Bureau of Statistics (ABS)

Waste challenge 3: Recycling facilities in Perth are inadequate

1) Use *Source 3: Waste and recycling in Western Australia 2019-20* to answer the following:

   a) What are the most common materials recycled in WA?

   b) What percentage of paper was sent overseas in 2019-20?

   c) What percentage of aluminium packaging was sent overseas in 2019-20?

   d) What percentage of plastic (PET) was sent overseas in 2019-20?

   e) Where are construction and demolition products recycled?

   f) Do you think Perth has adequate facilities for recycling:

   i. Construction and demolition waste? Why or why not?

   ii. Common household recyclables like plastic, paper and glass? Why or why not?

   g) Describe at least two implications of not having adequate recycling facilities. Consider transport costs, recycling rates, environmental impacts, jobs.

Source 3: Recycling activities in WA 2019-20

The following tables show different aspects of recycling activities in Western Australia.

1. Recycling By Material Category & Type

Total reported recycling in WA during 2019-20 was 3,387693 tonnes. The contribution of each recycled material category is shown in Table 2.

C&D materials accounted for 64 per cent (2,180,754 Tonnes) of WA's total recycling in 2019-20. Metals and organics made up 17 per cent (563,970) and 10 per cent (335,771 tonnes) respectively of the recycled material reported; with the paper and cardboard, glass, textiles, rubber, plastic and hazardous waste material categories cumulatively accounting for the other 9 per cent (307,174 tonnes).

Table 2. Annual recycling by material category, WA 2019-20

Material	Tonnes
Construction & demolition materials	2,180,754
Organics	335,771
Paper & cardboard	194,317
Metals	563,970
Glass	63,456
Textiles	990
Rubber	14,622
Plastic	15,484
Hazardous waste	5,430
Other	12,875
Total	3,387,693

2. Paper And Cardboard: Quantity Recycled And Material Destination

Approximately 194,317 tonnes tonnes of paper and cardboard was recycled in WA during 2019-20. The majority of this comprised of cardboard and paper packaging (118,857 tonnes), followed by mixed paper/cardboard (31,836 tonnes), then old newsprint (19,913 tonnes), then mixed paper (16,507 tonnes), then white office paper (6,798 tonnes) and then magazines (406 tonnes).

Most paper and cardboard (194,295 tonnes) was exported for reprocessing, with less than one per cent or 22 tonnes reprocessed in WA (Table 3).

Table 3. Paper and cardboard recycling, WA 2019-20

Material	Tonnes recovered	Destination		
		WA	Interstate	Export
Cardboard and paper packaging	118,857	0	0	118,857
Mixed paper/cardboard	31,836	17.10	0	31,819
Old newsprint	19,913	5.24	0	19,908
Paper-mixed	16,507	0	0	16,507
White office paper	6,798	0	0	6,798
Magazines	406	0	0	406
Total	**194,317**	**22.34**	**0**	**193,889**

3. Metals: Quantity Recycled And Material Destination

Metal recycling represents a significant portion of WA's recycling activity due to the relatively high value of scrap metals compared to other waste types. Approximately 563,670 tonnes of metals were recycled in WA in 2019-20 (Table 4).

Table 4. Metals recycling, WA 2019-20

Material	Tonnes recovered	Destination		
		WA	Interstate	Export
Steel (non-packaging)	526,002	400	0	525,602
Steel packaging	3,804	0	0	3,804
Aluminium (non-packaging)	18,769	0	0	18,769
Aluminium packaging	2,050	18		2,032
Non-ferrous metals (excluding aluminium)	13,344	0	0	13,344
Total	**563,970**	**418**	**0**	**563,551**

Bales of plastic bottles ready for recycling.

4. Plastics: Quantity Recycled And Material Destination

Approximately 15,848 tonnes of plastics were recycled in 2019-20. As shown in Table 5, 8,275 tonnes of the recovered plastic was exported for processing, 5,179 tonnes was processed locally, and 2,030 tonnes was sent interstate.

Table 5. Plastics recycling, WA 2019-20

Material[1]	Tonnes recovered	Destination		
		WA	Interstate	Export
PET	2,489	50	249	2,190
HDPE	6,133	3373	613	2,147
PVC	258	111	57	90
PE-LD/LLD	1,000	430	10	560
PP	1,603	413	381	809
PS	404	238	0	166
PS-E	392	231	0	161
ABS/SAN/ASA	537	250	5	282
Nylon	118	0	0	118
PU	471	0	471	0
Unknown polymer	1,888	0	245	1643
Other	192	83	0	109
Total	**15,484**	**5,179**	**2030**	**8,275**

[1] Refer to glossary for material type descriptions.

The composition of the plastic types recovered is shown in Table 5. HDPE made up approximately 40 per cent (6,133 tonnes) of all plastics recovered, with 52 per cent of all collected HDPE waste exported for recycling. PET represented the second most recovered plastic material at 16 per cent (2,489 tonnes).

5. Glass: Quantity Recycled And Material Destination

In 2019-20, approximately 63,486 tonnes of glass was recycled. Table 6 shows that the majority (62,301 tonnes) of the recycled glass was sold into WA markets.

Table 6. Glass recycling, WA 2019-20

Material	Tonnes recovered	Destination		
		WA	Interstate	Export
Glass packaging – mixed	63,486	62,301	1,155	0

6. Construction And Demolition Materials

Construction and demolition (C&D) waste data was split into five material type categories; asphalt, bricks, concrete, plasterboard, and sand, clean fill, and rubble. Fly ash was not included in the current or previous recycling activity reviews.

In 2019-20, approximately 2,180,754 tonnes of construction and demolition (C&D) material was recovered.

The quantity of each C&D material type recycled is presented in Table 7. All recycling was undertaken in WA with no recovered C&D material exported or processed in other states.

Table 7. C&D materials recycling, WA 2019-20

Material	Tonnes recovered	Destination		
		WA	Interstate	Export
Mixed C&D waste	1,229,569	0	0	1,229,569
Sand/soil	303,702	0	0	303,702
Mixed inert waste	147,383	0	0	147,383
Rubble/aggregate <150mm	16,706	0	0	16,706
Rubble/aggregate >150mm	15,697	0	0	15,697
Plasterboard	4,796	0	0	4,796
Masonry material	76,963	0	0	76,963
Contaminated soil	28,915	0	0	28,915
Concrete	255,578	0	0	255,578
Bitumen	90,114	0	0	90,114
Bricks	11,333	0	0	11,333
Total	**2,180,754**	**0**	**0**	**2,180,754**

[1] The sand, soil, clean fill and rubble material type only relates to material that has been diverted from landfill.

Source: Waste and Recycling in Western Australia 2019-2020 Report
www.wasteauthority.wa.gov.au/publications/annual-waste-and-recycling-data

Sorting waste at a recycling facility.

Is waste management a challenge for Perth?

Waste management is regarded as a challenge when the amount of waste produced by an urban area is greater than the area's capacity to treat, recycle or dispose of the waste.

1) Consider the definition of a waste management challenge and discuss "Is waste management a challenge for Perth?"

2) Summarise the nature, scope and implications of the waste management challenges in Perth.

Extension or homework

a) Read the article: www.abc.net.au/news/2013-10-22/locals-oppose-dumping-of-waste-near-rural-towns/5038540. How would you feel about having a new landfill built close to your house?

b) Use satellite images from Google maps to compare four past landfill sites: Elizabeth Quay, Leake St in Bayswater, Harper St in Woodbridge and Adenia Rd in Riverton.

   a. What do these sites have in common?

   b. Describe the current land use at these sites.

   c. Can you suggest other sites along the Canning and Swan River that might be old landfill sites?

c) Read the article on Perth's historical landfill sites. What are the main concerns outlined in this article?

   www.perthnow.com.au/news/wa/waste-dumps-line-our-river-banks-ng-911e07a061fc4138e28f131f4d9fff73

d) Conduct independent internet research on the benefits and opposing arguments of Waste to Energy. Does WA currently invest in Waste to Energy?

The site of the Elizabeth Quay is one of 23 unlined former waste dumps dotted around the Swan River. Picture: Michael Haluwana

Source: www.perthnow.com.au/news/western-australia/elizabeth-quay-how-perths-biggest-project-was-a-dream-to-change-the-face-of-the-city/news-story/534fb67e6a5360dec68f10b04d60d874

Historical landfill site at Leake St, Bayswater.

Section 2

Waste management planning strategies

Waste management hierarchy:
Read Source 4 to answer the following questions. More information can be found about the waste hierarchy at www.wasteauthority.wa.gov.au/images/resources/files/2019/11/Communication_on_the_Waste_Hierarchy_2013.pdf

1) Research and record examples from each level of the waste hierarchy (avoid, recover, and dispose).
2) Which options in the waste hierarchy are considered more environmentally sustainable?
3) Do you think some options are easier than others?
4) Why is avoidance (reducing waste) at the top of the hierarchy?

   Watch the video clips on waste management in the Maldives and Sweden.

   Simon Reeves Apocalyptic Island of waste in the Maldives:

   www.bbc.com/news/av/world-asia-18073917/apocalyptic-island-of-waste-in-the-maldives

   Importing garbage for energy is good business for Sweden:

   www.youtube.com/watch?v=GTV6f853IZE
5) Compare the waste management practises of Sweden, the Maldives and Australia
6) Draw and label the waste hierarchy triangle. Show on your triangle where you think each country fits into the waste hierarchy.
   - Sweden
   - Maldives
   - Australia
7) Identify at least one option that each country could use to manage its waste in more environmentally sustainable ways?

Source 4: The waste hierarchy

The Waste Authority is a statutory body established in 2008 under the *Waste Avoidance and Resource Recovery Act 2007*. Its role is to work with local government, regional councils, stakeholder groups, the waste management sector and the community to promote better waste management practices in Western Australia.

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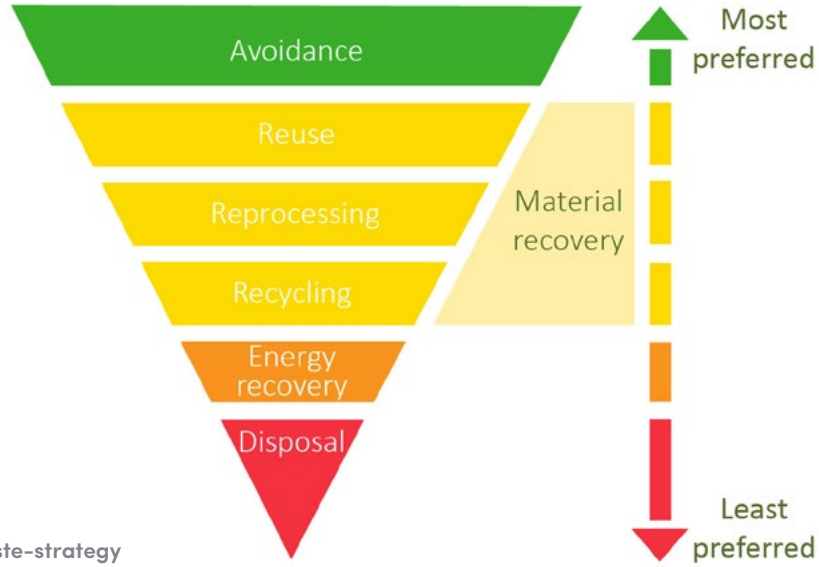
The Waste Authority of Western Australia (Waste Authority) has produced a waste hierarchy diagram which ranks waste management options in order of their environmental desirability. The waste hierarchy is set out in the *Waste Avoidance and Resource Recovery Act 2007* (WARR Act) and is included here.



Source: www.wasteauthority.wa.gov.au/about/waste-strategy

The hierarchy is recognised as important in providing guidance on environmental impacts. The waste hierarchy ranks waste management options in order of their general environmental desirability.

Avoid waste by bringing your own reusable coffee cup.

Avoidance options appear highest on the hierarchy. They are the most preferred option as they avoid or minimise the generation of waste, such as reducing packaging or avoiding the use of a product if it creates waste. This in turn minimises the overall environmental impacts of resource use and waste management.

Plastic bottles baled for recycling. Recycling is preferable to landfill because some of the resources in the plastic bottles can be recovered.

Recovery options include reusing items, reprocessing, recycling and energy recovery. These options are in the middle of the hierarchy and recover value from materials, thereby offsetting the environmental impacts of extracting and processing raw materials. Resource recovery options have some environmental impacts as a result of the resources used to collect and process materials.

Landfill is at the bottom of the hierarchy and delivers the lowest environmental benefit.

Disposal options at the bottom of the hierarchy recover the least value from materials and generally deliver the lowest environmental benefit. Options such as landfilling do not recover the value (including materials, and embodied energy and water) embedded in waste. Further, the direct impacts of landfilling can include groundwater contamination (from leachate), greenhouse gas emissions (primarily methane) and risks to community health and amenity.

Waste Strategy:

Review the *Waste Avoidance and Resource Recovery Strategy 2030 (Waste Strategy)* at www.wasteauthority.wa.gov.au/about/view/strategic-direction and answer the following questions:

1) In your own words, explain the purpose of the Waste Strategy. What is the purpose of the accompanying action plan document?

2) Summarise the objectives and targets of the Waste Strategy.

3) **Headline Strategy** "A consistent three bin kerbside collection system, which includes separation of food organics and garden organics from other waste categories, to be provided by all local governments in the Perth and Peel region by 2025 and supported by State Government through the application of financial mechanisms."

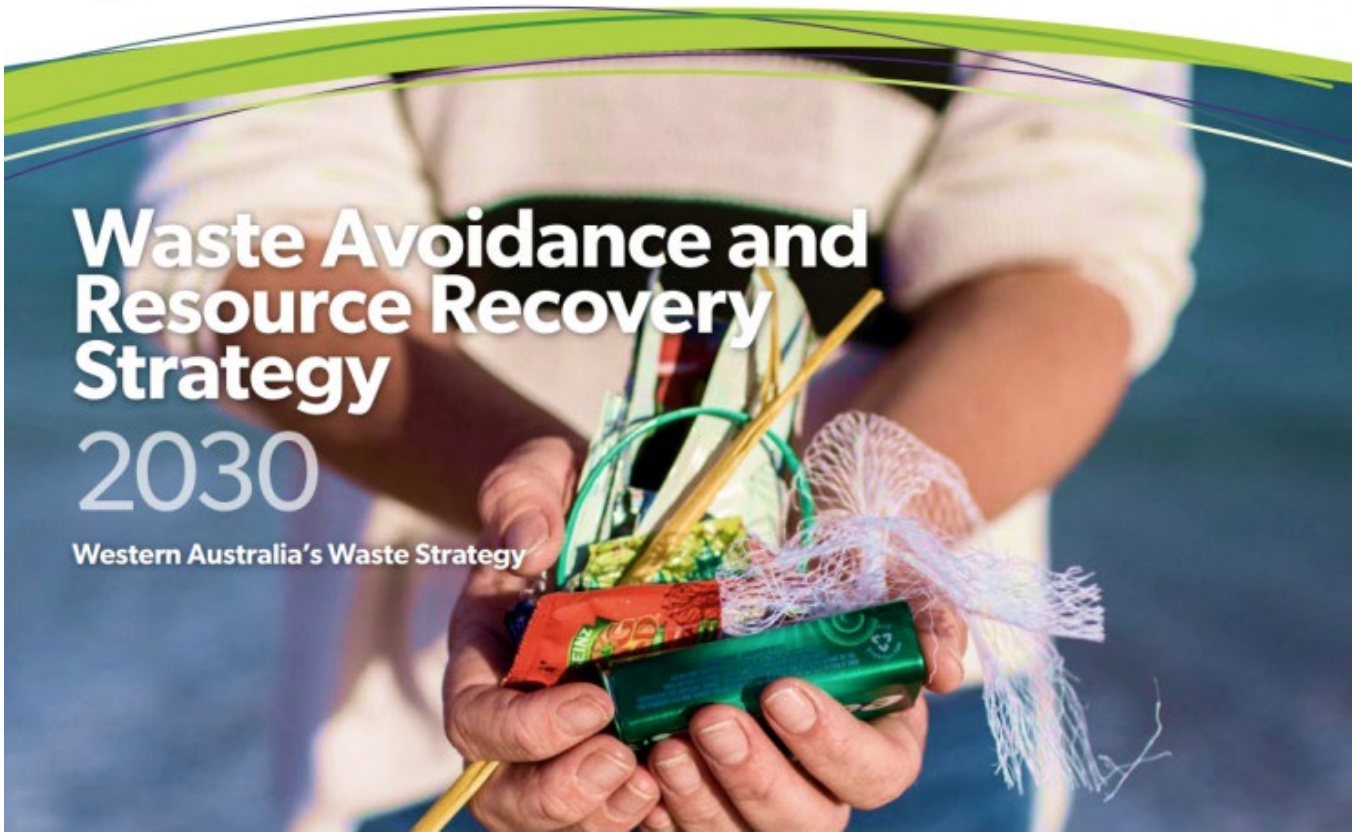
4) Consider the headline strategy above and reflect on the following?

   a) What kind of kerbside bin collection system do you currently have? Do you have a food organics and garden organics bin collected by your local government?

   b) Which Waste Strategy objective does this headline relate to? Avoid, Recover or Protect?

   c) Will having a food organics and garden organics bin help to meet the targets? Which target? How?

Waste Authority



The Waste Strategy

The Waste Authority promotes better waste management practices in WA under the *Waste Avoidance and Resources Recovery Act 2007*. One of the Authority's functions under the Act is to draft, for the Minister for Environment's approval, a long-term waste strategy for the whole of the State for continuous improvement of waste services, waste avoidance and resource recovery, benchmarked against best practice and targets for waste reduction, resource recovery and the diversion of waste from landfill disposal. The strategy must be reviewed at least every five years.

The *Waste Avoidance and Resource Recovery Strategy 2030* was approved by the Minister for Environment in 2019 and replaces WA's inaugural waste strategy, *Creating the Right Environment*, approved and published in 2012.

The *Waste Avoidance and Resource Recovery Strategy 2030* will guide the State in becoming a sustainable, low-waste circular economy. All waste policies, plans and programs developed by stakeholders in WA must be consistent with this strategy.

In February 2019, the Minister for Environment, Hon Stephen Dawson MLC, released the Western Australian ***Waste Avoidance and Resource Recovery Strategy 2030*** (Waste Strategy). The Waste Strategy outlines this vision:

> "Western Australia will become a sustainable, low-waste circular economy in which human health and the environment are protected from the impacts of waste."

This vision is supported by the three following objectives which reflect the waste hierarchy, whereby waste avoidance is the most preferred outcome and disposal is the least preferred:

Avoid – Western Australians generate less waste;

Recover – Western Australians recover more value and resources from waste; and,

Protect – Western Australians protect the environment by managing waste responsibly.

This waste hierarchy concept is also complemented by the circular economy sustainability concept. A circular economy moves away from the linear 'take, make, use and dispose model' to one that keeps materials and energy circulating in the economy for as long as possible. The Waste Strategy aims to change behaviour through a combination of strategies grouped around knowledge, enabling infrastructure and incentives.

Source: Waste Authority Business Plan 2019-2020

Source 5: China Sword

China has been a major component in global recycling, accepting up to 30 million tonnes of imported waste from countries worldwide per year, including the processing of 55 per cent of the world's scrap paper and 70 per cent of the world's plastic waste. However, over the past decade, the government has been gradually decreasing the amount of recyclables accepted by introducing protection policies. These aim to combat smuggling and illegal activities, to support China's developing domestic resource recovery industry, and to reduce the adverse impacts of imported contaminated waste on China's environment and the health of its population.

In 2013 the policy 'Operation Green Fence' was introduced to stop the import of unwashed and contaminated recyclable materials from entering China. In February 2018, China introduced the 'National Sword' policy, which effectively banned imports on 24 types of waste materials, by increasing the purity levels on recyclable goods from 90–95 per cent to 99.5 per cent. Recyclable materials are deemed to be contaminated if the material is dirty or contains other materials mixed incorrectly in the bales. This new policy meant that many countries and private industries were no longer able to sell their waste to China for recycling, causing global prices to drop. Recycling plants in Australia struggled to find a market for their recyclables and some local councils stopped recycling altogether due to the expense, while others absorbed the cost of recycling into their council rates.

The 2018 Federal Report for the Waste and Recycling Industry in Australia listed the changes to China's import policies as one of the key challenges and opportunities for Australia's recycling efforts. This was due to the changes to the international market for recyclable materials, a weak domestic market for recycled materials, and a lack of investment in infrastructure. The Australian Government responded to the global change in August 2019 by agreeing to ban the export on wastes to be recycled and focusing on building recycling infrastructure within Australia.

Source: www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/WasteandRecycling/Report/c05

Waste challenge 4: Changes to the international recycling market

Read Source 5 to answer the following questions.

1) How would China have previously benefited from importing waste materials from other countries?
2) Explain why the China Sword policy is both a key challenge and opportunity for Australia's recycling efforts?
3) Other countries such as Vietnam and Malaysia still buy recyclable wastes for use in manufacturing or to reprocess, and then sell to other markets, but typically at a lower price than was paid previously. What purpose would banning exports on waste plastic, paper, glass and tyres have for the Australian Government?

On 9 August 2019, the Council of Australian Governments (COAG) agreed Australia should establish a timetable to ban the export of waste plastic, paper, glass and tyres, while building Australia's capacity to generate high-value recycled commodities and associated demand.

Leaders also tasked environment ministers to advise on a proposed timetable and response strategy following consultation with industry and other stakeholders.

At the meeting of environment ministers on 8 November 2019, it was agreed that waste plastic, paper, glass and tyres that have not been processed into value-added material should be subject to the export ban. At the 13 March 2020 COAG meeting, the final framing of the waste export ban was agreed along with a government response strategy that included funding commitments. The timetable for implementation of waste export bans was agreed as follows (NB. COVID-19 has delayed Federal Parliament sitting resulting in enacting legislation being delayed).

- All waste glass by July 2020
- Mixed waste plastics by July 2021
- All whole tyres including baled tyres by December 2021
- Remaining waste products, including mixed paper and cardboard, by no later than 30 June 2022.

Source: www.environment.gov.au/protection/waste/exports

Extension or homework: Local government waste plans

Under the Waste Avoidance and Resource Recovery Act 2007, a local government can be required to develop a waste plan that aligns with the State's waste strategy.

1) View the City of South Perth's Waste and Resource Management Plan at the following link https://southperth.wa.gov.au/residents/waste-and-recycling/waste-management.

2) Does the City of South Perth's waste plan align with the Waste Strategy?

Section 3

Stakeholders

The role of local and regional councils in waste management:

1) Study Source 6:
   a) What is the function of a local government?
   b) What is the function of a regional council?
2) Use online research to identify which local governments are members of each of the five regional councils. Use the map at the end of Source 7 to identify and mark out the boundaries of each regional council. A list of regional councils and their local government members is provided here: http://walga.asn.au/About-Local-Government/Regional-Councils.aspx
3) Highlight your local government area on the map.
   a) Is your local government a member of a regional council? If so, which one?
   b) Research which waste management sites are operated by your regional council or local government.
   c) Mark the site/s on the map.

External stakeholders are identified by the City of Joondalup in their *Waste Management Plan, 2016 – 2021.* Image courtesy of the City of Joondalup. Source: www.joondalup.wa.gov.au/wp-content/uploads/2018/07/Waste_Management_Plan_2016.pdf

Tamala Park promotes reuse at the Tip Shop. Image courtesy of Mindarie Regional Park.

Source 6: The role of regional councils in waste management

Residents in Perth pay rates to their local government and then the local government provides services such as libraries, parks, security and waste collection. Even though local governments collect waste, either directly or via contacted commercial service providers, some local governments do not own or operate their own landfill sites.

Most individual local governments in Perth are members of a regional council. The function of regional council is to provide waste management services and facilities on behalf of its local government members. They operate landfill sites such as Red Hill and Tamala Park as well as other processing facilities such as South Metropolitan Regional Council Resource Recovery Facility. Membership with a regional council allows them to dispose of ratepayer's waste at a waste facility run by the regional council. In recent times, several local governments, such as Rockingham, have opted out of the regional council service as they are fortunate to have their own waste facilities or have used other facilities on a commercial basis.

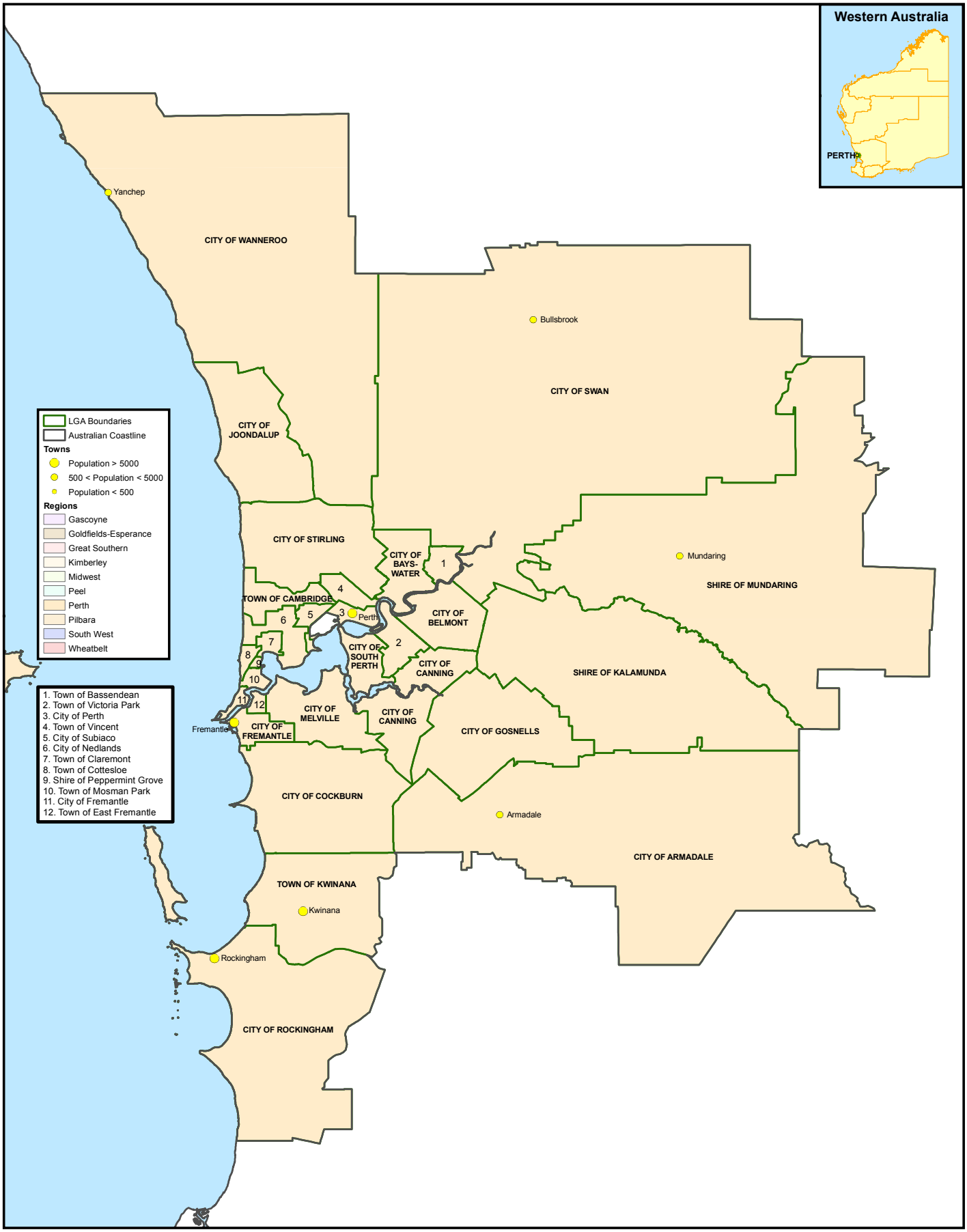
Currently Perth has five Regional Councils:

- East Metropolitan Regional Council (EMRC)
- Mindarie Regional Council (MRC)
- Rivers Regional Council (RRC)
- Southern Metropolitan Regional Council (SMRC)
- Western Metropolitan Regional Council (WMRC)

Mindarie Regional Council

Mindarie Regional Council (MRC), located 35km north of Perth, is one of the larger regional councils in WA, responsible for the disposal of 280,000 tonnes of solid waste annually. MRC comprises seven local governments and is responsible for the waste of over 700,000 residents. It opened in 1991 and manages the following facilities:

- Tamala Park. Tamala Park is a class II landfill site in Mindarie and has three landfill 'holes' (termed landfill cells). Two of which are full and the third is expected to reach capacity by 2028.
- A resource recovery facility at Neerabup (which composts waste, separating out beneficial waste-derived compost and sending any residual waste to landfill)
- A recycling centre for:
  - Recyclable materials (e.g. cardboard, steel) which are sent off site for recycling;
  - Household goods which can be sold through the tip shop;
  - Hazardous materials (e.g. chemicals, pesticides, batteries, paint) requiring special management and disposal.
- A power station where methane gas collected from landfill is converted to electricity and fed into WA's electricity grid.



MAP 1:
PERTH METRO REGION

KEY FEATURES

The purpose of this map is to display the Local Government Area boundaries for the Perth Metropolitan Region.

Datum and Projection Information
Vertical Datum: Australian Height Datum (AHD)
Horizontal Datum: Geocentric Datum of Australia 94
Projection: MGA 94 Zone 50
Spheroid: Australian National Spheroid

Project Information
Client: Regional Development and Lands
Map Author: Aidan Belouardi
Filepath: J:\gisprojects\Project\D_Series\D1101\0038_Pilbara_Director\0007 DLGRD Request - Alex Ballie\Local_Government_Area_Maps\mxd\
Filename: Map01-Perth_Metro-Legend-A4.mxd
Completion Date: 16/02/2010

Government of Western Australia
Department of Water

This map is a product of the Department of Water (Spatial Services), and was printed on 10/03/2010.

This map was produced with the intent that it be used for display purposes, at the scale of 1:600,000 when printing at A4.

While the Department of Water has made all reasonable efforts to ensure the accuracy of this data, the department accepts no responsibility for any inaccuracies and persons relying on this data do so at their own risk.

0 5 10 20 km

N

DATA DICTIONARY		
DATASET	SOURCE	DATE
LGA Boundaries	Landgate	March 2009
Towns	Landgate	December 2006

Government of Western Australia
Department of Regional Development and Lands

Views and attitudes of stakeholders:

1) Prepare a survey to research the knowledge, views and attitudes of residents regarding waste in Perth.
   a) Do residents know which facility their general waste goes to (e.g. landfill or composter)? Do they know which facility their recyclable waste goes to?
   b) Do they know that some recyclables are processed overseas?
   c) Do they think we have adequate recycling facilities in WA?
   d) Do they know what a regional council is? Do they know which regional council they belong to and which waste facilities they operate?
   e) Do they know what can be recycled?
   f) Do they know about the waste hierarchy or the waste targets in the Waste Strategy 2030?
   g) What do they do to reduce the waste they produce?
2) Do they believe waste is a challenge for Perth? Why or why not?
3) What do they think will solve the waste management challenge?
4) Conduct the survey with a small group of households in your local area in Perth. Summarise the findings on their views and attitudes on waste in Perth.
5) Watch Channel 10 Perth Waste news clip www.youtube.com/watch?v=lOpiytcpzEY.
   a) Name the stakeholders in the interview.
   b) What are the stakeholder's key points?

Read Source 7: Stakeholders in waste management. Choose one local government representative stakeholder and research their views and attitudes on waste in Perth.

6) Do they believe waste management is a major issue in Perth?
7) What are their views on the major costs and issues with waste management?
8) What do they think will solve the waste management challenge?

For example, Brad Pettitt, Mayor of Fremantle, has expressed views in the following links:

- https://cofremantle.wordpress.com/2014/05/03/recycling-and-waste-to-energy-in-tokyo
- https://cofremantle.wordpress.com/2016/09/17/recycling-energy-and-the-future-of-our-waste

'Community engagement, acceptance and awareness is as important as the provision of physical infrastructure and collection systems. Consistency of messaging across homes, workplaces and public areas is a key fundamental that needs to be tailored to local recovery infrastructure and systems.

The waste management sector is in a transitional phase and will require clear direction and guidance going forward that may include more directive approaches over voluntary ones. This could be aligned with careful reinvestment of waste levy funds into programs and alternative delivery methods to support implementation of our waste strategy.

There needs to be commitment by all stakeholders to adopt best-practice management and engagement and ensuring transition and waste plans are implemented in a timely manner.'

Marcus Geisler
Waste Authority Chairman (2019)

Source: Waste Avoidance and Resource Recovery Strategy 2030

Source 7: Stakeholders in waste management

Governance	Function, Policy, Legislation	Stakeholders
National	Responsible for national legislation, strategies and policy frameworks for waste, including measures that give effect to obligations under international agreements.	• Federal Government of Australia • Federal Environment Department
State	Responsible for state legislation, policy and programs. For example, the Waste Authority prepared the Waste Strategy ***Creating the right environment*** and set waste diversion targets for WA.	• Department of Water and Environmental Regulation • Waste Authority
Local governments	Local governments have responsibility for waste management within their local areas as laid down by the regulatory framework of each state or territory. Local governments play an important role in providing household waste collection and recycling services, either directly or via service providers, and some operate facilities, such as landfill sites. Most local governments deliver education and awareness programs and provide and maintain litter abatement services and infrastructure.	Examples • WA Local Government Association (WALGA) • City of Stirling • Town of Victoria Park • City of Joondalup • City of Melville • City of Wanneroo • Your local council
Regional councils	Undertake waste management functions on behalf of the member local governments. E.g. http://smrc.com.au/about-us or www.rrc.wa.gov.au * Most Perth local governments participate in one of the regional councils. Some, like the City of Rockingham, do not. They typically operate their own facilities, such as a landfill site.	• Mindarie Regional Council (MRC) • Eastern Metropolitan Regional Council (EMRC) • Southern Metropolitan Regional Council (SMRC) • Western Metropolitan Regional Council (WMRC) • Rivers Regional Council (RRC)
Industries and businesses	Private service providers collect commercial and industrial waste and construction and demolition waste. Some have their own landfill sites, others pay to use those operated by local / regional councils.	• Construction and demolition industry • Commercial and industrial industry
The community	Households and individuals have the responsibility of disposing of waste correctly.	• Households • Individuals

Section 4

Preparation for excursion to a local waste management facility

Residential waste collected from the kerbside is often sent to waste management facilities owned/operated by local government or regional councils.

1) Identify your local waste management facility using the table on page 9 or the incursion booklet appendix.
   a) How long has the facility been open?
   b) How much waste has been landfilled since inception?
   c) On average, how many tonnes of general waste are landfilled on-site each year?
2) Use Google Maps (or another application) to view a map of your local landfill and the surrounding areas.
   a) Are there properties nearby? How far away are they from the site boundary?
      i. Was the waste management facility there before the properties?
      ii. Discuss whether you would choose to live near a landfill. Your answer may include (but is not limited to): are there other cultural and natural features that make the place desirable to live? Is house and land affordable in the area?
   b) Are there any water bodies close by?
      i. If so, what impacts or implications might this have?
3) What reasons may have led to this site being chosen for a waste management facility?
4) Do you know if native animals inhabit the site?
5) What jobs and tasks are required to manage the site safely (operations, environmental officers, engineers, GIS mapping, soil testing, water testing, feral pest management, etc.)
6) Community members can tour waste facilities to learn about how waste is managed in their local area and what they can do to reduce waste to landfill. What objective in the waste strategy is met by these tours?
   - The tour provides information to the community to support behaviour changes to help avoid waste production, recover more resources from waste, and protect the environment from waste by educating the community about the hazards of waste. It is, therefore, a foundation strategy, as it underpins all the other strategies.
7) Does your waste management facility have a tip shop?
   Visit www.wastesorted.wa.gov.au/be-a-great-sort/gift and explain why tip shops and charity shops are important to minimising waste to landfill in the local community.

Name:

Year 12 Excursion booklet

Excursion

to local waste management facility

Tip shop at Tamala Park. Image courtesy of Mindarie Regional Council.

There's a fabulous range of furniture at the tip shop.
Image courtesy of Mindarie Regional Council.

Tip shop or reuse shop

Many landfill facilities will have a reuse shop on-site. Many people drop off products free of charge, preventing them from ending up in landfill.

Refurbishing and reusing household items and discarded building materials conserves raw materials and saves more energy compared to producing new products.

A reuse shop offers the public the opportunity to purchase second-hand goods which are too good to throw away. Furniture, barbeques, toys, and fitness equipment are sold at bargain prices.

Furniture at the tip shop.
Image courtesy of Mindarie Regional Council.

1. What other social and economic benefits do reuse shops provide for the community?

_____

_____

_____

_____

_____

2. Have you been to a reuse shop before? How can we better promote and support the use of reuse shops?

_____

_____

_____

_____

_____

3. Reusing and repairing items are a major component of a circular economy. What barriers might exist to creating a closed-loop system?

_____

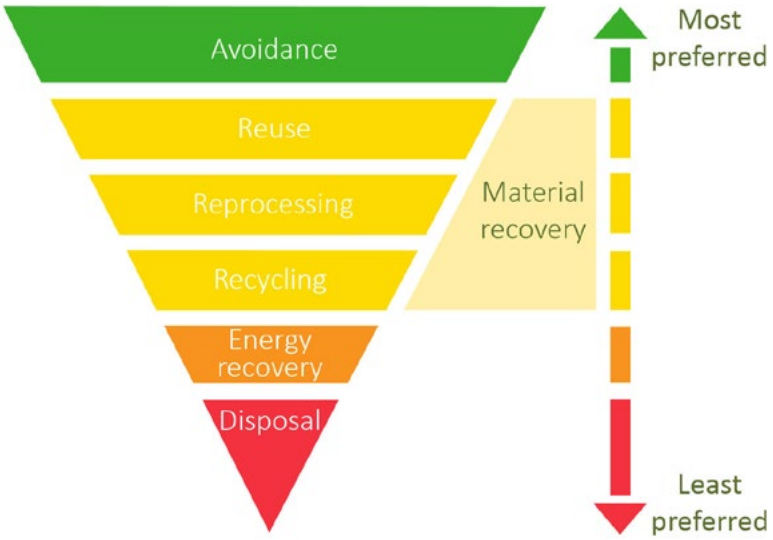
_____

_____

_____

_____

Waste hierarchy



Circular economy

4. Where does the reuse shop fit into the waste hierarchy? Mark the reuse shop on the waste hierarchy diagram. What would be a strategy that is more sustainable?

5. What other services at this waste management facility align with the options shown in the waste hierarchy?

6. How do you think our landscape would change if our community shifted to a circular-economy approach?

Homework/discussion point:

Watch the short clip "the story of stuff" and then answer the questions below:

For more information visit: http://storyofstuff.org/movies/story-of-stuff

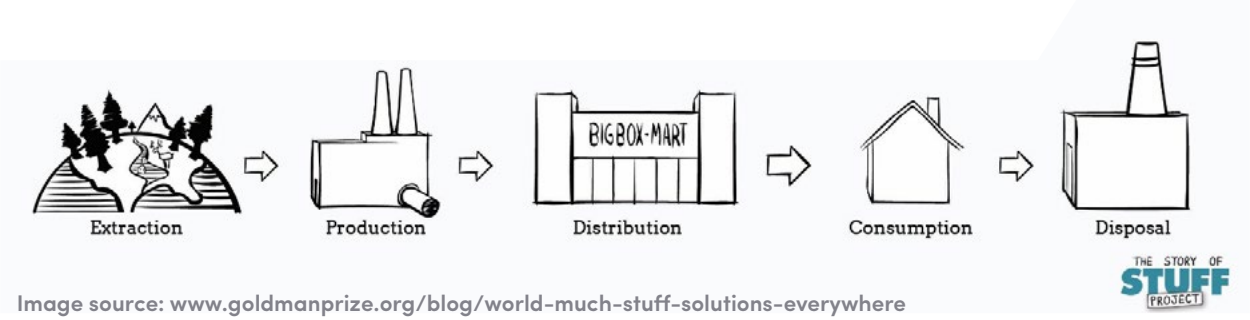


Image source: www.goldmanprize.org/blog/world-much-stuff-solutions-everywhere

i. Do we consume more stuff than we really need?

ii. Is there a link between what we buy and waste?

iii. Does recycling solve this problem?

iv. After watching the film, how do you feel about consumer culture?

Weighbridge at Tamala Park.
Image courtesy of Mindarie Regional Council.

Weighbridge

7. If the waste management facility you are visiting has a weighbridge, explain how it works.

a) What is the cost per tonne to dispose of general waste?

b) Is a waste levy applied to the cost per tonne? How much is it?

c) What is the purpose of the waste levy?

d) Why is the waste levy only applied to waste disposed of at metropolitan landfills?

8. If there is no weighbridge, how are fees determined?

9. Who is paying for the cost of disposal?

Transfer Station at Red Hill. Image courtesy of the Eastern Metropolitan Regional Council.

Transfer station/drop-off facilities

The transfer station or drop-off facility is only for residents with smaller loads of rubbish and items that should not go to landfill (rubbish trucks head straight to the landfill site).

10. What items can be taken to this facility?

_____

_____

a) Are any of these items classified as household hazardous waste (HHW)?
List them below and explain why they have this classification:

_____

_____

_____

_____

b) What happens to the various items once received at the transfer station/drop-off facility?

_____

_____

11. Mark the transfer station on the waste hierarchy diagram on the previous page.

12. How many waste hierarchy options are offered at the transfer station?

_____

_____

13. Why is it important that residents stop and separate their waste before putting it into landfill?
Explain the benefit this has to the individual and to the waste management facility:

_____

_____

_____

E-waste for recycling

Homework/discussion point:

i. Where is your nearest HHW collection facility?

ii. E-waste is the fastest-growing waste stream in the world, which presents a challenge for waste management.

a) How does obsolescence of electronic devices relate to waste?

b) Explain how the electronic industry is working to address challenges in e-waste.

c) How can individuals make a difference?

Lining a landfill at Red Hill Waste Management Facility.
Image courtesy of Eastern Metropolitan Regional Council.

Landfill

Landfill facilities in Western Australia require a works approval for construction and a licence for operation under the *Environmental Protection Act 1986*. Licences are issued with legally binding conditions which apply to the landfill and are intended to prevent or minimise the potential for harm to the environment.

The locations, geological characteristics of the site, proximity to sensitive receivers such as local residents or natural ecosystems, and the type and volume of waste proposed to be received at a landfill facility will, to a large extent, dictate the design, operational, management and monitoring controls that will be implemented at the facility during operation and after closure. Figure 1 in the appendix shows the typical characteristics of a Class III landfill cell for the containment and control of emissions, which includes liners, leachate collection and capping.

In Western Australia, landfill waste is divided into five classes. The current standards for suitability of waste for disposal at a landfill facility are based on the toxicity and concentration of contaminants in the waste.

Several environmental factors must be considered when dealing with waste disposal. These include maintenance of terrestrial vegetation and species diversity, surface water quality, groundwater quality, odour, dust and noise. Environmental work may be carried out on-site, such as environmental monitoring and research, community engagement, site rehabilitation and contaminated waste management.

14. Complete a sketch map of the landfill and surrounding area. Include site features (landforms, truck access, drainage, vegetation) and situation features (location, communication links such as major roads, land uses). You may like to use your map printout to help.

BOLTS: Make sure you include a border, orientation (correct north point), legend, title and scale.

15. What class(es) of landfill are on-site?

a) What type(s) of waste are they used for?

16. Explain how leachate is produced at a landfill.

a) What are the environmental impacts and implications?

b) How are these impacts being managed by the site owners? Discuss the implications of unlined landfills and lined landfills that may still leak.

17. Explain how methane is produced at a landfill.

a) What are the environmental impacts and implications?

b) How are these impacts being managed by the site owners?

18. Explain how the generation of methane can be avoided.

19. How many meters below surface level are landfill cells typically built? Why is this important?

20. What ongoing monitoring and/or land use restrictions apply to a landfill cell once it is closed?

21. No new landfills can be built on the Swan Coastal Plain. Why do you think that may be?

22. What can be done to reduce the need for landfill sites?

Discussion points: How has the area around the waste management facility changed since it was opened? Were there houses, schools, shops, parks, roads and other facilities when it opened compared to now? How has the liveability of the area changed?

Landfill gas and power

Methane gas is produced at landfills when waste decomposes under anaerobic conditions. This greenhouse gas is considered to be 20 times more potent than carbon dioxide. Recent years have seen significant declines in the total volume of greenhouse gases emitted by the waste sector. Declines in waste emissions have been largely due to increases in the volume of greenhouse gases captured at Australia's landfills. Captured gas from landfills can be converted into electricity (this is another type of waste to energy). It is sold to the Western Power grid to provide household power. For more information visit: edlenergy.com

23. How much electricity per hour does this plant generate? How many homes are powered by the energy generated?

24. How many years after capping a landfill cell can gas continue to be produced?

a) What does this mean in terms of environmental management? Does the owner have a responsibility to continue looking after and monitoring the site?

25. What are the benefits of this technology for waste management?

Organic waste management options

A Resource Recovery Facility (RRF) aims to 'recover' waste by treating it so that materials can be used as valuable resources. This includes separating materials for recycling and creating compost or mulch from the waste.

Several facilities around the Perth metropolitan region use a technology based on natural biological processes, called aerobic digestion, to convert food or garden waste into a usable product such as mulch or soil conditioner.

26. Which types of organic waste does this facility accept? (Choose the on that applies)

    Garden organics (FO)

    Food organics (FO)

    Food organics and garden organics (FOGO)

27. Why does organic waste smell?

    _____

    _____

28. How is the organic waste processed?

    _____

    _____

29. How long does the process take between receival and maturation?

    _____

30. What end products are produced?

    _____

a) Compare the cost of the product to a similar product sold at a garden centre.

    _____

Red Hill green waste area. Image courtesy of East Metropolitan Regional Council

31. What is the contamination rate?

a. What are the main contaminants in the end product?

b. How does contamination impact the viability of the final product?

c. What can the waste management facility (or local governments) do to decrease contamination rates in organic streams?

32. What are the benefits of separating and processing organic waste?

33. An RRF is considered a more sustainable means of dealing with waste than disposing of waste to a landfill. Why? How does an RRF help meet targets to reduce waste to landfill?

34. How does this facility compare with other facilities around Australia and the world?

Appendix

Landfill class descriptions

Landfill class	Common name	Types of waste
Class I	Inert landfill	Non-hazardous and non-biodegradable waste, such as bricks and concrete.
Class II	Putrescible landfill	Waste that is likely to become putrid, such as food and plant materials.
Class III	Putrescible landfill	Contaminated solid wastes.
Class IV	Secure landfill	Includes all of the above and additional contaminated solid wastes.
Class V	Intractable landfill	Waste in which the toxicity or chemical or physical characteristics make it difficult to dispose of or treat safely, and is not suitable for disposal in Class I–IV facilities.

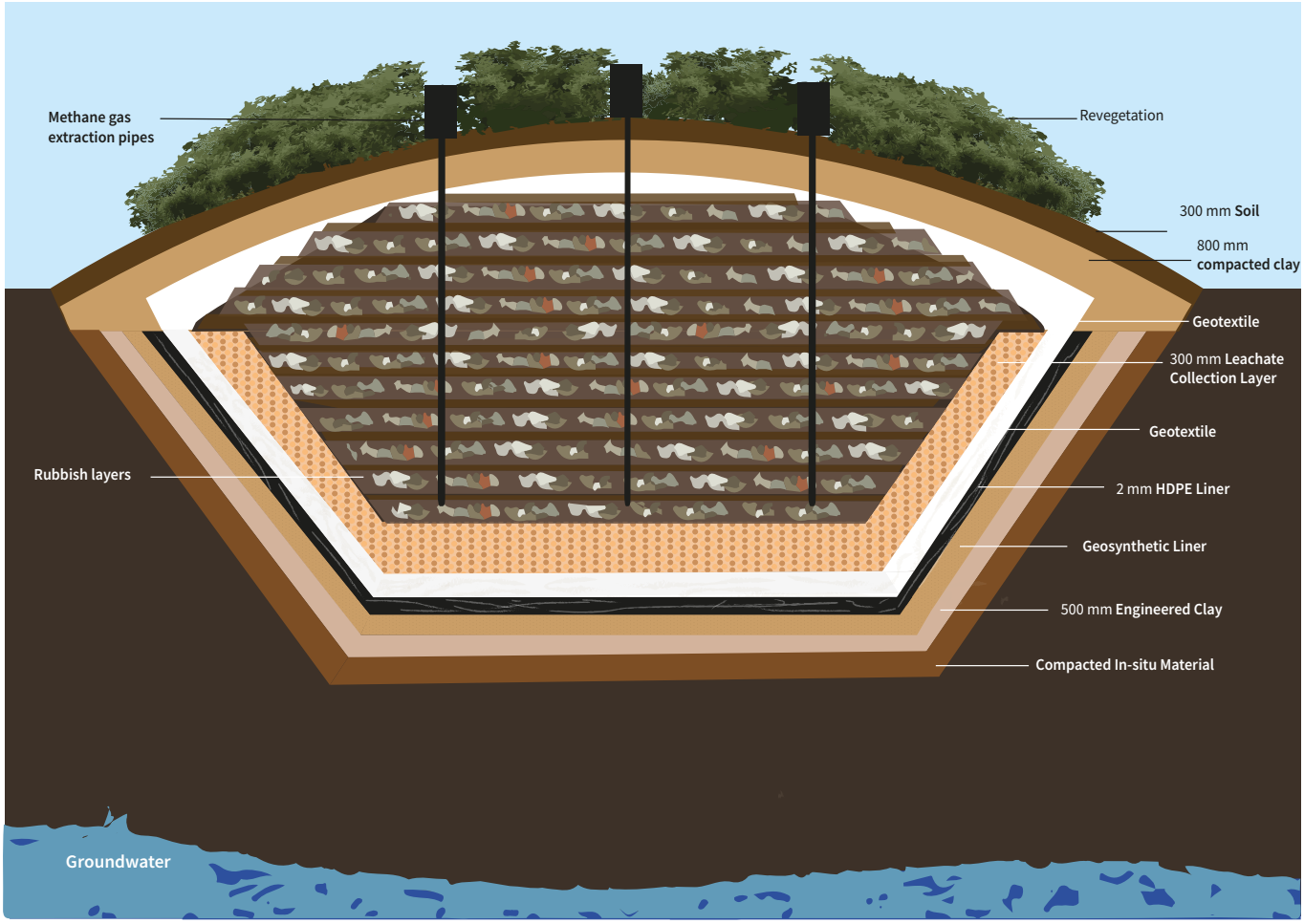


Figure 1: Typical cross-section of a Class III landfill cell. Diagram courtesy of Eastern Metropolitan Regional Council.

For more information on ways to reduce waste to landfill visit **www.wastesorted.wa.gov.au**

Section 5

Waste strategies adopted

Composting waste at Resource Recovery Facilities:

1) Watch the *Recycling Right Composting Virtual Tour* at http://smrc.com.au/virtual-tours

   Note: Don't be confused by the colour of the bins in this video. Many councils have a red-lidded general waste bin. This is because red is the Australian Standard colour for general waste.

   a) Describe how the facility meets the circular economy aim through resource recovery.

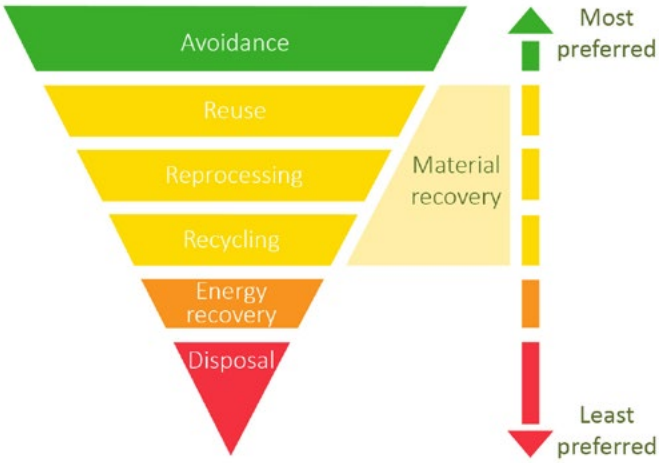
   b) What is the alternative to composting this waste stream?

2) SMRC opened the composting facility in 2009. www.abc.net.au/news/2017-06-20/inside-australias-first-co-composting-waste-facility/8630342

   a) Was Australia's first composting facility similar?

   b) Do you think the facilities at Neerabup and Canning Vale were influenced by strategies adopted on the East Coast?

3) To what extent do you think this strategy is informed by the concept of sustainability? Which aspect of sustainability (economic, social, or environmental) is informing this strategy?



The waste hierarchy ranks waste management options in order of their general environmental desirability.

Strategy 1. Composting waste at Resource Recovery Facilities

If you went on the excursion, you may have seen a Resource Recovery Facility that turns organic waste into compost or mulch. The Southern Metropolitan Regional Council (SMRC) operates a waste composting facility in Canning Vale.

The Regional Resource Recovery Centre (RRRC) in Canning Vale processes waste and recyclables from over 260,000 residents in Perth's southern suburbs. The operation of this facility prevents about 70,000 tonnes of greenhouse gases from entering the atmosphere each year.

Alternative waste technology (AWT) is the generic term used for waste and resource recovery operations that are deemed to be 'alternative' to disposal of wastes at conventional (dry) landfills. Composting facilities and Waste to Energy facilities are both considered to be an alternative waste technology.

The Waste Compost Facility

Strategy 2. Waste to Energy in Perth

There are four proposed Waste to Energy plants in WA, that have received varying levels of environmental assessment and approval, three in metropolitan Perth (East Rockingham, Kwinana, and Red Hill) and one in regional WA (Port Hedland). As yet, none of these are operational. Other local and regional councils are considering Waste to Energy as a future strategy to adopt (for example, Mindarie Regional Council are considering it for when the Tamala Park landfill site is full).

Waste to Energy in Kwinana:

1) Compile an information profile on the Kwinana Waste to Energy plant. Recommended websites are listed below to assist with research. Include the following information within the profile:
   a) When will the plant begin operating?
   b) What is the estimated cost of the Kwinana Waste to Energy plant?
   c) How many jobs does the plant provide? Why is this important for Perth and WA? Hint: Consider the skills required for jobs at a landfill and the types of jobs required during construction and operation to a waste to energy facility.
   d) How much electricity will the plant produce and how will it get used?
   e) How much residual waste will the plant be expected to process each year?
   f) Which local governments are due to use the plant?
   g) Is a regional council involved in the plant?
2) View the presentation ***How the French are burning garbage to heat homes*** (6.04 minutes): www.youtube.com/watch?v=g6We1uDJ6cE. As a class, discuss how Waste to Energy in Paris compares to Perth? How long has Waste to Energy been used in Paris compared to Perth? What proportion of heating is generated by Waste to Energy? Are the household waste collection systems different?
3) Consider the advantages and disadvantages of Waste to Energy as outlined by the WA Waste Authority below. To what extent is the decision to move to Waste to Energy in Perth informed by the concept of sustainability?

Useful links on the Kwinana Waste to Energy plant

- www.abc.net.au/news/2019-01-25/potential-of-waste-to-energy-but-caution-urged/10734868
- https://thewest.com.au/business/renewable-energy/australias-first-waste-to-energy-plant-fuels-800-jobs-in-kwinana-ng-b88697263z
- www.phoenixenergy.com.au/wp-content/uploads/2014/06/Phoenix-Energy-Kwinana-WTE-PER-Document-FINAL.pdf
- www.phoenixenergy.com.au/projects
- www.abc.net.au/news/2015-10-15/was-first-thermal-waste-to-energy-facility-contract-inked/6855510
- www.perthnow.com.au/business/renewable-energy/kwinana-renewable-energy-plant-set-to-create-800-jobs-in-construction-phase-ng-b881129961z

The Issy-les-Moulineaux (ISSEANE) Waste to Energy Plant.
Source: www.aialifedesigners.cn/content/isseane-waste-sorting-and-recovery-centre

The Waste Authority position statement on waste to energy indicates waste to energy should only target genuine residual waste that could not with reasonable efforts be reused, reprocessed or recycled, and would otherwise go to landfill.

Energy recovery is a recognised option at the lower end of the waste hierarchy, which may be suitable for residual waste. Energy recovery is more favourable than disposal to landfill, but less favourable than the options of avoidance, re-use, reprocessing and recycling.

Residual waste generally refers to material that is left over after processing (through a processing facility and/or a source separation system), and which would otherwise be sent to landfill. The composition of residual waste streams may vary from region to region and over time, depending on the availability of recycling and recovery options. Considerable volumes of residual waste are currently being disposed to landfill.

The Waste Authority considers best practice waste to energy processes to be a preferable option to landfill for the management of residual waste, but not at the expense of reasonable efforts to avoid, reuse, reprocess or recycle waste. Waste to energy has the potential to divert substantial volumes of waste from landfill and produce a beneficial product.

www.wasteauthority.wa.gov.au/publications/view/position-statements/waste-to-energy-position-statement

www.wasteauthority.wa.gov.au/publications/view/miscellaneous/waste-to-energy

France's Issy-les-Moulineaux (ISSEANE) Waste to Energy plant came into operation in 2007 and treats 460,000 tonnes of residual waste a year. The ISSEANE plant is widely known for its innovative design, as it has been built partially underground and the chimney has been designed in such a way that no large stack is visible on the Paris skyline. It's located in a densely populated Parisian suburb on the banks of the River Seine with a view of the Eiffel Tower.

Image source: wastesorted.wa.gov.au

Strategy 3. Three bin system

Better kerbside bin systems and supporting communications and infrastructure, support increased resource recovery and make it easier to correctly use and support kerbside bin collections. The WA Waste Authority provides funding to local governments that introduce best practice kerbside collection. Previous programs encouraged local governments to implement three bin systems so that more waste can be separated at the home. New programs will build on those initiatives to support the further diversion of organic wastes, such as food organics and garden organics (FOGO), to drive resource recovery to meet Waste Strategy targets.

Three bin system:

1) Read through Source 8: Source separation and the three-bin system.
   a) What is source separation?
   b) Explain why the three-bin system can help to meet the Waste Strategy targets for diversion.
   c) Do you think all councils in Perth should adopt a three-bin system?
   d) Why might this not be practical?
2) Refer to Source 9: Comparison of bin systems.
   a) How does Perth's kerbside collection system compare with other capital cities in Australia?
   b) Does Perth have fewer local governments with three bins than other states?
   c) What about AWT (composting) plants?
   d) Which state has the most consistent system?
   e) Does it perform better than other states?
   f) Do you think the ***Better Bins program*** was influenced by the results shown by the waste collection systems in other states in Australia?
3) To what extent is the three-bins system informed by sustainability?
4) Use the Compare Council tool at https://mycouncil.wa.gov.au/Council/CompareCouncil to compare the waste streams at two local governments. Compare local governments who use three-bin systems such as the City of Melville or Bunbury with local governments that have decided to keep the two-bin system, such as the City of Armadale.
   a) Create a table or graph to show a comparison of where each local government send their waste.
   b) Does having a FOGO bin decrease the amount of waste going to landfill?
   c) Compare your local government to The City of Melville or City of Bunbury. How did it compare?
   d) Read the following excerpt from the Armadale City Council Waste Services Departmental Activity Report. Discuss if you think the reasons for not partaking in the three-bin systems are justified.

Excerpt from the Armadale City Council:

Council considered the implementation of a three-bin system at its 9 June 2014 meeting (Recommendation Number. T40/6/14) and resolved not to participate in the system for the following reasons:

- Financial cost to ratepayers that does not appear to justify the limited environmental and social benefits (high cost, low benefit);
- The three bins present an increased capacity to generate more household waste;
- High incidence of contamination in areas where this system has been implemented;
- A strong likelihood of an oversupply of product due to increased capture of green waste creating a glut in the compost and mulch market;
- High cost to produce an Australian Standard grade product suitable for open markets;
- Potential to spread plant disease/pathogens through under processed mulch;
- Lack of space to store bins on verges in front of properties and on properties;
- Additional truck movement in residential streets, adding to the risk and increasing wear and tear; and
- Increased carbon emissions from additional transport.

Source 8: Source separation and three bins system

Source separation is the process of sorting waste for separate collections. Perth households usually separate waste into two or three bins. Through the Better Bins program, the Waste Authority encourages local governments to adopt a three-bin system of source separation to maximise recovery of waste.

A three-bin system involves a bin for general waste (red lid), co-mingled (yellow) and green waste (green lid). The general waste bin is usually smaller than the others, to encourage people to produce less waste and encourage recyclable waste to be placed in the relevant recycling bin.

In some local government areas, the green lidded bin is for food too. This is sometimes called a FOGO bin because it takes Food Organics and Garden Organics. The City of Melville trialled FOGO in 2017 and within six months had exceeded the government's recovery rates of 65% by 2020. As part of the roll out, the City worked collaboratively with the South Metropolitan Regional Council (SMRC) to educate those participating in the FOGO trial about what goes in each bin and offered personalised feedback by bin tagging and auditing to reduce contamination rates.

The Waste Authority supports source separation because it has been shown to be effective in increasing recycling. More importantly, good source separation reduces contamination, which in turn improves the quality of the recycled product.

"The separation of materials at the point of collection results in a more homogenous and higher quality waste stream. Source separated material streams are less contaminated by other materials and are easier and less costly for recyclers to recover. Therefore, source separated materials represent a higher value to recycling markets." Waste Authority Source Separation of Waste Position Statement, 2014.

Image source: http://recycleright.wa.gov.au/3-bin-system-fogo-trial

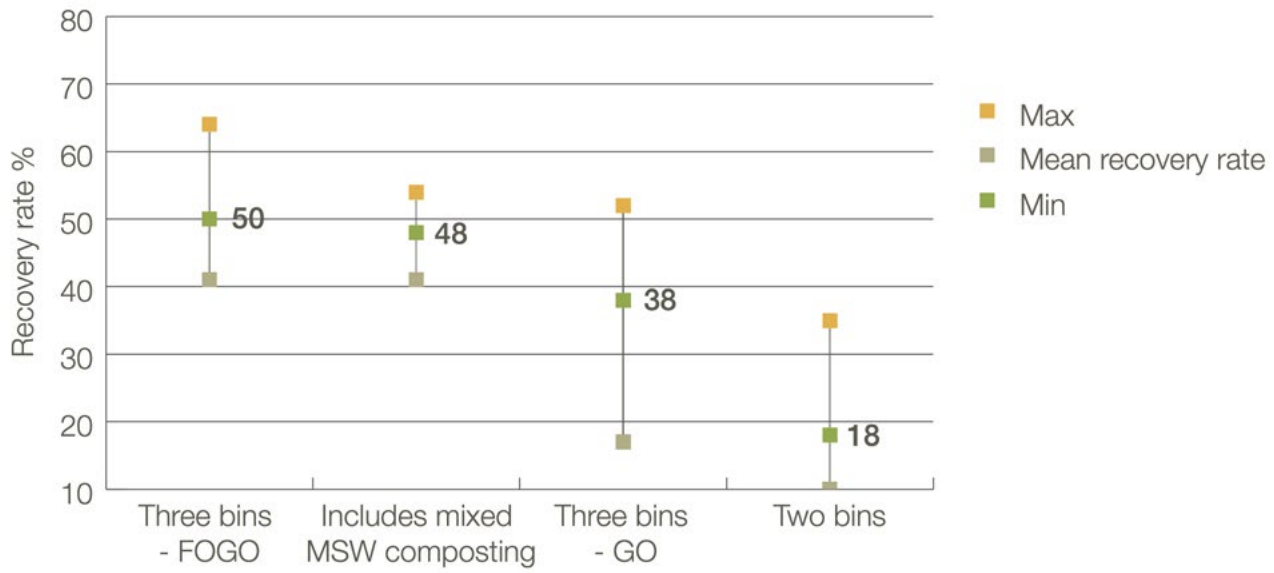
The Waste Authority has a position statement on Source Separation of Waste which can be accessed here. www.wasteauthority.wa.gov.au/publications/view/position-statements/source-separation-of-waste-position-statement

South Australia, New South Wales and Victoria have commonly used a three-bin system for source separation of household waste and kerbside recycling for some time. Their recycling rates are typically between 50 and 60 per cent, which is significantly higher than the kerbside recycling rate being achieved by most Western Australian local governments. Victoria announced in February 2020 that it will introduce a fourth purple lidded bin for glass recycling as part of its aim to reduce waste to landfill rates by 80 per cent.

In 2019-20, the best performing kerbside systems for material recovery were those with a third bin for the recovered of combined FOGO materials. FOGO systems had an average recovery rate of 50 per cent (highest performing was 64%), compared with only 18 per cent for local governments with two-bin systems.

For more information visit www.wasteauthority.wa.gov.au/publications/local-government-census

Mean, maximum and minimum reported recovery rates for kerbside systems in 2019-20



Note that systems which included any mixed MSW composting were assigned to this category. Three-bin system performance includes local governments where not all residents are provided with a third bin (i.e., there is a mix of two- and three-bin collections).

Source: Waste and Recycling in Western Australia 2019-2020 Report
www.wasteauthority.wa.gov.au/publications/annual-waste-and-recycling-data

Source 9: Comparison of bin systems

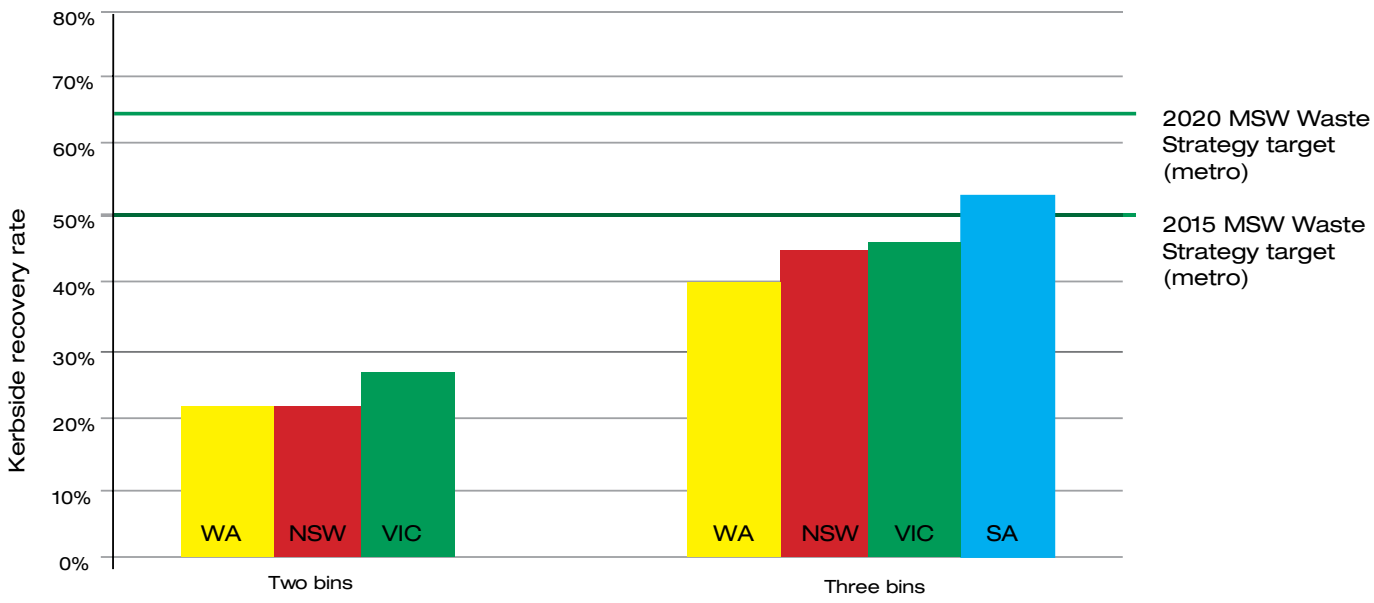
The types of kerbside collection systems used by Western Australian local governments have varied significantly. The following systems were used by Perth metropolitan local governments in 2012-13.

- Single bin (with mixed-waste treatment, often referred to as alternative waste treatment or AWT)
- Two bins - general waste, co-mingled recycling
- Two bins - general waste (with AWT), co-mingled recycling
- Three bins - general waste, co-mingled recycling, green waste
- Three bins - general waste (with AWT), co-mingled recycling, green waste.

Kerbside collection systems in Perth, Adelaide, Melbourne and Sydney (2012-13)

City	Number of local governments using kerbside system						% with three-bin system
	Single bin	Two bins	Two bins with AWT	Three bins	Three bins with AWT	TOTAL	
Perth	1	17	8	3	1	30	13
Adelaide	0	0	0	19	0	19	100
Melbourne	0	2	0	28	0	30	93
Sydney	0	1	3	24	10	38	89

Average recovery rates achieved using different bin systems. For the purposes of comparison, the graph excludes the use of AWT (alternative waste treatment) facilities.



Source: www.wasteauthority.wa.gov.au/images/resources/files/2019/11/Better_Bins_Reference_Report.pdf

Strategy 4. Waste levy

Waste Levy:

1) Read through Source 10: The waste levy
   a) How does the levy rate in Perth compare to other states?
   b) Is the levy effective?
   c) What are the benefits?
   d) What challenges are associated with the Waste Levy?
2) Do you think the landfill levy has been successful strategy for diverting construction and demolition waste from landfill?
3) The Waste Levy is not a unique strategy to Perth. Many governments around the world find this an effective strategy to divert C&D waste. Access www.wasteauthority.wa.gov.au/publications/view/miscellaneous/economic-drivers-of-waste Pages 47 – 74 of this resource provide case studies of places that impose a landfill tax, similar to Perth. These included the Netherlands, the United Kingdom, Italy, Canada, Japan, South Australia, Victoria and New South Wales. Choose one case study of interest and compare its landfill tax to that of Perth's.
4) To what extent is the waste levy informed by sustainability?

Source 10: The Waste Levy

A Waste Levy was established under the ***Waste Avoidance and Resource Recovery Act 2007*** (WARR Act). It is a state government levy that must be paid on waste sent to landfill. This means that a fee (levy) must be paid to put waste into a landfill. The Waste Levy applies to waste disposed to Perth metropolitan landfills or to waste generated in the metropolitan area but disposed to landfills outside of Perth.

A Waste Levy does not apply to regional landfills where the source of waste is from regional WA.

The Waste Levy acts as an economic instrument to reduce waste to landfill by increasing the cost of disposal (making it more and more expensive to put waste in to landfill). The higher cost of landfill makes other options like recycling more attractive.

The levy also generates substantial revenue for the state government so that they can invest in waste management and recycling initiatives. The WARR Act requires at least 25 per cent of the levy to be paid into the Waste Avoidance and Resource Recovery Account (WARR Account). The remaining 75 per cent is paid by the Department of Water and Environmental Regulation to the State. From 1 July 2008 to 30 June 2016, the WARR Account received $108 million in Waste Levy payments. The WARR Account is used to fund programs to improve recovery rates and reduce waste such as the WasteSorted Schools Program and the Better Bins program.

In recent years, the Waste Levy has increased significantly. If you own a home, you pay rates to the local government. Rates pay for the costs of services provided by local governments, including waste management services provided to households. Waste management costs include collection costs (collecting waste from households) and disposal costs (including the cost of disposing waste to landfills). There are two main costs associated with landfill disposal: 1. a gate fee charged by the landfill operator to cover the expenses of running a landfill, and 2. the waste levy (for waste generated in the metropolitan area) which is passed on to the Government.

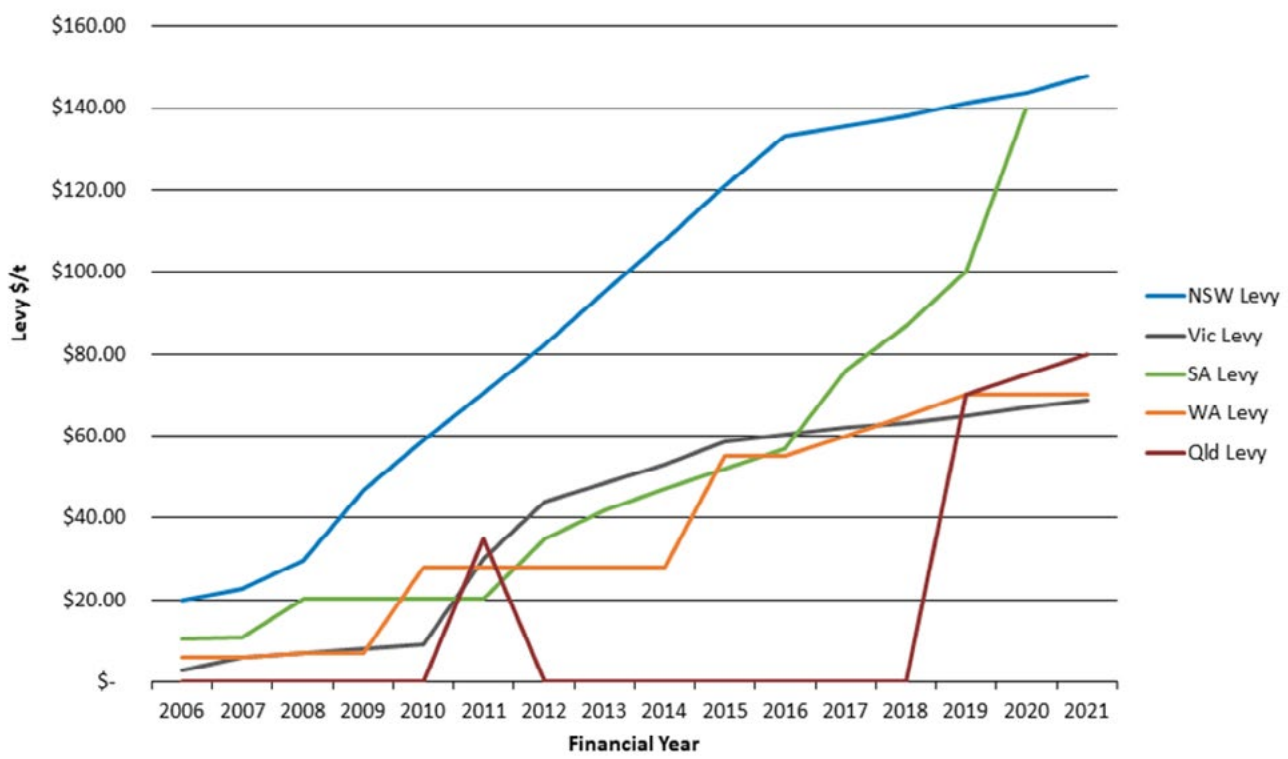
Waste levy rates for Perth

Period	Putrescible Rate per tonne	Approx. inert rate per tonne*	Inert Rate per cubic metre (m^3)
Current to 31 December 2014	$28	$8	$12
1 January 2015 to 30 June 2016	$55	$40	$60
1 July 2016 to 30 June 2017	$60	$50	$75
1 July 2017 to 30 June 2018	$65	$60	$90
1 July 2018 to 30 June 2019	$70	$70	$105
1 July 2019 onwards	$70	$70	$105

Source: www.der.wa.gov.au/about-us/media-statements/112-landfill-levy-rates-to-rise-from-january-2015

For more details about the levy relevant to WA please access www.wasteauthority.wa.gov.au/about/view/About-the-Waste-Authority-Levy

For most waste materials the cheapest disposal option has almost always been landfill. Most States have recognised this reality and introduced landfill levies to drive up the price of landfill and to make other options like recycling more competitive. The landfill levies for each State are shown below.



Source: https://blog.mraconsulting.com.au/2016/04/20/state-of-waste-2016-current-and-future-australian-trends

Waste Levy challenges

The average volume of inert waste (sand, bricks, concrete and glass) disposed to landfill in metropolitan Perth declined from 266,860 tonnes per quarter in 2014 to 36,930 tonnes per quarter in 2015. This equates to over 900,000 tonnes per year, or an 86 per cent reduction. This reduction in waste disposed to landfill coincided with the January 2015 increase in the Waste Levy from $8 to $40 per tonne.

Unreliable data makes it difficult to tell if the decrease in landfill activity is a result of increases in resource recovery (recycling), or other factors, such as stockpiling or illegal dumping of waste. Industry feedback and site visits showed evidence of alternative disposal methods to avoid paying the waste levy, which included:

- Metropolitan waste disposed to regional landfills – while the waste levy must be paid on all waste collected within the metropolitan region, waste transport operators may avoid payment of the levy by not declaring waste disposed of to a regional landfill as being from the metropolitan area.
- Sequential landfilling – inert waste is collected, sifted, crushed or shredded and used as 'construction fill'.
- Stockpiling of waste
- Illegal dumping of waste

Examples of Stockpiling and Illegal Dumping in WA

Illegal dumping of building waste in Baldivis

Source: www.perthnow.com.au/news/wa/illegal-dumping-of-building-waste-in-perth-rockets-as-landfill-levy-rises-ng-cea21bf3aad5810dcb7d667df3e8e68f

Stockpile of bricks and concrete at a metropolitan C&D recycling facility

Source: https://audit.wa.gov.au/reports-and-publications/reports/western-australian-waste-strategy-rethinking-waste/key-findings/c-and-d-waste-stockpile

Section 6

Evaluating liveability and sustainability

1. Liveability and sustainability definitions

a) Use internet research and/or read Source 11 to define the words 'liveability' and 'sustainability'.

b) Discuss with your classmates the definition of liveability. What makes a liveable city? What factors influence where people live? What do you like about the place that you live in? What don't you like? Are some factors more important than others? Do the factors vary between groups of people? Consider things like environmental quality, crime and safety, education and health provision, access to shops and services, recreational facilities and cultural activities.

c) Discuss the definition of sustainability with your classmates. Is it just about looking after the environment? What else is considered important?

d) Discuss how the concepts of liveability and sustainability are aligned. Can a community live simultaneously with all its needs being met now and in the future while improving its liveability?

2. Evaluating liveability and sustainability of waste management strategies

Use the *Worksheet: Evaluation of waste management strategies Perth* to **evaluate** the **extent** to which each strategy reflects liveability and sustainability. There are two parts to this – **evaluating** and the **extent**

- Things to consider when **evaluating**: Does the strategy improve the sustainability and liveability of Perth? Does the strategy address the challenge? What are the advantages and disadvantages of the strategy? What changes or improvements could be made to the strategy?
- Things to consider when rating the **extent**: Does the strategy have a significant impact to Perth's sustainability and liveability? Consider using a scale of 1 – 10 to describe the impact or use phrases such as 'minimal impact', 'small or minor impact', and 'large impact'. When comparing, you can use phrases like 'lesser impact' or 'greater impact'.
- Always assess each waste strategy against factors of liveability and pillars of sustainability.

Take action and choose a reusable coffee cup.

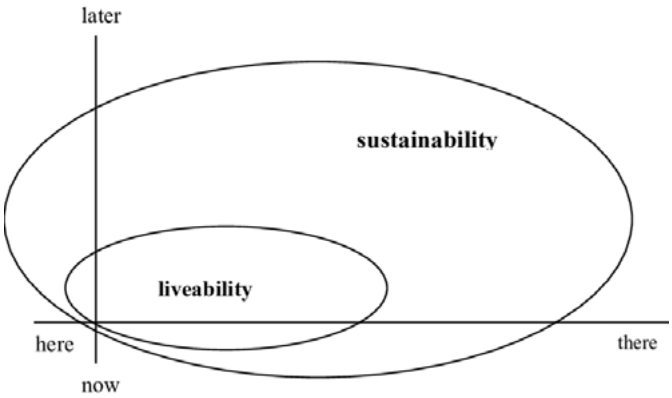
Source 11: Liveability and sustainability

Liveability reflects the wellbeing of a community and comprises many factors that make a neighbourhood desirable now and in the future. These factors include things such as:

1. Crime and safety
2. Housing
3. Education
4. Employment, income and standard of living
5. Healthcare and social services
6. Transport
7. Public open space
8. Social cohesion and local democracy
9. Leisure and culture
10. Food and other local goods

Sustainability is about meeting the needs of today's population without compromising the needs of future generations. The concept incorporates the three pillars of social, economic and environmental sustainability. Sustainability has a distinct emphasis on a long-term outlook and ensures the wellbeing of future generations.

The Connection of Liveability and Sustainability



Source: https://socialequity.unimelb.edu.au/__data/assets/pdf_file/0006/1979574/Liveability-Indicators-report.pdf

Sustainability is closely aligned with **liveability**. Sustainability is focused on the longer- term perspective of a place while liveability is about the localised and immediate concerns of a community.

Worksheet: Evaluation of Waste Management Strategies Perth

Evaluate the **extent** to which each strategy below has enhanced liveability and sustainability.

Strategy	**Evaluation of Liveability:** Crime and safety; Housing; Education; Employment, income and standard of living; Healthcare and social services; Transport; Public open space; Social cohesion and local democracy; Leisure and culture; Food and other local goods.	**Evaluation of Sustainability:** Environmental; Social: Economic.
Waste strategy and waste reduction targets	Has the waste strategy enhanced liveability? To what extent? 0 1 2 3 4 5 6 7 8 9 10	Has the waste strategy enhanced sustainability? To what extent? 0 1 2 3 4 5 6 7 8 9 10
Waste to Energy (e.g. one of the proposed waste combustion facilities in WA)	Has Waste to Energy enhanced liveability? To what extent? 0 1 2 3 4 5 6 7 8 9 10	Has Waste to Energy enhanced sustainability? To what extent? 0 1 2 3 4 5 6 7 8 9 10
The waste levy	Has the waste levy enhanced liveability? To what extent? 0 1 2 3 4 5 6 7 8 9 10	Has the waste levy enhanced sustainability? To what extent? 0 1 2 3 4 5 6 7 8 9 10

Strategy	**Evaluation of Liveability:** Crime and safety; Housing; Education; Employment, income and standard of living; Healthcare and social services; Transport; Public open space; Social cohesion and local democracy; Leisure and culture; Food and other local goods.	**Evaluation of Sustainability:** Environmental; Social: Economic.
Three bin system	Has the three-bin system enhanced liveability? To what extent? 0 1 2 3 4 5 6 7 8 9 10	Has the three-bin system enhanced sustainability? To what extent? 0 1 2 3 4 5 6 7 8 9 10
Landfill	Has landfill enhanced liveability? To what extent? 0 1 2 3 4 5 6 7 8 9 10	Has landfill enhanced sustainability? To what extent? 0 1 2 3 4 5 6 7 8 9 10
Alternative Waste Treatment (e.g. composting facility Neerabup)	Has the Alternative Waste Treatment enhanced liveability? To what extent? 0 1 2 3 4 5 6 7 8 9 10	Has the Alternative Waste Treatment enhanced sustainability? To what extent? 0 1 2 3 4 5 6 7 8 9 10

Section 7

Leadership in waste

What can you do to reduce waste in your school?

1. Generate a class discussion about the following:

   Waste avoidance is the preferred method of waste management as per the waste hierarchy. It is interesting to note that strategies adopted to manage waste in Perth rarely reflect avoidance. Rather, recycling, reprocessing, reusing and recovery (e.g. Waste to Energy) are common strategies used.

2. As a class consider a strategy that could be implemented in your school that demonstrates leadership in waste management. That is, waste avoidance, reusing waste and or recycling waste. Examples are:
   - Promotion of key message to increase the importance of waste avoidance. You could run a plastic free July competition (www.plasticfreejuly.org)
   - Waste free lunch days
   - Reusable canteen lunch bags
   - School worm farm
   - Second hand book sales
   - Composting bins
   - Additional recycling and organic waste bins
   - Become a WasteSorted School: www.wasteauthority.wa.gov.au/wastesortedschools/accreditation
   - At an assembly, watch excerpts of ***War on Waste***. This ABC three-part series provides ideas on what to do about waste in Australia (www.abc.net.au/ourfocus/waronwaste).

   A range of schools across WA have successfully implemented waste strategies in their community. For details and examples access www.wasteauthority.wa.gov.au/wastesortedschools/resources/case-study

3. Once you have selected a strategy, consider collaborating with key stakeholders within your school community to bring this to life:
   - Art / Design Graphics class: Students may design posters of key messages
   - Principal: To give overall approval of the strategy
   - Parents: May volunteer time and expertise to assist with the program
   - Canteen manager: To provides ideas to reduce waste in the canteen
   - Grounds person: To provide logistics for waste infrastructure.
   - Student council: Perhaps the Year 12 Geography class could present this opportunity to the student leaders of the school. Year 12 geography could act as an overseer of the project, whilst student council members implement a waste strategy on the behalf of Year 12 Geography.

PLASTIC FREE JULY

Students from a school pledge to reduce single-use plastic.

Section 8

Sample examination questions

Question 1

Refer to metropolitan Perth or a regional urban centre in Western Australia to answer Question 1.

Identify **two** significant challenges facing your chosen location and describe the views and attitudes of a major stakeholder group for each challenge.

(6 marks)

Challenge one: _____

Major stakeholder group: _____

Views and attitudes: _____

_____

_____

_____

_____

_____

_____

_____

Challenge two: _____

Major stakeholder group: _____

Views and attitudes: _____

_____

_____

_____

_____

_____

_____

_____

Question 2

Explain the concept of sustainability.

(3 marks)

Question 3

Refer to **one** planning strategy adopted in metropolitan Perth or a regional urban centre in Western Australia and **one** planning strategy adopted in a megacity.

Explain how these planning strategies aim to enhance/have enhanced the sustainability and liveability of **each** of the two locations.

(12 marks)

Question 4

a) Describe the nature, scope and causes of any two significant challenges confronting metropolitan Perth or a regional urban centre in Western Australia.

(8 marks)

To answer Question 4(b), refer to **one** challenge facing metropolitan Perth or a regional urban centre in Western Australia and **one** different challenge in a megacity,

b) Explain how a planning strategy has addresses/is addressing these challenges in **each** of the two locations.

(12 marks)

Question 5

Describe **two** significant challenges and explain the implications of each for metropolitan Perth or a regional centre in Western Australia.

(12 marks)

Question 6

Select **one** planning strategy adopted in metropolitan Perth or a regional centre in Western Australia. Describe the selected planning strategy and explain the extent to which it has been or could be informed by the concept of sustainability.

(12 marks)

GOVERNMENT OF
WESTERN AUSTRALIA

WASTE
AUTHORITY
WA...TOO GOOD TO WASTE

WasteSorted
Schools