STATEWIDE waste and resource recovery infrastructure PLAN

A 30 year roadmap for Victoria

Sustainability Victoria

VICTORIA State Government

Statewide Waste and Resource
Recovery Infrastructure Plan

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Foreword

Managing the waste we generate is an essential service for Victorians – a service provided by our waste and resource recovery system. The Statewide Waste and Resource Recovery Infrastructure Plan – the SWRRIP – provides a roadmap for this system over the next 30 years. The SWRRIP will ensure that Victoria has the right network of infrastructure to manage and recover the increasing amounts of materials being generated by our growing population.

Since the SWRRIP was first released in 2015, the Victorian Government has published seven regional implementation plans, with regional priorities and guiding implementation of the SWRRIP at the local level. Collectively these form a coordinated framework for planning our waste and resource recovery infrastructure – the first of its kind in Australia.

Our waste contains valuable materials, which are used in roads, buildings and in the manufacturing of new products and packaging. The entire waste and resource recovery sector is estimated to contribute over $4 billion to our economy and employ over 12,000 Victorians.

Increasing the recovery of waste will not only protect our environment, it builds an economy that is circular – one that maximises the productive use and reuse of valuable resources. The Victorian Government is committed to supporting a sustainable and robust local resource recovery industry. We are working to improve the collection, sorting and processing of recyclable materials to maximise their value, for both local and international use. To enable this, we have made the record investment of $30.4 million in the 2017–18 State Budget and $23 million in the 2016–17 Budget into the waste and resource recovery sector.

We also recognise the impact international markets can have on the viability of Victoria's recycling industry. This is why we are providing $13 million in support to councils and industry to maintain household recycling services, while Victoria's recycling sector adapts to new market conditions.

We can be proud that, in Victoria, we recover 67 per cent of materials, but we can do more.

To maximise recovery, we need a system with the right infrastructure. Industry and local governments will continue to play a critical role in safely operating and investing in both tested and innovative infrastructure.

Our system will need to adapt as our production and consumption patterns change the types of waste we discard. We are discarding products such as electronic waste more than ever before. That is why we propose to ban e-waste from landfill and have committed $16.5 million to develop a network of collection infrastructure, so that all Victorians can safely dispose of e-waste for recovery.

Increasing the recovery of organic materials, particularly food waste will be critical. The system currently manages nearly a million tonnes of food waste, but in 2015–16 only 10 per cent was recovered. Victoria will need new collection services and processing facilities to recover valuable nutrients and energy – and the Government is supporting this through implementation of the Victorian Organics Resource Recovery Strategy.

We will continue to need safe and well operated landfills to dispose of waste materials that we cannot viably recover. However, we want to reduce our reliance on landfill and increasing recovery will help us achieve this. **Over the next few years we expect to see up to 72 per cent of materials recovered for recycling or energy.** Similarly, alternative technology to manage the residual waste which cannot be recovered may play a role.

While increasing our recovery is important, so too is managing the impacts our waste and resource recovery facilities on the Victorian community. Integrating our land use planning system and decisions with our long-term planning for waste and resource recovery infrastructure protects the community and the environment from impacts, and provides certainly for the sector.

Reducing the waste each of us generate will not only save money and conserve the resources used in production, it will also reduce pressure on the waste and resource recovery system.

Infrastructure is a critical part of the system but it does not operate alone. How we all use it is important too. Implementation of the Victorian Waste Education Strategy will strengthen our understanding of the system and help us to recycle correctly.

Without sustainable markets for the end products, the system will not succeed. Developing and strengthening local markets will help to buffer our system from global disruptions, whilst strengthening Victoria's economy. The Victorian Market Development Strategy for Recovery Resources supports industry to develop and test new products made from recovered materials and promote their uptake and to strengthen markets for existing products – critical work of the Victorian Government which will help implement the SWRRIP.

A comprehensive overview of the programs, initiatives and funding being delivered by the Andrews Labor Government to reduce and manage waste in Victoria, can be found in Reducing waste: Victoria's waste and resource recovery statement.

We all have a role to play in building a waste and resource recovery system – owners and operators of facilities, local governments, private investors, waste transporters and the community.

Lily D'Ambrosio MP
Minister for Energy, Environment and Climate Change
Minister for Suburban Development

Contents

Foreword **1**

1. Overview **9**
1.1 Introduction 10
1.2 Legislative and policy context 12
1.3 Victoria's waste and resource recovery system 15

2. Implementing the SWRRIP **23**
2.1 Introduction 24
2.2 Achieving SWRRIP goals 26
2.3 SWRRIP strategic directions 27
2.4 Initiatives to support SWRRIP implementation 35
2.5 Decision-making guidance 41
2.6 Economic and transport assessments 43
2.7 Responding to climate change 46
2.8 Government actions to implement the SWRRIP 49
2.9 Key opportunities to increase recovery of materials 52
2.10 Monitoring and evaluating the SWRRIP 57

3. Integrated land use planning and hubs **59**
3.1 Introduction 60
3.2 Land use planning 61
3.3 Waste and resource recovery hubs 64

4. Materials managed by the waste and resource recovery system **77**
4.1 Introduction 78
4.2 Data considerations 79
4.3 How much are we currently managing? 80
4.4 Where do materials come from? 83
4.5 Materials and waste from household and municipal activities 84
4.6 Materials from commercial and industrial activities 86
4.7 Materials from construction and demolition activities 87
4.8 Where do we manage materials and waste? 88
4.9 Cross-regional flows 88
4.10 Interstate and export flows 90

5. Improving recovery of individual materials **93**
5.1 Introduction 94
5.2 Data considerations 95
5.3 Overview of organic materials 96
5.4 Food organics 100
5.5 Garden organics 102
5.6 Wood and timber 104
5.7 Commingled recyclable stream 106
5.8 Paper and cardboard 108
5.9 Glass 110
5.10 Plastics 112

5.11 Tyres and rubber 116
5.12 Metals 119
5.13 Aggregates, masonry and soils 120
5.14 E-waste 122
5.15 Waste to energy 124
5.16 Residual waste 125

6. Infrastructure supporting the waste and resource recovery system 127
6.1 Introduction 128
6.2 Data considerations 129
6.3 Existing infrastructure network 130
6.4 Collection 131
6.5 Recovery facilities 134
6.6 Reprocessing facilities 140
6.7 Residual waste management 143
6.8 Disposal infrastructure (landfills) 143

7. Appendices 151
7.1 Appendix 1: Economic and transport modelling methodology 152
7.2 Appendix 2: Land use planning and waste planning framework infrastructure categorisation 156
7.3 Appendix 3: Process for review, inclusion, expansion, downgrading and removal of hubs 157
7.4 Appendix 4: Data sources, data considerations and modelling 159
7.5 Appendix 5: Waste and Resource Recovery Group regions: member local governments 164
7.6 Acronyms and abbreviations 166
7.7 Glossary 167

List of tables

TABLE 1.1 SWRRIP legislative framework ... 13
TABLE 1.2 Waste and resource recovery system stakeholders ... 18
TABLE 1.3 Defining waste and materials in Victoria ... 20
TABLE 2.1 Summary of enabling initiatives and complementary plans supporting the SWRRIP ... 26
TABLE 2.2 Opportunities identified in Regional Implementation Plans ... 36
TABLE 2.3 Victorian Organics Resource Recovery Strategy projects ... 38
TABLE 2.4 Guidance on making decisions consistent with SWRRIP goals ... 42
TABLE 2.5 Mechanisms considered by modelling to improve transport efficiencies ... 45
TABLE 2.6 Main sources and mitigation mechanisms of greenhouse gas ... 46
TABLE 2.7 SWRRIP actions for government ... 49
TABLE 2.8 Summary of opportunities identified to recover individual material streams ... 53
TABLE 2.9 Gaps in the current resource recovery infrastructure network ... 55
TABLE 2.10 Gaps in reprocessing capacity identified in Regional Implementation Plans over the next 10 years ... 56
TABLE 3.1 Descriptors of local, regional and state hubs ... 65
TABLE 3.2 Hubs of state importance ... 66
TABLE 3.3 Opportunities and potential barriers to developing hubs ... 75
TABLE 3.4 Hub roles and responsibilities ... 76
TABLE 4.1 Main materials managed, recovered and landfilled (2015–16) ... 80
TABLE 4.2 Percentage of materials sourced from each sector (2015–16) ... 83
TABLE 4.3 Materials from the MSW sector (2015–16) ... 84
TABLE 4.4 Materials from the C&I sector (2015–16) ... 86
TABLE 4.5 Materials from the C&D sector (2015–16) ... 87
TABLE 4.6 Materials managed by waste and resource recovery region in (2015–16) ... 88
TABLE 4.7 Cross-regional flows significant to the statewide system (2013–14) ... 89
TABLE 4.8 Main recovered materials exported from Victoria 2015-16 ... 91
TABLE 5.1 Main categories of organic materials ... 97
TABLE 5.2 Organic materials managed (2015–16) ... 97
TABLE 5.3 Opportunities to increase recovery of food organics ... 101
TABLE 5.4 Opportunities to increase recovery of garden organics ... 103
TABLE 5.5 Opportunities to increase recovery of wood and timber ... 105
TABLE 5.6 Indicative breakdown of materials in the commingled stream from municipal collection services (2015–16) ... 107
TABLE 5.7 Lists the opportunities to increase the recovery from the commingled stream ... 107
TABLE 5.8 Opportunities to increase recovery of paper and cardboard ... 109
TABLE 5.9 Opportunities to increase recovery of glass ... 111
TABLE 5.10 Opportunities to increase recovery of plastics ... 114
TABLE 5.11 Products possible from recovery of tyres ... 117
TABLE 5.12 Opportunities to increase recovery of tyres and rubber ... 118
TABLE 5.13 Product and materials made from recovered aggregates, masonry and soils ... 121
TABLE 5.14 Opportunities to increase recovery of aggregates, masonry and soils ... 121
TABLE 5.15 Opportunities to increase recovery of e-waste ... 123
TABLE 5.16 Opportunities to increase recovery of materials from the residual waste stream ... 126

TABLE 6.1 The four major groups of waste and resource recovery infrastructure 129
TABLE 6.2 Number of resource recovery and residual waste infrastructure by region as at 1 June 2017 130
TABLE 6.3 Municipal collection services in Victoria (2015–16) 131
TABLE 6.4 Opportunities to improve municipal kerbside collection services 133
TABLE 6.5 Opportunities to improve recovery from commercial collection services 133
TABLE 6.6 Major types of recovery infrastructure across Victoria 134
TABLE 6.7 Number of resource recovery facilities by type and region 136
TABLE 6.8 Factors affecting the optimisation of the resource recovery centre network 137
TABLE 6.9 Opportunities to increase materials recovery at MRFs 139
TABLE 6.10 Victorian reprocessors and estimated tonnes managed (2015–16) 140
TABLE 6.11 Types of landfills in Victoria 144
TABLE 6.12 Number of operating landfills by region (June 2017) 146
TABLE 6.13 Types of waste accepted at landfills across Victoria 147
TABLE 7.1 Transport modelling Data inputs 153
TABLE 7.2 Economic Modelling Data inputs 154
TABLE 7.3 Land use planning and waste planning framework infrastructure categorisation 156
TABLE 7.4 Cascading criteria for waste and resource recovery hubs 157
TABLE 7.5 Process for reviewing and assessing hubs of state importance 158
TABLE 7.6 Main data sources for the SWRRIP 159
TABLE 7.7 Local government areas by waste and resource recovery region 164

List of Figures

FIGURE 1.1 Flow of resources in Victoria's waste and resource recovery system 15
FIGURE 1.2 Map of Victoria's waste and resource recovery regions 17
FIGURE 2.1 SWRRIP vision, purpose and long term strategic directions 25
FIGURE 2.2 The enabling initiatives delivering the goals of the SWRRIP 26
FIGURE 2.3 Wastes hierarchy 41
FIGURE 2.4 Recovery of main material streams (2015–16) (tonnes and percentage recovered) 52
FIGURE 3.1 Hubs of state importance 65
FIGURE 4.1 Materials being managed annually (2005–06 to 2015–16) (tonnes) 81
FIGURE 4.2 Projected waste and materials recovered and landfilled (tonnes), business as usual scenario (2005–06 to 2045–46) 82
FIGURE 4.3 Materials recovered in Victoria for export (2015–16) 90
FIGURE 5.1 Organic materials entering the waste and resource recovery system (2005–06 to 2015–16) 99
FIGURE 5.2 Quantity (tonnes) of flexible and rigid plastics managed (2014–15) 113
FIGURE 5.3 Indication of possible end uses of tyres in Victoria 116
FIGURE 5.4 Indicative composition of municipal and C&I materials entering landfills (2014) 125
FIGURE 6.1 Quantity (tonnes) of materials from municipal collection services (2015–16) 132
FIGURE 6.2 Trends in the number of landfills (2001–02 to 2015–16) 145

1. Overview

1.1 Introduction

This chapter provides an overview of the purpose of the Statewide Waste and Resource Recovery Infrastructure Plan within Victoria's legislative and policy settings and an outline of Victoria's waste and resource recovery system.

The *Statewide Waste and Resource Recovery Infrastructure Plan* (SWRRIP) provides Victoria with a roadmap to guide planning and investment in waste and resource recovery infrastructure over the next 30 years.

Victorian households and businesses use and then discard a wide range of materials. Many of these materials can be and are recovered for reuse or recycled into useful products; although some residual waste remains and requires disposal.

As Victoria's population grows, so too will the amount of materials we discard. In 2015–16, approximately 12.7 million tonnes of materials entered Victoria's waste and resource recovery system. By 2046, it is projected to reach 20 million tonnes – an increase of 57 per cent.

Victoria's waste and resource recovery system provides an essential service by managing these materials through a network of infrastructure and a wide variety of services, such as collection and transportation. The community's behaviours and approach to recycling also contribute to a healthy system. The system recovered 67 per cent of the materials in 2015–16.

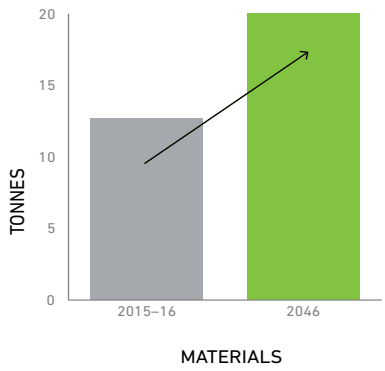
One of the most vital components of this system is the network of more than 630 pieces of infrastructure across Victoria, run by over 590 businesses and local governments. It contributes more than $4 billion to the Victorian economy and employs over 12,000 Victorians[1]. As materials and wastes can be harmful to human health, damage the natural environment, and/or impact on amenity, the system, which is regulated by the EPA, must operate to minimise these risks

The SWRRIP seeks to ensure that Victoria has the right network of infrastructure to both manage the increasing amounts of materials being generated by our growing population and to increase the recovery of valuable resources and reduce our reliance on landfill. The infrastructure needs to enable safe and efficient collection, sorting, reprocessing and disposal of materials.

"The Victorian waste and resource recovery system provides an essential service."

In 2015–16 approximately 12.7 million tonnes of materials were managed by the Victorian waste and resource recovery system.

By 2046, it is projected to reach 20 million tonnes, an increase of 57%.



1 Department of the Environment and Energy, Centre for International Economics, *Headline economic value for waste and materials efficiency in Australia*. October 2017.

Victoria's long term waste and resource recovery infrastructure planning prioritises establishing infrastructure to maximise resource recovery. Diverting materials away from landfill for viable recovery creates opportunities to reduce potential risks, capture value from our wastes and generate jobs. However, efforts to recover resources must be matched by efforts to stimulate demand for these materials from well-developed markets. Insufficient demand for recovered material could lead to unintended environmental or economic consequences.

Planning for resource recovery and waste infrastructure is inherently linked with planning for other essential services, particularly land use and transport planning. Integrating this planning ensures the availability of enough suitably located land that is protected from encroachment and will encourage enough industry investment in the system over the next 30 years. This planning also needs to include mechanisms to protect the community and environment and prevent incompatible activities that might affect the viability of resource recovery and waste management activities over the long term.

The SWRRIP is intended to guide planning and investment decisions made by the waste and resource recovery industry, local and state governments, and to influence land use planning, transport and broader environmental policy.

The SWRRIP sets out the current waste and resource recovery infrastructure at the state level and models projections for future trends in waste generation, recovery and landfilling over the next 30 years. For each of the main material streams, the SWRRIP summarises current recovery scenarios, as well as future opportunities and potential barriers to increasing recovery. The SWRRIP currently identifies infrastructure needs for non-hazardous municipal and solid industrial waste, but may incorporate other material and waste streams in future iterations.

The SWRRIP was first published in in June 2015. This version has been updated to reflect the seven Regional Implementation Plans and policy settings, include the latest data and information and is clearer about how the SWRRIP informs decision-makers.

MANAGING WASTE IS AN ESSENTIAL SERVICE

The waste and resource recovery system provides an essential service to manage Victoria's waste and material streams. Without proper management, waste can cause a range of issues that may affect the community and the environment, such as odour, dust, noise, leachate (which can contaminate groundwater and soil) and greenhouse gases.

To achieve this, the community needs to recognise the benefits of an efficient and effective waste management system, the essential nature of the services required, be involved in the decision-making process and be reassured that facilities operate to best practice standards to protect them from any adverse impacts of activities.

1.2 Legislative and policy context

The *Environment Protection Act 1970* (EP Act) establishes the Victorian Waste and Resource Recovery Infrastructure Planning Framework (the Framework). The aim of the Framework is to achieve long term planning for waste and resource recovery infrastructure at state and regional levels, integrated with land use and transport planning systems.

The EP Act requires Sustainability Victoria (SV) to develop the SWRRIP and the seven Waste and Resource Recovery Groups (Regional Groups) to each develop a Regional Waste and Resource Recovery Implementation Plan (Regional Implementation Plan).

The SWRRIP provides strategic direction for managing resource recovery and waste infrastructure in Victoria for 30 years. Regional Implementation Plans describe how this will be implemented at a local and regional level. Regional Implementation Plans also provide an opportunity for local government and the community to be involved in waste planning in their region.

Collectively, the SWRRIP and the seven Regional Implementation Plans enable Victoria to establish an integrated statewide waste and resource recovery system that:

- effectively manages the expected mix and volumes of wastes and materials
- supports a viable resource recovery industry
- reduces the amount of valuable materials going to landfill
- reflects environmental justice principles to ensure that impacts on the community, environment and public health are not disproportionately felt across communities.

The SWRRIP operates within a legislative framework, including but not limited to the Acts described in Table 1.1.

ENVIRONMENTAL JUSTICE PRINCIPLES

The principles of environmental justice are based on the concepts of equity and participation. Environmental justice ensures that environmental benefits and impacts are distributed proportionately, and affected communities can participate in decision-making.

For waste and resource recovery planning in Victoria, this means involving the community in determining waste and resource recovery priorities, with opportunities to participate in the decision-making and long term planning to establish a safe, integrated waste and resource recovery system.

As part of the 2017 response to the independent Inquiry into the Environment Protection Authority, the Victorian Government committed to developing a whole-of-government approach to environmental justice.

TABLE 1.1
SWRRIP LEGISLATIVE FRAMEWORK

Act	Description
Environment Protection Act 1970 (EP Act)	In addition to establishing the Framework and Regional Groups, it establishes the regulatory framework for environmental protection. It has a range of guiding principles including the wastes hierarchy, and underpins the regulatory framework for managing waste. It details the content and process by which the SWRRIP and Regional Implementation Plans must be developed, including specifying the way regional groups must develop the infrastructure schedules within the Regional Implementation Plans.
Planning and Environment Act 1987	Sets out the objectives of planning in Victoria, establishes the Victorian Planning Provisions and local planning schemes including the State Planning Policy Framework which seeks to ensure that all responsible authorities work to achieve the objectives of this Act.
Sustainability Victoria Act 2005	Provides that a function of SV is to prepare the SWRRIP and establishes a range of functions relating to resources. These include to: › plan on a statewide basis, and to facilitate managing waste in accordance with Victorian legislation and government policies › promote throughout Victoria waste avoidance, waste reduction and recovery, reuse and recycling of resources and best practices in waste management › facilitate the uptake of fledgling technologies, industries, markets and practices in environmental sustainability, including demonstration projects.
Transport Integration Act 2010 (TI Act)	Creates a framework to provide an integrated and sustainable transport system that contributes to an inclusive, prosperous and environmentally responsible state. The SWRRIP includes a transport analysis so that transport implications and requirements can be considered.
Local Government Act 1989	Establishes the powers and functions of local governments in Victoria. Under the Act, the primary objective of a council is to endeavour to achieve the best outcome for the local community. A council must ensure the most efficient and effective use of resources, and ensure that it provides services in accordance with best value principles. These principles must guide local waste and resource recovery services, as well as any decision to opt into collective infrastructure procurement. Under this Act, a council can pass local laws that reinforce land use planning and municipal waste and resource recovery strategies.
Climate Change Act 2017	Establishes a legislated emissions target (net zero emissions by 2050) and seeks to ensure the long and short term impacts of climate change are considered in all Victorian Government policies, programs or processes.

1.2.1 Other relevant policies, positions and regulations

The SWRRIP also incorporates relevant Victorian and national government policies, positions and regulations, and will consider the following factors when delivering the long term goals for Victoria's waste and resource recovery system:

E-waste ban to landfill

In 2014, the Victorian Government committed to banning e-waste from landfill. E-waste is growing three times faster than general municipal waste in Australia, putting pressure on waste management infrastructure and the environment. Banning e-waste from landfill will increase resource recovery and supports jobs and investment in the recycling industry.

SV is working with the Department of Environment, Land, Water and Planning, the Environment Protection Authority Victoria (EPA) and Regional Groups to design an effective approach to banning e-waste from landfill in Victoria.

Victorian Climate Change Framework

Released in 2017, the Victorian Climate Change Framework, together with the *Climate Change Act 2017*, establishes an emissions reduction target and the Victorian Government's four pillar approach to reducing Victoria's impact on climate change. The first three pillars focus on reducing energy emissions, which account for over 80 per cent of Victoria's emissions, while the fourth seeks to reduce emissions from non-energy-related activities such as landfilling waste and fertiliser use.

Waste management policies

Under the EP Act, the EPA can develop waste management policies (WMPs) to improve management of waste and material streams. WMPs provide enforceable statewide objectives and directions. Currently, a series of WMPs address movement of controlled waste, landfills, used packaging materials and other waste-related operations.

National waste policy: Less Waste, More Recycling

This policy establishes national waste and resource recovery policy direction to 2020, and was agreed to by all Australian governments.

Waste to Energy

The Victorian Government recognises that WtE has the potential to play an increasing role in the future management of wastes in Victoria. It is important that WtE options only be used where higher order recovery options are not practicable, or where higher order recovery options may lead to worse outcomes for the environment or human health. In 2017–18 the Victorian Government is undertaking a consultative process to investigate how WtE options can best provide options for statewide and regional economic development, employment prospects and increased recovery of resources from our wastes.

Waste avoidance

Reducing the amount of wastes we generate also reduces our impact on the environment and community amenity. While the primary role of the SWRRIP is to plan for the infrastructure needed to manage the waste and materials entering the waste and resource recovery system, the Victorian Government's supporting initiatives also help Victorians avoid generating waste in the first place. As well as the broader environmental benefits, avoiding waste generation also reduces pressure on the infrastructure network and services, enabling it to better meet the needs of Victoria's expanding population.

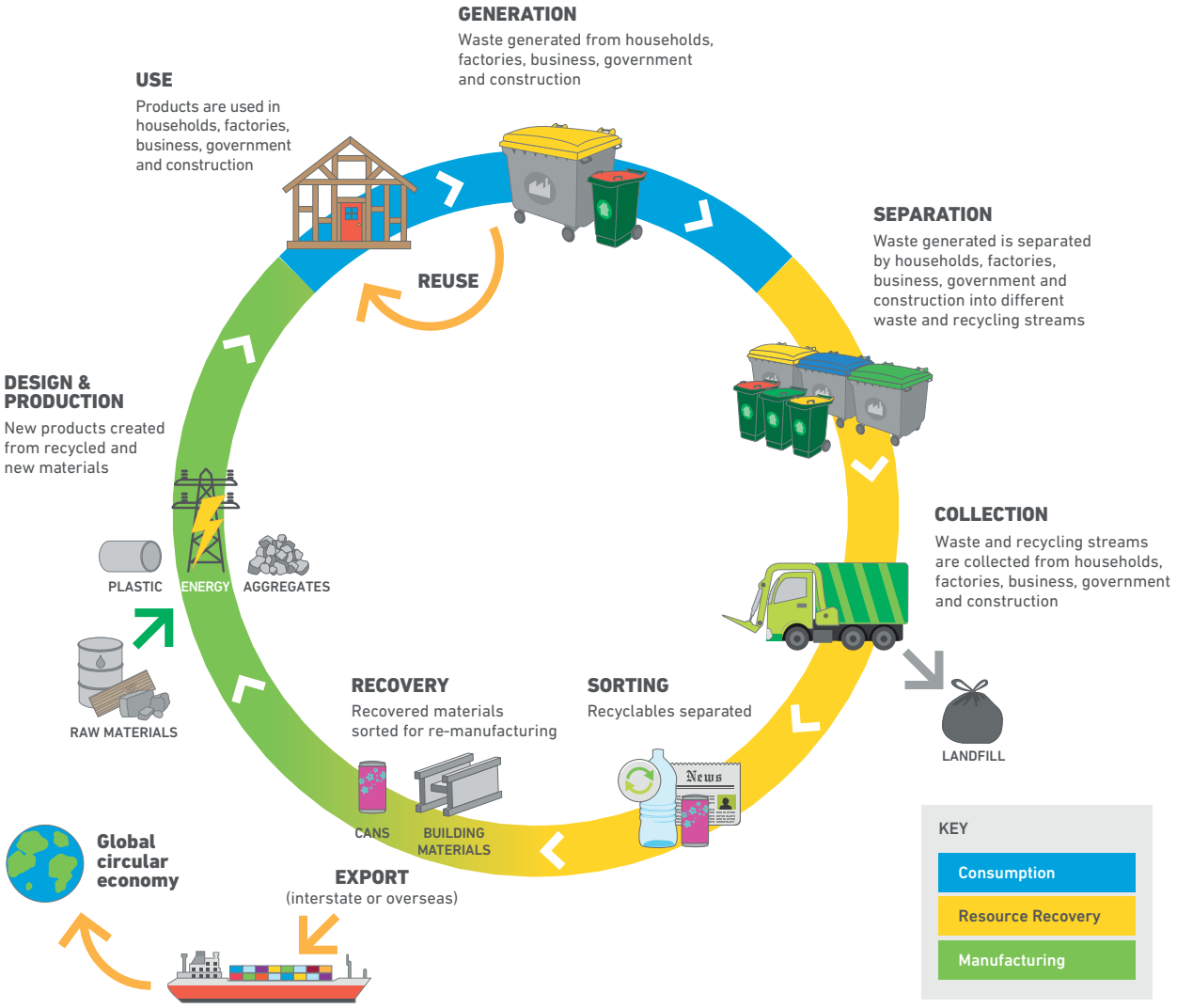
1.3 Victoria's waste and resource recovery system

Victoria's waste and resource recovery system is made up of the infrastructure, transportation networks, services and stakeholders that manages the materials discarded by Victorian households and businesses. Most of these materials are valuable resources which can be recovered for reuse or recycling.

1.3.1 Resource recovery and residual waste system activities

Figure 1.1 shows the flow of resources in Victoria's waste and resource recovery system.

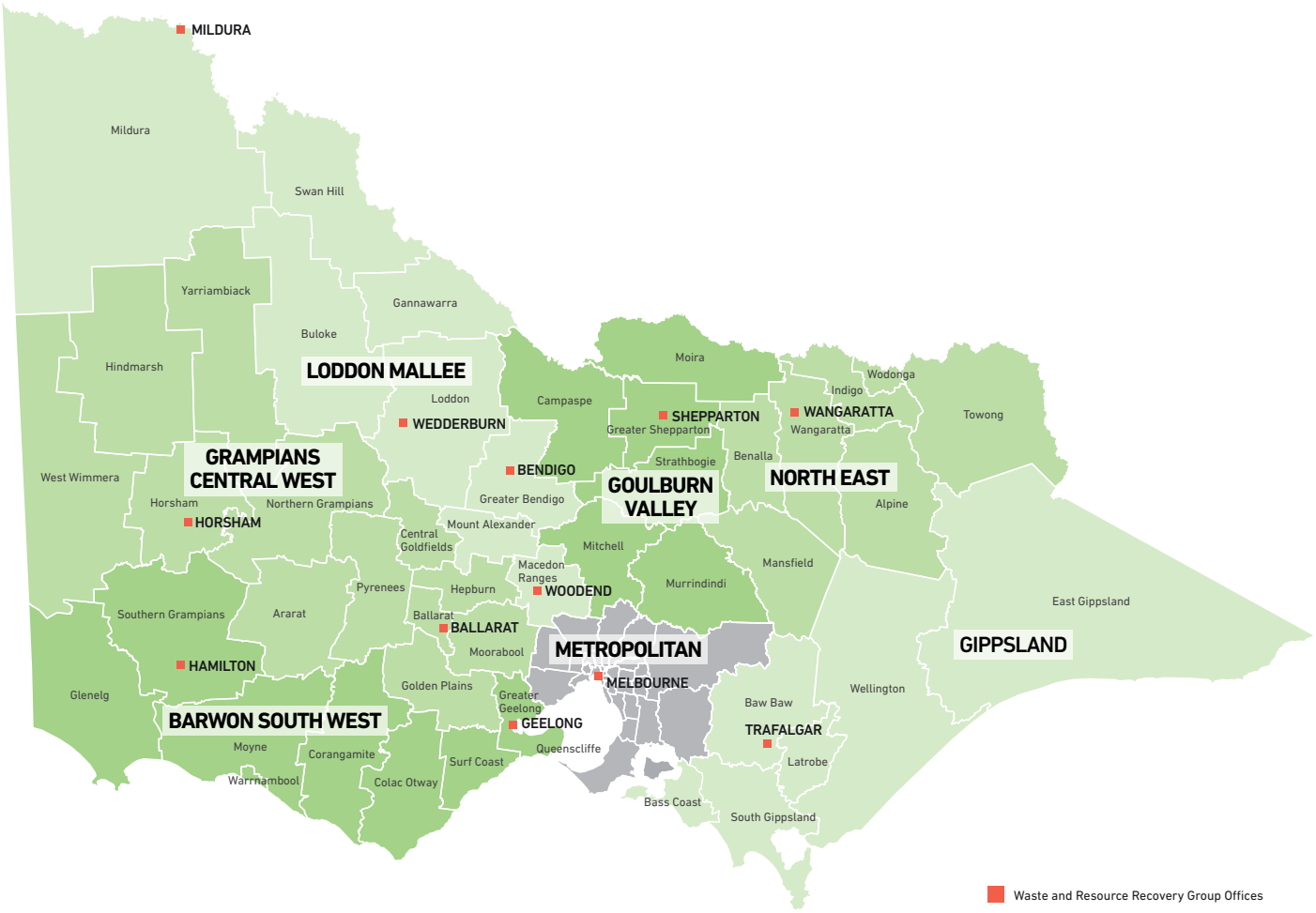
FIGURE 1.1
FLOW OF RESOURCES IN VICTORIA'S WASTE AND RESOURCE RECOVERY SYSTEM



1.3.2 Waste and resource recovery regions

To effectively manage our waste and resource recovery needs, Victoria is divided into seven regions, as shown in Figure 1.2. Each region has its own Waste and Resource Recovery Group, which are Victorian statutory authorities established under the EP Act. Among other responsibilities, they develop Regional Implementation Plans for their regions to identify local waste infrastructure needs and how to meet them over the next 10 years. This is discussed further in Section 2.4.1.

FIGURE 1.2
MAP OF VICTORIA'S WASTE AND RESOURCE RECOVERY REGIONS



1.3.3 Stakeholders

Numerous organisations plan for, invest in, use and operate Victoria's system, as listed in Table 1.2.

TABLE 1.2
WASTE AND RESOURCE RECOVERY SYSTEM STAKEHOLDERS

Stakeholder	Role in waste and resource recovery system
Community	› Generate recoverable material streams and residual waste › Separate household commingled recyclables and organics for recovery › Can choose to buy goods made from recovered material streams helping to develop markets to support increased recovery › Can participate in decision-making processes at the local and regional level as part of the process for developing of Regional Implementation Plans › Provide industry with a social licence to operate waste and resource recovery facilities and services by understanding the need and value to their community when facilities are operated to minimise community, environment and public health impacts
Businesses, industry and government	› Generate recoverable material streams and residual waste › Separate some material streams for reprocessing › Potential market for goods made from recovered material streams › Can participate in decision-making processes at the local and regional level as part of the process for developing Regional Implementation Plans
Manufacturers	› Generate recoverable material streams and residual waste › Separate material streams for recovery › Potential users of recovered materials as raw inputs to manufacturing processes
Waste and resource recovery industry	› Provide collection, transport, sorting and reprocessing, trading and exporting, disposal and resource recovery infrastructure and services › Plan and invest in the infrastructure that manages waste and resource recovery material streams
Local governments	› Provide and procure waste and recycling services, transport, reprocessing and/or disposal to landfill services for their communities either directly or through contractors › Educate local communities on waste and resource recovery, litter and waste avoidance › Deliver waste and resource recovery related projects › Undertake strategic land use planning and assess development applications, including applications for waste and resource recovery facilities, high-rise and multi-unit developments and associated waste infrastructure under their planning schemes › Can choose to buy goods made from recovered material streams helping to develop markets to support increased recovery › Support the Regional Groups to develop Regional Implementation Plans › Develop Waste Management Plans (or equivalent) consistent with Regional Implementation Plans

Stakeholder	Role in waste and resource recovery system
Waste and Resource Recovery Groups (Regional Groups)	› Legislative responsibility to develop a Regional Implementation Plan for their region, including an infrastructure schedule, and work with SV to integrate Regional Implementation Plans with the SWRRIP › Involved in planning to meet the future needs of their region while minimising community, environment and public health impacts of waste and resource recovery infrastructure › Deliver a range of projects, campaigns and other initiatives to achieve the outcomes in their Regional Implementation Plans › Facilitate effective procurement of waste and resource recovery services and infrastructure for their region by working collaboratively with member local governments, industry, other Regional Groups and SV › Consult with regional stakeholders on their Regional Implementation Plans and educate businesses and communities to reduce waste going to landfill › Coordinate and support community education › Help local governments and industry to maximise resource recovery, reduce waste and minimise impacts to the community, environment and public health from the management of waste and material streams › Help local government with strategic and statutory land use planning activities relevant to the waste and resource recovery system in their region
Sustainability Victoria (SV)	› Legislative responsibility to develop the SWRRIP, support Regional Groups to develop their Regional Implementation Plans and work with Regional Groups to integrate Regional Implementation Plans with the SWRRIP › Develop and implement strategies, frameworks, projects and programs and resources to promote and facilitate the sustainable use of resources to support SWRRIP implementation › Provide data and information to inform waste and resource recovery planning and publish data-related reports including the Victorian Annual Recycling Industries Report and the Victorian Local Government Annual Waste Services Report › Help local government with strategic and statutory land use planning activities related to the statewide waste and resource recovery system
Environment Protection Authority Victoria (EPA)	› Responsible for controlling pollution by regulating businesses and industry to achieve clean air, healthy water, safe land and minimal disturbance from noise and odour (includes setting and enforcing standards) › Regulates the waste and resource recovery industry through works approvals and licences and other regulatory tools › Assesses works approvals in line with the EP Act, state environment protection policies and regulations, the SWRRIP and Regional Implementation Plans › Provides guidance documents related to specific technologies or statutory rules as required, including EPA's landfill BPEM (*Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills*, August 2015). › Help local government with strategic and statutory land use planning activities
Department of Environment, Land, Water and Planning	› Prepare legislative amendments and develop waste and resource recovery policy, portfolio leadership and coordination governance › Work with other government departments, particularly the Department of Economic Development, Jobs, Transport and Resources and the Department of Health and Human Services to maximise investment and employment opportunities and to address the community, environment and public health problems posed by waste
Victorian Planning Authority	› Work with local government, local communities, other government agencies, landowners and developers to plan for strategically important precincts in inner and middle ring Melbourne › Plan strategically for growth areas and regional cities
Federal government	› Prepare and coordinate the National Waste Policy › Coordinate the *National Product Stewardship Act 2011*

1.3.4 Materials managed by the waste and resource recovery system

The materials managed by the waste and resource recovery system reflect the solid wastes discarded by our households, industry and business. Some contain valuable materials and resources that have the potential to be recycled, reused or reprocessed for use back into the community.

If not managed properly, these materials and wastes can adversely impact our communities and the environment. The SWRRIP operates within a regulatory framework that aims to protect public health, community amenity and the environment across all resource recovery and waste management activities.

Some materials are more hazardous than others, these hazardous materials are controlled and regulated by the EPA under the *Environment Protection (Industrial Waste Resource) Regulations 2009*. Currently referred to as prescribed or hazardous wastes, special requirements are placed on their handling, storage, transport and disposal.

This SWRRIP considers the infrastructure needed to manage the solid wastes that enter the waste and resource recovery system. It does not consider infrastructure needed to manage hazardous wastes in Victoria. The only exception is where hazardous waste management crosses over with managing non-hazardous wastes. For example, some landfills that accept putrescible and solid inert wastes are also licensed to accept some types of hazardous wastes. This has been considered when determining landfill airspace availability, as discussed in Section 6.8.5.

There is a clear need for a strategic and coordinated approach to planning for hazardous waste. The next version of the SWRRIP will address hazardous waste and the infrastructure required to for its management.

Table 1.3 lists some common definitions of waste and materials in Victoria. More detail on the materials managed by the waste and resource recovery system can be found in Section 4.3.

TABLE 1.3
DEFINING WASTE AND MATERIALS IN VICTORIA

Material type	Description
Putrescible	› Readily decomposes and includes food and organic material from gardens.
Inert	› Neither chemically nor biologically reactive and will not decompose. Includes glass, sand and concrete.
Garden organics	› Putrescible materials derived from garden sources, such as grass clippings and tree prunings. Also known as green organics.
Food organics	› Putrescible food organics from households or industry, such as food processing waste, out-of-date or off-specification food, meat, fruit and vegetable scraps. Excludes liquid wastes.
Commingled recyclables	› Materials, generally inert, combined for collection, mainly through kerbside collection services. Includes rigid plastics, other plastics (in some instances), paper and cardboard, glass and metal containers. › Also called commingled materials and dry recyclables.
Individual material streams	› Materials in the waste and resource recovery system that have been collected and sorted for recovery, reprocessing or disposal. The main material streams discussed in the SWRRIP are organics, paper and cardboard, plastics, tyres and rubber, metals, aggregates, masonry and soils, and textiles.
Residual waste	› Residual waste is what remains after materials that can be viably recovered have been removed for reuse, recycling or energy generation. A mixture of putrescible and inert components.
Hazardous wastes (also known as prescribed industrial wastes)	› Hazardous wastes are materials discarded from industrial processes and activities, as prescribed under the *Environment Protection (Industrial Waste Resource) Regulations 2009*. Tonnages of these materials are not considered in the SWRRIP except where their disposal affects landfill airspace. › Industrial wastes are classified by the risk posed to the environment: – Category A prescribed industrial wastes are highly contaminated and must be treated before disposal. – Category B prescribed industrial wastes have medium levels of contamination. There is only one landfill licensed to accept these wastes in Victoria. – Category C prescribed industrial wastes have low levels of contamination and can be disposed of at a few specially licensed landfills.

1.3.5 Infrastructure

The waste and resource recovery system provides an essential service to Victorian communities by managing public health and the environmental impacts of discarded materials and wastes.

There are more than 630 major pieces of infrastructure supporting Victoria's system, owned and managed by both the private and public sector. Chapter 6 discusses the current system of waste and resource recovery infrastructure across the state, while Section 2.9 summarises key opportunities to increase recovery and potential infrastructure capacity gaps across the State, based on projected levels of waste generation.

Victoria's system includes a network of 'hubs and spokes'. Hubs are facilities, or groups of facilities, that process or manage waste and material streams. Spokes are the sequence of activities that move materials from waste generators to hubs, for example, for collection, transporting and sorting. Hubs are discussed in more detail in Section 3.3.

Establishing an effective network of hubs relies on linking waste and resource recovery infrastructure planning with other government processes, such as land use and transport planning. This is critical for protecting existing infrastructure through adequate buffers and zoning and to ensure land is available in appropriate locations to meet future infrastructure needs.

While the SWRRIP's goals and strategic directions seek to maximise recovery of materials, landfills are recognised as a critical component of Victoria's system for managing residual waste. However, to support recovery, new and expanded landfills will only be established if there is a demonstrated need for additional airspace to manage materials that cannot be viably recovered and to meet potential contingency requirements to manage events such as a natural disaster. This is in accordance with the EPA's *Waste Management Policy (Siting, Design and Management of Landfills*) that seeks to limit the use and development of landfills.

When developing Regional Implementation Plans and their infrastructure schedules, Regional Groups used a consistent approach[2] to assessing the need for landfill airspace and how this need would be met in their region over the next 10 years. This assessment confirmed that no new landfills are likely to be required to meet the expected needs in Victoria over the next 10 years, subject to expansions proceeding as planned.

1.3.6 Waste to energy

The SWRRIP defines Waste to Energy (WtE) as producing usable forms of energy from individual or mixed material streams. Energy products include fuels (gaseous, liquid or solid) electricity and heat.

Waste to Energy is lower in the wastes hierarchy than materials recovery, which captures materials for reuse, but is preferred to landfill, as it captures the energy value of waste, and reduces the use of landfill.

Waste to Energy infrastructure and technologies vary in scale, efficiency and costs (capital and operational), outputs and environmental performance. Energy can be generated from a range of different materials, including food and agricultural organics, wood, timber, tyres and residual waste. These materials are discussed further in Chapter 4. Environmental and economic benefits from WtE are best realised when the materials cannot be viably recovered for reuse or recycling.

The Victorian Government is currently investigating the role WtE technologies could play in our waste and energy systems.

The energy from waste guideline (EPA publication 1559.1, published in 2017) provides guidance on WtE facilities, including best practice thermal efficiency.

Whilst WtE facilities operate in many jurisdictions and many meet environment and community safety regulations, the potential for perverse outcomes needs to be considered. One potential risk is creating ongoing demand for a waste stream that could potentially undermine future 'higher order' recovery opportunities. This should be considered alongside the decision-making guidance outlined in Section 2.5.

Most WtE processes produce a residual material; the quantity and composition vary depending on material composition and technology used. This residual waste must be managed in accordance with regulations, and may require disposal to landfill.

Incineration, or the use of other thermal technologies without energy or material recovery is not considered WtE. They remove the opportunity to recover value from residual waste and are identified as a form of infrastructure that is inconsistent with achieving the goals of the SWRRIP.

2 In accordance with the process prescribed in the EP Act, relevant ministerial guidelines and SV's guide, *Outline of Process: Statewide Waste and Resource Recovery Infrastructure Scheduling* (2015), available from www.sustainability.vic.gov.au

2. Implementing the SWRRIP

2.1 Introduction

Chapter two outlines the SWRRIP goals and strategic directions to achieve them. It outlines how the SWRRIP will be implemented, including the role of the Victorian government, key opportunities to increase the recovery of valuable resources and how it will be monitored and reviewed.

Victoria will benefit in the long term from achieving a statewide waste and resource recovery system that maximises resource recovery and protects the community, the environment and public health. Such a system needs integrated planning at the local, regional and state levels. A suite of enabling initiatives addressing all aspects of the waste and resource recovery system will support the SWRRIP to achieve this.

As Victoria's population and economy grows, our waste and resource recovery system will require additional capacity just to maintain current rates of resource recovery. Significant investment in resource recovery infrastructure is needed to increase recovery beyond the 67 per cent achieved in 2015–16. To maximise both resource recovery and economic viability, additional infrastructure must be available to coincide with the increased availability of feedstocks being generated by our expanding population.

The SWRRIP seeks to establish the right conditions to attract the investment needed to:

- protect the community, environment and public health
- recover valuable resources from the materials being discarded by households, businesses and industry
- provide investment and job opportunities that contribute to our economy
- minimise long term costs to households, industry and government.

The SWRRIP is being implemented in collaboration with the seven Regional Groups and other state government agencies, local government and industry.

The SWRRIP has an overarching vision and purpose, supported by four goals and six strategic directions, as shown in Figure 2.1.

“ Integrated local, regional and state planning will maximise recovery. ”

The SWRRIP is being implemented in collaboration with 7 Regional Groups, state government agencies, local government & industry.

FIGURE 2.1
SWRRIP VISION, PURPOSE AND LONG TERM STRATEGIC DIRECTIONS

SWRRIP Vision

Victoria has an integrated statewide waste and resource recovery system that provides an essential community service to:

- protect the community, environment and public health
- recover valuable resources from our waste
- minimise long term costs to households, industry and governments.

SWRRIP Purpose

To provide strategic direction for the management of waste and resource recovery infrastructure to achieve an integrated system that effectively manages the expected mix and volumes of waste, reflects the principles of environmental justice to ensure that impacts on the community, environment and public health are not disproportionately felt, supports a viable resource recovery industry and reduces the amount of valuable materials going to landfill.

Goals

What we want to achieve in 30 years

GOAL 1

Landfills will only be for receiving and treating waste streams from which all materials that can be viably recovered have been extracted.

GOAL 2

Materials are made available to the resource recovery market through aggregation and consolidation of volumes to create viability in recovering valuable resources from waste.

GOAL 3

Waste and resource recovery facilities including landfills are established and managed over their lifetime to provide best economic, community, environment and public health outcomes for local communities and the state and ensure their impacts are not disproportionately felt across communities.

GOAL 4

Targeted information provides the evidence base to inform integrated statewide waste and resource recovery infrastructure planning and investment at the state, regional and local levels by industry, local government, waste and resource recovery groups, government agencies and the broader community.

Long Term Strategic Directions

What we want to do differently

STRATEGIC DIRECTION 1
Prioritise viable recovery

Resource recovery will be undertaken by local government and industry to maximise the diversion of recoverable materials from landfills where:

- it is economically viable
- there is a viable market for end products
- it results in better community, environment and public health outcomes.

STRATEGIC DIRECTION 2
Reduce landfill reliance

Planning for new landfill airspace, including the scheduling of new landfill sites, will be based on:

- volumes of residual waste streams remaining after all materials that can be recovered viably have been extracted
- a demonstrated need for additional airspace.

STRATEGIC DIRECTION 3
Aggregate materials

Consolidation and aggregation of material streams, around a hubs and spokes network, to achieve quantities for reprocessing will be undertaken if:

- there is a market for the feedstock
- there is a viable business case
- potential community amenity, environmental, public health impacts are minimised.

STRATEGIC DIRECTION 4
Utilise land

Suitably located and zoned land will be available for the expected mix of infrastructure required to manage waste and materials streams.

STRATEGIC DIRECTION 5
Evidence-based decision making

Decisions to determine waste and resource recovery options will be based on evidence to:

- maximise economic outcomes
- provide cost-effective service delivery
- reduce the community amenity, environmental and public health impacts.

STRATEGIC DIRECTION 6
Integrated planning

Integrated statewide planning and decision making will be capable of addressing local, regional and state needs to facilitate a cost-effective statewide network of waste and resource recovery infrastructure.

2.2 Achieving SWRRIP goals

The SWRRIP goals will be achieved by implementing the strategic directions at a state, regional and local level over the next 30 years. These directions guide the activities and decisions made by everyone involved in waste and resource recovery infrastructure planning in Victoria.

The strategic directions are supported by a set of complementary plans and enabling initiatives, which are being implemented over five to ten years. Collectively, these initiatives work towards establishing an integrated waste and resource recovery system for Victoria.

Figure 2.2 illustrates the seven enabling initiatives and Table 2.1 lists the related activities.

FIGURE 2.2
THE ENABLING INITIATIVES DELIVERING THE GOALS OF THE SWRRIP

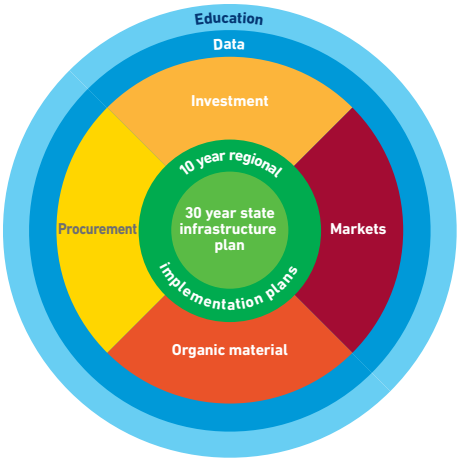


TABLE 2.1
SUMMARY OF ENABLING INITIATIVES AND COMPLEMENTARY PLANS SUPPORTING THE SWRRIP

Area	Enabling initiative/complementary plans	Details
10-year regional implementation plans	Regional Waste and Resource Recovery Implementation Plans	Identifies how regional and local waste infrastructure needs and opportunities will be met over the next 10 years, and delivers statewide goals and strategic directions in the seven waste and resource recovery regions
Markets	Victorian Market Development Strategy for Recovered Resources	Seeks to stimulate and expand strong markets for recycled materials, critical to the success of Victoria's waste and resource recovery system
Organic material	Victorian Organics Resource Recovery Strategy	Provides the mechanism to improve recovery of organic materials
Investment	Investment facilitation service	Provides information and advice on Victoria's waste and resource recovery sector to prospective investors in infrastructure
Procurement	Procurement support	› Facilitates collaborative procurement of waste and resource recovery services and infrastructure for local governments › Sustainable procurement seeks to increase the state and local governments' use of fit for purpose products made from recovered materials.
Data	Victorian Waste Data System	Improves the quality, timeliness and accessibility of waste and resource recovery data. Provides accurate, useful and timely data to underpin good decision-making to enable Victoria to plan for, and better manage, waste and material streams
Education	Victorian Waste Education Strategy	Leads targeted waste education to facilitate reduced waste generation, improve resource recovery and increase the community's participation and understanding of waste management and resource recovery infrastructure and services

2.3 SWRRIP strategic directions

The six strategic directions describe the key planning directions for the next 30 years.

2.3.1 Strategic Direction 1

Prioritise viable recovery

Resource recovery will be undertaken by local government and industry to maximise diversion of recoverable materials from landfills where:

- it is economically viable
- there is a viable market for end products
- it results in better community, environment and public health outcomes.

Prioritising recovery of materials and resources is fundamental to achieving the goals of the SWRRIP. Recovery should be core practice where there:

- are better benefits to the environment, community amenity and public heath from recovery compared to if the material was landfilled
- is an economic business case for recovery
- is a demonstrated market for recovered materials.

In 2015–16, the resource recovery industry recovered around 67 per cent of materials that entered the waste and resource recovery system from Victorian households, businesses and industry.

Recovering materials for recycling is a higher order outcome in the wastes hierarchy than recovering for energy (see Figure 2.3). Options for WtE can be appropriate for particular materials or waste streams where recovery is not viable. However, the viability of large-scale solutions has yet to be tested in the Victorian context.

The material streams managed by the system are detailed in Chapter 4 and the key needs for infrastructure capacity over the next 10 years identified in Section 2.9.

Considerations for prioritising viable recovery in Victoria include:

Priority materials for recovery

- The priority materials for Victoria are organics (including timber) and e-waste, along with plastics, tyres, glass fines, concrete and aggregates.
- Regional Implementation Plans identify food organics collection services as a key mechanism to increase recovery of organics.
- We may need new or updated infrastructure that prioritises recovery, including but not limited to priority materials. This should be encouraged through government programs.
- Some Regional Implementation Plans identify additional local priority materials.

Best practice resource recovery operations

- Facilities that operate to maximise resource recovery while also protecting the community, the environment and public health are more viable over the long term. This requires a best practice approach. In terms of infrastructure, this means efficient systems, mechanisms to identify continuous improvement, energy efficiency, readiness to respond to climate change impacts, and rehabilitation. Statewide guidance, case studies and facilitating information sharing is key to enabling facility operators to improve their operations and will be supported by Regional Groups.
- Operators will be supported to engage with local communities using best practice engagement principles and practice, to maintain or develop a social licence to operate for individual facilities and the sector more broadly.

Innovation and new recovery technologies

- New technologies are developing and may increase the viability of recovery.
- The government will work with industry to identify emerging technologies that could support increased recovery and explore how they might be applied in Victoria, subject to compliance with relevant laws and regulations.

Local government services and infrastructure

- Prioritising resource recovery in local government waste services and facilities, whether delivered by council or contractors, where viable, will contribute to increasing recovery.
- Expanding the number of councils that offer food organics collection services as part of the kerbside system is a key action in Regional Implementation Plans to increase organics recovery rates. Food comprises about 35 per cent of the materials currently in household garbage bins. In many instances, councils may opt for collective procurement arrangements, as discussed in Section 2.4.5.
- Local governments develop waste management plans to guide their decisions. Regional Groups will support local governments to develop plans that align with the relevant Regional Implementation Plan and maximise resource recovery.

Business and industry services

- There is a significant opportunity to recover more priority materials from commercial and industrial activities.
- Regional Implementation Plans outline how the Regional Groups will work more closely with the resource recovery and waste sector to facilitate options that prioritise recovery in their services and identify opportunities, particularly for significant generators.
- Business and industry can also play a large role in developing markets by prioritising procurement of goods and materials made from recovered materials.

Recovery from residual waste

- Residual waste in Victoria currently contains significant quantities of recoverable materials, including organics, plastics and metals.
- Some Regional Implementation Plans identify prioritising infrastructure that can improve separation and sorting to recover materials and resources from residual waste to reduce volumes going to landfill.
- Other methods to recover more resources from remaining residual waste operate extensively overseas, such as producing soil conditioners and/or energy products including electricity, heat, syngas and process derived fuels. Viability depends on a market for end products and being able to meet regulatory requirements and community expectations.

Government procurement

- The *Victorian Market Development Strategy for Recovered Resources* (discussed in Section 2.4.2) outlines how local and state governments can use their purchasing power to increase markets for goods and services made from recovered materials by including it as a priority in procurements.
- As part of the Market Development Strategy, the Victorian Government is also facilitating the creation of markets for recovered materials more broadly.
- Regionals Groups can facilitate procurements for local governments for waste and resource recovery services and infrastructure. This is a key mechanism for Regional Groups to improve resource recovery in line with their Regional Implementation Plan.

Government decision-making to prioritise recovery

- The state government will look for opportunities to prioritise resource recovery when developing policy, planning and programs in procurements.

What will be different?

- Material streams for recovery will be diverted from landfills (where appropriate) if it is economically viable and can improve community, environment and public health impacts.
- Resource recovery will be prioritised in procurements for waste and resource recovery services (where appropriate).

2.3.2 Strategic Direction 2

Reduce landfill reliance

Planning for new landfill airspace, including the scheduling of new landfill sites, will be based on:

- volumes of residual waste streams remaining after all materials that can be recovered viably have been extracted
- a demonstrated need for additional airspace.

Historically, landfills provided a cheap, readily available option for managing residual waste. Community expectations on managing landfills have led to more regulation and greater management requirements, which in turn has increased landfill costs. Even so, almost one-third of materials managed by the Victorian waste and resource recovery system end up in landfill.

To support increased recovery, establishing and using landfills in Victoria will be limited to the minimum required to safely manage the residual waste remaining after all viable options for recovery have been explored. Minimising new landfills is a key objective of the EPA's *Waste Management Policy (Siting, Design and Management of Landfills)*.

While establishing new landfills and expanding existing landfills is to be limited, we recognise the important role they play to protect public health and the environment by managing materials and wastes that cannot be viably recovered.

Scheduling for landfill

Works approvals for new landfills can only be considered by the EPA if they are provided for in the proposed sequence for filling of available landfill sites in the Infrastructure Schedule of a Regional Implementation Plan (EP Act s50C), as discussed in Section 6.8. Landfills and the wastes they may accept, are only listed in schedules after analysing the landfill airspace required to manage expected levels of residual waste (after extracting all materials that can be viably recovered) from that region or other regions using the landfill.

The process used to develop infrastructure schedules in each Regional Implementation Plan is prescribed in the EP Act. A consistent statewide methodology is used that considers:

- waste generation rates
- the likely diversion from landfill for recovery
- approved available airspace in operating landfill sites
- provisions for contingencies
- identified capacity gaps.

If additional landfill airspace is considered necessary, the landfill scheduling process provides guidance on how to address this need. An outline of the statewide waste and resource recovery infrastructure scheduling process is published on SV's website at **www.sustainability.vic.gov.au** and discussed further in Section 6.8.5.

Contingency planning

Infrastructure schedules are a key component of Regional Implementation Plans. Each region needs to plan for circumstances that may change projected 'fill rates', such as emergency events (e.g. bushfires, floods) or unexpected changes in landfill airspace availability (e.g. dismantling large-scale infrastructure). Resource recovery facilities may also be affected.

Landfill airspace available at regional and statewide levels will be reviewed annually to ensure adequate contingencies. The review will also consider key resource recovery infrastructure and could trigger a scheduling process.

The infrastructure schedules and the SWRRIP will be reviewed within five years.

Incineration

Incineration or the use of other thermal technologies without energy or material recovery, removes the opportunity to recover any value. When these technologies are applied without material or energy recovery, they are considered inconsistent with achieving the goals of the SWRRIP.

Incineration is a suitable disposal method when the material poses a public health or environmental risk if landfilled, for example following an emergency event as specified in the *Emergency Management Act 2013*. Options for recovery should still be explored where feasible. The treatment or incineration of hazardous waste is regulated by the EPA. Strict environmental procedures and guidelines must be followed.

What will be different?

A consistent statewide process is used to assess the need for, and scheduling of, landfill airspace that includes:

- a robust analysis of viable opportunities to maximise resource recovery and minimise volumes of residual waste requiring landfill
- identification of any remaining airspace needed, including allowance for contingencies and identification of alternatives
- mechanisms to preserve against encroachment, resulting in amenity impacts on the surrounding communities.

2.3.3 Strategic Direction 3

Aggregate materials

Consolidation and aggregation of material streams, around a hubs and spokes network, to achieve quantities for reprocessing will be undertaken if:

- there is a market for the feedstock
- there is a viable business case
- potential community amenity, environment and public health impacts are minimised.

For recovery to be sustainable over the long term, it must be supported by a reliable supply of feedstock. The tonnes required to support a viable business case varies for each material stream, and is strongly influenced by commodity values and contamination levels.

Aggregating and consolidating materials, either physically or through collaborative and joint procurements can provide a source of consistent feedstocks for industry. However, poor demand for feedstocks can lead to perverse outcomes, such as stockpiling, which can have negative community, environment and public health impacts.

The *Victorian Market Development Strategy for Recovered Resources* provides a framework to stimulate markets for recovered resources by reducing barriers and developing the right conditions for material and product markets to grow and mature. State priority materials include organics (including timber), rubber (tyres), e-waste, flexible plastics, glass fines, and aggregates and masonry. Each Regional Implementation Plan may also have specific priorities for its region.

Considerations for greater aggregation and consolidation of materials in Victoria are summarised below:

Aggregating materials and wastes from municipal sources

- Local governments manage around one-third of materials entering Victoria's waste and recovery system through kerbside and municipal services. These streams provide predictable tonnages with a relatively consistent composition and contamination levels, which can be offered to the resource recovery industry as predictable baseload feedstocks.
- Local government procurement of waste services is a key mechanism to provide long term supply of feedstocks. Local governments can include their regional and local priorities and service needs in tender specifications. Tenderers can then identify the most viable options to meet these needs.
- Opportunities may arise where tonnages can be supplemented with streams from industrial and manufacturing sources.
- Regional Groups play a role in facilitating collective procurements with local governments to aggregate and consolidate waste and material streams, for example in clusters or along major transport routes, as discussed in Section 2.4.5.

Opportunities at a local scale

- Consolidation is not always economically viable when tonnages are small and dispersed, particularly in rural and regional areas. Nevertheless, opportunities to activate local resource recovery businesses to stimulate local employment, and social enterprises that incorporate local priorities should be encouraged where viable and possible.
- Regional Implementation Plans respond to unique opportunities in their region. Regional Groups will continue to work with local industries, councils and the resource recovery sector to identify and progress opportunities, such as recovering significant quantities of materials generated in the local area (e.g. timber or agricultural waste, such as silage wrap).

Transport

- Where local solutions are not available, materials can be consolidated and transported to hubs for further sorting, consolidation or reprocessing.
- Infrastructure and process changes may be required at the local and regional level to enable the effective collection, storage and/or consolidation of materials to achieve the tonnages needed for viable collection and transport. Requirements will vary for each material stream and must consider regulatory conditions and the potential impacts of storing materials on community amenity, the environment and public health.
- Waste and resource recovery hubs form a network that can facilitate aggregation and should be considered when appropriate. Hubs are discussed further in Section 3.3.
- Increasing the efficiency of transport will reduce costs and can improve the viability of aggregation.

Resource recovery centre networks

- Regional Implementation Plans identify the need for regional integrated resource recovery centre networks – one of the key mechanisms to achieve aggregation.
- We need an evidence-based approach that balances the distances residents are required to travel with the need to establish facilities that can aggregate and manage the quantities of waste needed to be viable.

Stockpiling

- In some situations, getting enough individual materials to support viable recovery may take some time and require storing or stockpiling materials at recovery facilities.
- Stockpiling for long periods of time, or where there is no option for recovery can have adverse impacts.
- Stockpiling must be undertaken in accord with regulatory requirements. The EPA's *Interim Waste Management Policy (Resource Recovery Facilities)* is designed to improve safety standards at resource recovery facilities while work continues to deliver a long term solution for managing large-scale waste stockpiles. The EPA released a supporting guideline, *Management and storage of combustible recyclable and waste materials (publication 1667: 29 August 2017)*. Both are available from **www.epa.vic.gov.au**

What will be different?

- Local governments and/or industry will develop collective procurements for waste and resource recovery services.
- Local governments will be supported to develop waste management plans that maximise local recovery opportunities.
- Industry will be proactively engaged and identify waste and resource recovery management options that are economically viable and minimise community, environment and public health impacts.
- The Victorian Government will take a strategic approach to determine where to intervene to stimulate markets for recovered resources.

2.3.4 Strategic Direction 4

Utilise land

Suitably located and zoned land will be available for the expected mix of infrastructure required to manage waste and materials streams.

Making sure Victoria has adequate land to support an integrated network of facilities will protect public health, communities and the environment and maximise recovery of materials. This is pivotal to achieving the goals of the SWRRIP. To achieve this, planning for the waste and resource recovery system must be integrated with land use and transport planning. An integrated planning system will aim to:

- protect the community, environment and public health from potential impacts of the waste and resource recovery system
- protect the functionality of Victoria's existing waste and resource recovery infrastructure
- provide adequate sites for current and future infrastructure, with appropriate transport networks.

Considerations to ensure suitably zoned land is available in Victoria are summarised below:

Integrated waste and resource recovery and land use planning

- Victoria's land use planning system and the Waste and Resource Recovery Infrastructure Planning Framework are integrated at the state level through the Victorian Planning Provisions. This is discussed further in Section 3.2.
- Strategic planning at all levels will consider existing and future waste and resource recovery needs and ensure that suitably zoned land is available for activities to underpin investment. The hubs network may inform this planning.
- Regional Groups and local governments will align Regional Implementation Plans with local planning schemes to ensure current and future waste and resource recovery needs and facilities are adequately considered, while protecting the community and the environment from potential impacts, by applying planning controls for buffers.

Waste and resource recovery hubs

- Waste and resource recovery hubs play a key role in managing materials at a state, regional and local level. Hubs are discussed in more detail in Section 3.3.
- The hub network will be a key mechanism to identify existing activities that may need to be considered in the land use planning system, and may help identify suitable sites for new infrastructure.
- Collocating waste generators, resource recovery facilities and users of end products in hubs may provide efficiencies.
- Strategic planning for hubs, initially focusing on hubs of state significance, will be completed in consultation with stakeholders to identify and establish a plan to achieve relevant objectives for each hub.

Transport

- The cost of transporting waste and materials can have a significant impact on the viability of recovery.
- Access to, and efficient use of transport is an integral component of land use planning. The principles of the *Transport Integration Act 2010* must be considered by all agencies.
- While the overall impact of the waste and resource recovery system on Victoria's transport and freight system is not significant, transport impacts will be appropriately considered when planning for sites, including hubs. This is discussed further in Section 2.6.

What will be different?

- Suitable sites and buffers will be progressively protected through local planning schemes or other land use planning tools.
- Planning will ensure unsuitable land uses are not established with, or near waste and resource recovery facilities.
- Compatible activities that can support the waste and resource recovery industry by generating or using feedstock, or creating markets for products, will be encouraged.
- Closing or closed landfill sites will be used for alternative resource recovery activities where appropriate, when a viable business case and improved community, environment and public health impacts can be demonstrated.

2.3.5 Strategic Direction 5

Evidence-based decision making

Decisions to determine waste and resource recovery options will be based on evidence to:

- maximise economic outcomes
- provide cost-effective service delivery
- reduce community amenity, environmental and public health impacts.

The principle of evidence-based decision-making underpins the SWRRIP. It is critical to base infrastructure planning decisions on evaluated evidence to ensure the options chosen are sustainable and provide the best long term community, environment and public health outcomes.

Considerations to ensure decisions are evidence-based are summarised below:

Data and information

- A key enabling initiative underpinning the SWRRIP is the Victorian Waste Data System as discussed in Section 2.4.6, which provides accessible, accurate and timely data and information to inform planning and decision-making.
- State agencies will continue to contribute data and information to the waste data system, ensuring that data governance framework requirements — including confidentiality — are met.

Guidance and programs

- Statewide guidance and programs for industry and local governments will be based on evidence. Sharing learning to facilitate informed planning and decisions will be encouraged.
- Guidance, analysis and programs will address various aspects of the waste and resource recovery system, such as:
  - collection and consolidation systems including resource recovery centres/transfer stations
  - waste to energy
  - transport efficiencies
  - responding to climate change.
- These programs are complemented by the enabling initiatives discussed in Section 2.2.
- Regional Groups play a crucial role by working with industry and local governments at a more detailed level to identify opportunities and communicate and facilitate implementing statewide guidance at a regional level. Regional Groups may supplement statewide guidance at a regional level, where required.
- Regional Groups play a facilitation role to support local governments to carry out informed planning and make evidence-based decisions. This may include support to:
  - identify options on how waste services are delivered to communities
  - develop and review local waste management plans
  - procure waste services and infrastructure
  - operate facilities to best practice.

Section 2.5 lists additional factors to consider when making resource recovery and waste management planning decisions so that SWRRIP and Regional Implementation Plans goals will be met.

What will be different?

- Identifying and analysing opportunities will include assessing:
  - community service needs
  - economic, community, environment and public health costs
  - benefits, risks and costs associated with rehabilitation (where appropriate).
- Assessing alternatives to local management of residual waste will consider:
  - transitioning small landfills to resource recovery and consolidation activities
  - transporting residual waste to appropriate facilities, including regional landfills.

2.3.6 Strategic Direction 6

Integrated planning

Integrated statewide planning and decision making will be capable of addressing local, regional and state needs to facilitate a cost-effective statewide network of waste and resource recovery infrastructure.

Achieving the goals of the SWRRIP and Regional Implementation Plans requires coordination across government and other relevant stakeholders. Many policies, strategic plans, programs and business decisions intersect with the waste and resource recovery system. Stakeholders need to know where their decisions may have an impact and consider the goals of the SWRRIP and Regional Implementation Plans accordingly.

SV and Regional Groups work with other government departments and agencies to ensure that recovery and waste needs are considered at the appropriate time. These areas include, but are not limited to, infrastructure planning, climate change, investment and development, land use planning, public health and regulatory decision-making, particularly by the EPA, as discussed in Section 2.5.

The priorities of local and regional areas are defined in Regional Implementation Plans. Combined with statewide priorities, they play an important role in shaping how the waste and resource recovery system looks and operates. Integrated planning needs to focus on priorities during the planning phase, with an integrated approach to delivery.

The community has a role to play in identifying local priorities and solutions that meet local needs. Local governments reflect these priorities in their waste management plans and contribute to developing and implementing Regional Implementation Plans. The community can also contribute directly at this strategic level during the development and review of plans.

Considerations to ensure integrated planning are summarised below:

Alignment across state government policy, programs and decision-making

- The SWRRIP will be considered, where relevant, when developing and delivering Victorian Government policies, plans and programs in the environment and other portfolios. Guidance for making decisions to achieve the SWRRIP goals is provided in Section 2.5.

Integration at the regional level

- At a regional level, integration will occur between local governments, relevant state agencies, industry, other regions and, in some instances, other jurisdictions.
- The Regional Implementation Plans and Local Government Forums are key mechanisms to facilitate this integrated approach as the Regional Implementation Plans are implemented. This work will be led by the Regional Groups, and involve statewide agencies such as Regional Development Victoria, SV and the EPA, as needed.

What will be different?

- Planning by government departments, agencies and local government will be aligned with the SWRRIP's long term strategic directions and the relevant Regional Implementation Plans.
- Government departments, agencies and local government will actively engage the community when planning for waste and resource recovery infrastructure.

2.4 Initiatives to support SWRRIP implementation

Victoria's waste and resource recovery system relies on a functional regulatory and planning framework. It is also supported by a suite of initiatives that enable the SWRRIP to be realised, as discussed in Section 2.2. Reliable data and information, markets for end products, effective community and business education and adequate private investment are all critical to the system. These enabling initiatives are outlined below. More detail can be found on the SV website at www.sustainability.vic.gov.au

2.4.1 Regional Waste and Resource Recovery Implementation Plans

Each Regional Group developed a Regional Implementation Plan in accordance with the EP Act.

Regional Implementation Plans provide an understanding of each region's current waste infrastructure, environmental and financial performance, projected waste volumes, urban growth and industry demands. They aim to integrate planning at the state level with the needs of local and regional communities. The plans are fundamental to implementing the SWRRIP and its strategic directions.

An important component of Regional Implementation Plans is the infrastructure schedule. This lists the waste and resource recovery infrastructure in the region that is operational at the time of publication and indicates potential future needs. Part B of this schedule includes the proposed sequence of filling available at landfill sites in accordance with section 50C (2) of the EP Act. The EPA must refuse applications for works approvals for new landfills if they are not provided for in the proposed sequence of filling of available landfill sites in Part B of the Schedule (see Section 6.8.5 for more information).

Regional Implementation Plans identify additional local opportunities to achieve the goals of the SWRRIP. Table 2.2 lists potential opportunities common to the seven Regional Implementation Plans.

TABLE 2.2
OPPORTUNITIES IDENTIFIED IN REGIONAL IMPLEMENTATION PLANS

Opportunities	Steps
Align Regional Implementation Plans with local government planning	› Support local governments to develop waste management plans aligned with the relevant Regional Implementation Plan and the SWRRIP goals › Work with local governments to align Regional Implementation Plans with local planning schemes and other land use planning activities to ensure that current and future waste and resource recovery needs and facilities are adequately considered while protecting the community, environment and public health from potential impacts by applying planning controls for buffers
Facilitate joint procurement and investment in new infrastructure and services	› Work with local governments to facilitate joint procurements for waste and resource recovery infrastructure and services
Investigate options for remote communities	› Investigate sustainable service models for more remote communities in non-metropolitan regions
Increase recovery of organics	› Work with local governments to increase food and garden organics collections › Identify and work with significant local generators to identify appropriate solutions › Investigate co-location opportunities for organics processing facilities with water authorities
Look for local and cross-regional solutions	› Continue to engage local industries, councils and the resource recovery sector to identify options and develop local and cross-regional solutions that prioritise recovery › Facilitate links between clusters of significant waste generators (e.g. timber industry, silage wrap from the agricultural sector) and existing or potential local processors › Investigate the potential role of social enterprises › Strategically plan to use and improve existing infrastructure, such as transfer stations
Distribute statewide guidance	› Help distribute and apply statewide guidance for best practice operation and management of infrastructure to increase resource recovery and reduce impacts on communities, the environment and public health
Deliver local and regional programs	› Deliver campaigns, projects and other initiatives to communities, local government and industry to support implementation of Regional Implementation Plans
Improve data	› Support the sector to collect more consistent, reliable and timely data, including commercial and industrial waste data
Educate generators	› Help reduce contamination by supporting the education of generators, including households, and/or improving infrastructure
Use networks to help councils	› Facilitate work between councils and/or industry and the EPA to progress rehabilitation assessments and requirements for closed landfills › Build waste and resource recovery networks for knowledge sharing

2.4.2 Victorian Market Development Strategy for Recovered Resources

Stronger markets for end products are critical to a successful resource recovery industry and underpin the economic viability of recovery. Strong markets can also prevent perverse outcomes such as stockpiling materials and undesirable disposal.

SV published the *Victorian Market Development Strategy for Recovered Resources* (Market Development Strategy) in May 2016. It recognises that developing and expanding appropriate and sustainable markets for recovered materials and products is pivotal to diverting viable materials from landfill. This depends on:

- an adequate, reliable and relatively clean supply of recovered resources
- sufficient consumer demand for products containing recovered resources to meet end market supply.

The Victorian Government is committed to supporting development of markets by:

- stimulating production industries and markets for recovered resources
- reducing barriers
- supporting the right conditions for product markets to grow and mature.

The Market Development Strategy is supported by Victoria's regulatory framework and focuses on market development interventions including:

- research and development (material/product performance and development)
- product specifications (quality standards)
- product procurement (stimulating market demand by purchasing goods and services)
- product stewardship (a shared responsibility for the environmental and social impact of a product across its entire lifecycle).

These initiatives complement other infrastructure programs that aim to improve the quantity and quality of recovered resources as well as providing education for industry and consumers.

The Strategy identifies the current priority materials, with flexibility to add new or emerging priorities in future years. Current priority materials include:

- organics (including timber)
- rubber (tyres)
- e-waste
- flexible plastics
- glass fines
- aggregates masonry and soils.

As new markets are developed, new infrastructure solutions may be required.

2.4.3 Victorian Organics Resource Recovery Strategy

The Victorian Organics Resource Recovery Strategy (Organics Strategy) was developed by SV and released in September 2015. It provides the Victorian Government's vision for improved recovery of organic resources where:

- a vibrant, functioning recycled organics market will ensure that environment, human and animal health and amenity impacts of organic materials are eliminated
- organic resources will contribute to climate change adaptation and mitigation by improving soil quality and providing an energy source to local infrastructure.

The Organics Strategy provides the strategic directions, desired outcomes and government actions for the next five years. It prioritises protecting the environment and human and animal health, and building the knowledge, skills and infrastructure for Victoria to realise the benefits of better use of organic resources. Table 2.3 lists relevant projects lead by SV and portfolio partners.

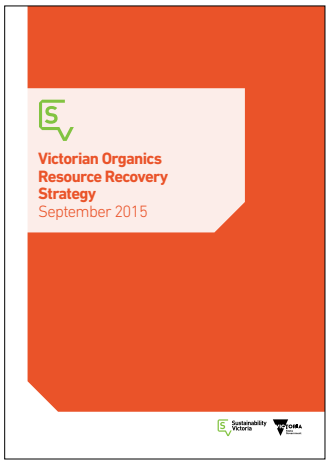


TABLE 2.3
VICTORIAN ORGANICS RESOURCE RECOVERY STRATEGY PROJECTS

Project	Description
Best practice environmental management	EPA-led research into applying organic material to land
Sustainable markets	Market specification and quality assurance (QA) – SV is working with compost and agricultural sectors to develop voluntary QA schemes to improve end markets
Leveraging existing assets	The Australian biomass for bioenergy assessment project seeks to catalyse investment in the renewable energy sector by providing detailed information about biomass resources
Identify future needs	Grant funding for WtE infrastructure Developing a resource recovery technology guide to help local governments and industry decide on appropriate resource recovery technologies Reviewing SV's Guide to Best Practice for Organics Recovery (2009).
Education to facilitate change	Actions delivered as part of the *Victorian Waste Education Strategy*
Building collective knowledge	Optimising kerbside collection systems by providing guidance material to local government and industry
Streamlined governance and strong leadership	Government framework – coordinating a working group to align the organics management framework across all agencies
Facilitate procurements for new infrastructure and services	Regional Groups work with their local governments to facilitate joint procurements for waste and resource recovery infrastructure and services

The Organics Strategy is referenced throughout the SWRRIP, particularly in Chapters 4 and 5 where organic materials are discussed in more detail.

2.4.4 Investment facilitation

Victoria needs investment in new or expanded infrastructure to maintain current recovery rates as its population grows. The SWRRIP seeks to increase the proportion of materials recovered, which will require even greater levels of investment.

Facilitating investment to support the goals of the SWRRIP and Regional Implementation Plans is a key activity for all Regional Groups to increase recovery in their regions.

To support this initiative, SV offers a free investment facilitation service for projects that increase Victoria's resource recovery, and will work with current and prospective investors from Victoria, interstate or abroad.

To address barriers to investment, the service helps investors by:

- providing data and information on waste and resource streams
- providing advice on business case development, approval processes and site planning
- identifying potential financial and non-financial support mechanisms across government
- facilitating introductions across industry, government, regulators and the community
- providing insights into the status and development of local end markets
- informing investors of environmental issues and requirements
- advising on engaging with local communities
- coordinating relationships with government
- helping investors understand the government's policy direction and its priorities.

2.4.5 Procurement

Collective procurement

As outlined in Strategic Direction 3, collective procurement provides an opportunity to consolidate materials to facilitate recovery and provide the feedstocks needed to underpin new or expanded infrastructure. Additionally, collaborative approaches can be more efficient and attract more cost-effective outcomes for communities. Facilitating collective procurements between local councils is a function of the Regional Groups.

Sustainable Procurement

Sustainable procurement includes recommending the use of recycled and recovered material in infrastructure design and build and the purchase of products that are made from or contain recycled or recovered material. The Victorian Government can play a significant role in contributing to the development of markets for recycled and recovered products by leveraging opportunities for procurement of products with, and use of, recycled content where these meet agreed applications and quality standards.

2.4.6 Victorian Waste Data System

Accurate, useful and timely data underpins good decision-making and enables Victoria to plan for and better manage waste and material streams.

SV manages the state's waste data system. It collates, analyses and communicates waste and resource recovery data from a range of government and private sources. New technology has improved the capability of the system and its interface, and SV will continue to improve accessibility and usefulness of the system.

The waste data system operates under a governance framework with standards and guidelines for managing waste data. These standards improve, strengthen and standardise the collection, storage, analysis and sharing of waste data while maintaining confidentiality.

SV and Regional Groups will support data collection by helping stakeholders improve consistency, reliability and timeliness of existing datasets and contributing to new datasets to better understand opportunities to increase recovery and identify sources of feedstock. Improving data on material streams generated by the commercial and industrial sector has been identified as a priority.

Historically data has been based on waste generated from three sectors:

- municipal and household sector
- commercial and industrial sector
- construction and demolition sector.

To maximise recovery, the SWRRIP moves away from the sector generation approach to a material stream approach. This requires a shift in the way data is collected and will evolve over time. The SWRRIP categorises waste by material streams where possible but also includes sector-based data due to this being the predominant reporting method in recent years.

2.4.7 Victorian Waste Education Strategy

Education and engagement is key to achieving the goals of the SWRRIP. As generators of waste and users of the system, the community and businesses both require a service and play a pivotal role in providing materials to the waste and resource recovery sector to enable recovery. Additionally, communities have an interest in facilities located near their community. A broader understanding of services provided by the sector and effective engagement by operators play a role in giving the sector a social licence to operate in Victoria.

SV published the *Victorian Waste Education Strategy* in August 2016 to provide a coordinated and best practice approach to waste education. It articulates the roles and responsibilities of waste educators (SV, Regional Groups, local government, industry and educational institutions) in waste education, sets out agreed principles and approaches for delivering waste education and encourages collaboration between waste educators, generators and receivers. It commits to evidence-based programs and knowledge sharing of best practice for stakeholders and innovative approaches.

The *Victorian Waste Education Strategy* focuses on six key areas:

- increase the Victorian community and business perception of waste management as an essential service
- increase community awareness of waste and support and encourage waste avoidance
- improve resource recovery and reduce contamination
- reduce litter and illegal dumping
- support waste and resource recovery education for schools
- strengthen Victoria's waste and resource recovery education capabilities.

2.5 Decision-making guidance

This section provides guidance for all decision-makers involved in planning, establishing and operating waste and resource recovery infrastructure in Victoria. This includes state government agencies, local governments and infrastructure owners, operators and investors.

Decision-makers consider a range of legislation, policy and regulations in relation to waste and resource recovery infrastructure planning. For example land use planners consider Clause 19 and other relevant sections of the Victoria Planning Provisions and the EPA considers the guiding principles of the EP Act, including the wastes hierarchy that establishes an order of priority for managing waste in Victoria (Figure 2.3).

Specifically, the EPA may refuse to consider an application for a works approval or a license in relation to a waste management facility (save for certain private landfills) if the operations could be inconsistent with the SWRRIP (EP Act s50C). This provides the EPA with a discretion to consider the SWRRIP and if so to consider if the facility's operations could be inconsistent with it. SV is available to assist the EPA if such assistance is sought.

Table 2.4 provides guidance to all decision-makers in relation to the four SWRRIP goals.

FIGURE 2.3
WASTES HIERARCHY

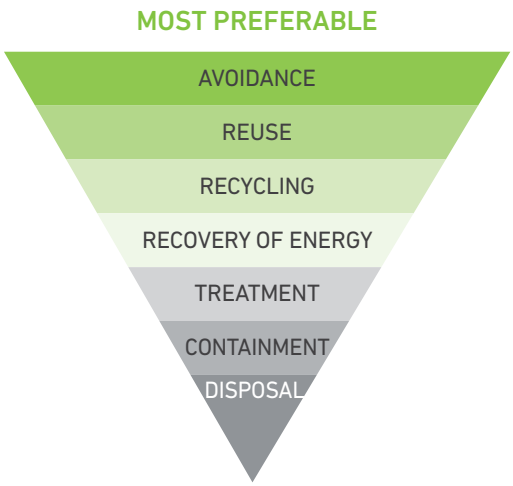


TABLE 2.4
GUIDANCE ON MAKING DECISIONS CONSISTENT WITH SWRRIP GOALS

	Guidance for decision-makers	Desired outcome/impact
Goal 1	**Landfills will only be for receiving and treating waste streams from which all material that can be viably recovered have been extracted.**	
	› Consider mechanisms to minimise the use and development of landfills. › Only landfill airspace (new, expanded or changed landfill conditions) listed in the seven infrastructure schedules (Part B) of the Regional Implementation Plans should be considered for approval.	› Restricting landfill airspace will minimise impacts on communities, the environment and public health and help ensure that we only dispose of waste to landfill that cannot be viably recovered. › For more information on the statewide landfill scheduling process, see Section 6.8.
	Determining the viability of landfills should consider the costs associated with the design, construction, operation and rehabilitation	Including all the costs of owning and operating a landfill in the business case will ensure that rehabilitation costs are planned for and may make alternatives including resource recovery more viable.
	› Processing infrastructure should seek to recover the maximum quantity of materials or resources as possible. › Incineration or the use of other thermal technologies without energy or material recovery removes the opportunity to recover value and is a form of infrastructure that is inconsistent with achieving of the goals of the SWRRIP.	› Encouraging Victoria's network of processing technology to achieve the highest level of material recovery will contribute to an overall increase in Victoria's recovery rates. › For more information on materials recovery, see Chapter 5.
	WtE infrastructure needs to meet the thermal efficiency rates outlined in the EPA's Energy from Waste Guideline.[3]	› Recovering energy from waste will reduce waste to landfill. Maximising energy generation ensures the greatest amount of value and use is extracted from our resources. › For more information on WtE technologies, see Section 5.15.
Goal 2	**Materials will be made available to the resource recovery market through aggregation and consolidation of volumes to create viability in recovering valuable resources from waste.**	
	Collection infrastructure and services should maximise aggregation and consolidation of materials to increase recovery and reprocessing rates.	Aggregation and consolidation helps achieve the quantities of feedstocks required to support viable reprocessing and improves the cost effectiveness of transport.
Goal 3	**Waste and resource recovery facilities, including landfills are established and managed over their lifetime to provide the best economic, community, environment and public health outcomes for local communities and the state and ensure their impacts are not disproportionately felt across communities.**	
	Waste and resource recovery planning decisions should consider any impacts on the availability of suitably located and zoned land for waste and resource recovery facilities.	To attract investment, enough suitability zoned land with adequate buffers must be available over the term of the investment.
	Planning decisions should consider the objectives of waste and resource recovery hubs, and protect waste and resource recovery infrastructure of statewide importance, as outlined in Section 3.3.	Ensure the correct land use planning mechanisms are in place around hubs. This includes buffers to protect the surrounding community and the environment from adverse impacts from facilities and to protect facilities from encroachment by incompatible land uses.
Goal 4	**Targeted information provides the evidence base to inform integrated statewide waste and resource recovery infrastructure planning and investment at the state, regional and local levels by industry, local government, Waste and Resource Recovery Groups, government agencies and the broader community.**	
	Use the best available information to inform decisions.	Decisions based on evidence are more viable in the long term and can be monitored for progress.

3 Environment Protection Agency, *Guideline: Energy from waste*, publication 1559, Melbourne, 31 July 2017, viewed 26 October 2017 <epa.vic.gov.au/our-work/publications/publication/2017/july/1559-1>.

2.6 Economic and transport assessments

The SWRRIP identifies opportunities for additional infrastructure to improve resource recovery. We need to understand the economic and transport factors that influence investment decisions in waste and resource recovery infrastructure to determine any barriers to future investment.

SV has explored several hypothetical scenarios aimed at increasing resource recovery in line with the goals of the SWRRIP. For each scenario, SV used modelling to analyse the net economic gain to the State, including the impact of transport on the viability of recovery.

Importantly, as well as providing guidance for future investment decisions, the main findings below also broadly confirm the actions and priorities of the SWRRIP, the Market Development Strategy and Organics Strategy, which were developed following extensive consultation with community and industry stakeholders.

The modelling is described in Appendix 1.

2.6.1 Main economic findings

The major economic findings were as follows:

Landfill gate fee avoidance

The modelling showed landfill gate fee avoidance to be the biggest driver for resource recovery. Higher landfill gate fees, reflecting either increases in landfill operating costs or changes in the landfill levy, will drive additional recovery.

Operations efficiencies

Optimising facility operations create efficiency gains which reduce input costs for recovery. This means we could increase resource recovery using existing facilities. The operational efficiencies identified in the modelling with the most impact include:

- securing a reliable and consistent supply of feedstock to optimise process flows
- reducing contamination
- improving operations and systems associated with processing and sorting materials to improve productivity and output
- optimising resource use, particularly energy, including investigating alternative lower cost energy sources and opportunities for local energy solutions
- upgrading existing infrastructure to reduce manual handling and improve sorting and reprocessing rates.

Net positive benefits

The different infrastructure options tested were all found to generate positive net benefits for the State over the life of the SWRRIP. This suggests that the tested options are economically viable for improving resource recovery.

Targeted investment in new infrastructure

Targeted industry investment in new infrastructure, especially for reprocessing food organics to produce recycled organic products (excluding energy), could potentially increase the state recovery rate from the current 67 per cent to 73 per cent in five years and up to 76 per cent in 20 years. This would result in an estimated 1.8m tonnes of additional material diverted from landfill in 2043. Evidence from other jurisdictions demonstrate that further increases in diversion rates are not readily achieved without the introduction of waste to energy infrastructure.

Increased food organics recovery

Increasing recovery of food organics will potentially play a pivotal role in increasing the overall recovery rate for the State. The modelling compared traditional composting with WtE using anaerobic digestion. Both technologies were shown to provide positive net benefits to the State.

The benefits of WtE were potentially higher due to a combination of lower operational costs, higher product value and higher avoided landfill greenhouse gas generation. However, the modelling did not consider the value of the higher order recovery achievable through composting to produce soil conditioners and compost. A combination of composting and WtE are likely to provide the most optimal outcome for the State.

Recovering energy from residual waste

Waste to Energy options for recovering energy from residual waste showed a positive net benefit to the State. Modelling showed that with sufficient investment in infrastructure, a diversion rate of 45 to 50 per cent of the waste currently going to landfill could be achieved over the life of the SWRRIP.

Employment

The current employment trends for the sector are expected to continue, with the number of jobs associated with resource recovery expected to remain higher than those associated with landfill. An influencing factor will be the degree of automation adopted by the industry, which could impact future job growth.

2.6.2 Main transport findings

The major transport findings were as follows:

Improving transport efficiencies affects resource recovery differently

Transport modelling showed that improving transport efficiencies affects the viability of recovering materials differently, depending on the material stream. Resource recovery is influenced by a range of factors including the commodity value of the recovered material, contamination and the total distance travelled by materials. Improving one factor for all material streams (e.g. transport efficiencies) will therefore have varying impacts across the different material streams because the other influencing factors (e.g. contamination) affect different materials disproportionately. For example, food organics may be more affected by contamination than aggregate. So, increasing transport efficiencies for both streams will improve recovery of aggregate more than food organics.

Minimising the distance between generators and recovery and reprocessing facilities

The geographical relationship between the point of generation, the recovery facility and landfill influences viability of recovery. The analysis suggests that minimising the distance between generators and recovery and reprocessing facilities would yield desirable outcomes both in terms of recovery and economic benefits. The economic and transport analysis supports the role of hubs as outlined in Section 3.3.

Limited local or regional infrastructure

Limited local or regional infrastructure to handle individual material streams or streams that require specialist technologies may require materials to travel larger distances or even pass through multiple facilities. This can increase the proportion of transport costs in the overall recovery cost.

Transport efficiencies

Achieving transport efficiencies reduces input costs and improves the viability of recovery.

Table 2.5 outlines the potential mechanisms tested to improve transport efficiencies.

TABLE 2.5
MECHANISMS CONSIDERED BY MODELLING TO IMPROVE TRANSPORT EFFICIENCIES

Mechanisms	Description
Improve load value	› Reducing contamination reduces the quantities of materials being transported that cannot be recovered, resulting in improved costs per tonne › Increasing compaction where it does not affect feedstock quality increases the amount of material transported per load, reducing the cost per tonne
Increase load size	› The smaller the vehicle, generally the greater cost per tonne to transport particularly for long distances › Aggregating small loads from various sources at regional consolidation hubs can increase viability of transport
Reduce travel time	› Improve travel times through route choice and avoiding congestion or peak periods › Improve reception bay design (loading and unloading)
Optimise vehicle operational costs	› Maintain and/or upgrade fleet to reduce vehicle downtime › Reduce fuel costs through congestion avoidance and if possible source alternative cheaper forms of fuel
Backloading	› Transport costs will be considerably reduced if all or part of the return trip can be used to transport loads of value › This relies on demand for goods along the return route and considering factors such as the time and costs required to clean and decontaminate vehicles
Transport mode	› Using different transport modes capable of moving large quantities over long distances can potentially significantly reduce transport costs › However, many factors need to come into play to make modal change viable, for example, moving from road to rail includes considering: – the cost of transport and labour of getting feedstocks to rail head and from rail to reprocessors – the physical form of the feedstock including weight, putrescible nature and ability to be loaded into containers – achieving the economies of scale that make modal change viable – using existing rails services versus the need to establish new or dedicated services

2.7 Responding to climate change

One of the biggest challenges for Victoria over the next 30 years will be mitigating and adapting to the impact of climate change. The Victorian Government is committed to acting on climate change through various initiatives as outlined in the breakout box.

While the emissions generated by Victoria's waste and resource recovery system contribute only a small fraction of Australia's total emissions, these emissions still need to be managed and reduced where possible. The industry has already significantly improved emissions generation largely due to the capture of GHGs at landfills.

One major source of GHG emissions from waste and resource recovery activities is the breakdown of putrescible materials in landfills. When putrescible materials break down they generate by-products, one of which is methane gas. Methane gas is 21 to 25 times more potent than carbon dioxide.[4]

Most major landfills in Victoria operate best practice landfill gas management infrastructure, as outlined in the EPA guideline, *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills* (August 2015). This has resulted in significant reductions in GHG generation from the sector.

However, landfill gas capture at medium and small putrescible landfills in regional centres and rural areas in Victoria is poorly developed. If flaring equipment was installed at all medium-sized landfills (open or closed) in Victoria, an estimated 180,000 tCO^2-e could be recovered annually. This represents 4 per cent of landfill methane generated and is equivalent to the emissions of about 80,000 cars.[5]

Recycling and recovery activities play an important role in reducing net GHG emissions. Avoiding extracting virgin materials, in most examples, can heavily offset the emissions associated with resource recovery. The virgin extraction and production of some material streams is heavily GHG emission intensive; greater than that of recycling and reusing materials.

Table 2.6 discusses the different sources of emissions from the waste and resource recovery sector.

TABLE 2.6
MAIN SOURCES AND MITIGATION MECHANISMS OF GREENHOUSE GAS

Source of GHG emissions	Description	Mitigation/management mechanisms
Direct generation	› Primary source is the breakdown of putrescible materials in landfills › Can also be released through the collection, storage and stockpiling of organics materials › Some reprocessing technologies can reduce GHG emissions, for example in-vessel composting with gas capture versus open windrow composting	› Divert organic materials from landfills for viable recovery › Develop markets for recovered materials to increase viability of recovery › Investigate options to recover energy from organics materials in residual waste › Capture landfill gas for flaring or energy recovery where viable, including using microflares at small to medium-sized landfills
Associated with energy use	› Energy use associated with recovering and managing material streams from the use of fuels including diesel, gas and electricity › Recovery and reprocessing of some material streams is more energy intensive than others, for example paper and cardboard and metals › Processes used in Victoria depend heavily on electricity consumption, which in Victoria generates significant amounts of GHG emissions through burning coal	› Maximise energy efficiency of resource recovery infrastructure including optimising operation controls and reducing baseload energy use and maximising heat and power recovery › Investigate use of low emission energy sources including cogeneration of electricity and heat from process waste materials
Associated with transport	› Emissions associated with transport of materials and waste to reprocessing and disposal facilities (within Victorian and overseas) › Emissions associated with moving recovered materials to access markets (within Victoria, interstate and overseas)	› Optimise transport efficiencies through aggregation and consolidation › Optimise transport routes and distances › Investigate lower emission modes of transport › Investigate local solutions

4 Environment Victoria, *The problem with landfill*, 16 June 2013, viewed 26 October 2017 <environmentvictoria.org.au/resource/problem-landfill>.
5 Sustainability Victoria, *Greenhouse gases from the Victorian waste sector*, prepared by Randell Environmental Consulting (unpublished), Melbourne, 2017.

We also need to plan for the potential impact of extreme weather events and a changing climate and how to manage events when they occur. This will be supported by contingency planning at a state and regional level by government, but may also require infrastructure operators to consider both their own operations, and how they service the broader community when events occur. Broader changes resulting from climate change, such as changes to flood zones, may also affect current and future operations, and must be considered as part of long term contingency planning.

PAPER AND CARDBOARD RECYCLING

The total emissions from paper and cardboard reprocessing infrastructure in Victoria in 2014–15 are estimated at 67,900 tCO^2-e, or about 785 kg CO^2-e/t of material recovered. Additional emissions of approximately 26,100 tCO^2-e are associated with collection and sorting activities at materials recovery facilities and 56,200 tCO^2-e with disposal of paper and cardboard at landfills.

Most emissions associated with recycling paper arise from the actual reprocessing of the recovered materials. The processes used in paper recycling are equally dependent on fuels (e.g. diesel, gas) and electricity from offsite.

Improving systems used in paper and cardboard recycling plants with improved material efficiencies and reduced energy consumption are a major opportunity for reducing GHG emissions. Several examples already exist where improvements in technology have led to savings from electrical and heat energy.

The paper industry has been able to significantly offset their need for energy from fossil fuels (reducing GHG emissions) by recovering energy from wastes generated during the pulping process in onsite 'recovery boilers'.

Opportunities exist to install cogeneration infrastructure to generate electricity and heat from process waste materials, which helps to reduce the amount of energy required from offsite electricity generation and reduces outputs to landfill. Composting some of the unavoidable organic materials generated by the paper and cardboard industry could further reduce waste sent to landfill.

Source: Sustainability Victoria, *Greenhouse Gases from the Victorian waste sector*, prepared by Randell Environmental Consulting (unpublished), 2017.

VICTORIAN GOVERNMENT CLIMATE CHANGE INITIATIVES

The Victorian Government is committed to positioning Victoria as a national and international leader in climate change action and is implementing a range of policy initiatives:

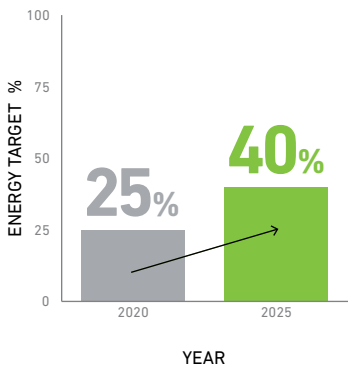
- Victoria has a new climate change act (*Climate Change Act 2017*) which legislates a long term target of net zero greenhouse gas emissions by 2050 and includes most of the commitments set out in the Victorian Government's response to the 2015 Independent Review of the *Climate Change Act 2010.*
- Victoria's Climate Change Framework sets out the vision for Victoria in 2050 and the steps required across government and key sectors of the economy to begin the transition.
- Victoria's *Climate Change Adaptation Plan 2017-2020* sets out the priorities for the next four years for the Victorian Government to better understand and manage current impacts, and to prepare for the long term risks of climate change.
- TAKE2 is Victoria's climate change pledge program for state government, local governments, businesses, community groups, educational institutions and individuals to make public commitments to reduce emissions and build capacity between now and 2020.
- The Government is committing to Victorian renewable energy targets of 25 per cent by 2020 and 40 per cent by 2025, supported by a competitive reverse auction scheme.

"The Government is committing to VIC renewable energy targets of

25% BY 2020

AND

40% BY 2025"



2.8 Government actions to implement the SWRRIP

The SWRRIP encompasses a broad range of actions that intersect with different aspects of Victoria's waste and resource recovery system. Actions were developed to ensure that the SWRRIP supports an environment that encourages appropriate investment, removes barriers and provides the best economic, community, environmental and public health outcomes. Table 2.7 lists the Victorian Government actions to implement the SWRRIP for the next 10 years.

State government, local government and industry play an important role in implementing the SWRRIP. The waste and resource recovery portfolio will work together to engage stakeholders, providing guidance and support and seeking input into developing programs and resources.

State government implementation of the SWRRIP actions is supported by cross-portfolio planning processes and reporting that allows for effective collaboration, evaluation and, where relevant, adaptation.

TABLE 2.7
SWRRIP ACTIONS FOR GOVERNMENT

Ongoing S = Short term: 1–3 years M = Medium term: 3–5 years L = Long term: within 10 years

	Action	Lead	Support	Key stakeholders	Timing	Reference
Goal 1	**Landfills will only be used for receiving and treating waste streams from which all materials that can be viably recovered have been extracted**					
1.1	Publish and revise (as needed) guidelines on a consistent statewide process for infrastructure scheduling	SV (publish and support), Regional Groups (lead process)	EPA	Landfill operators (private and local government)	Published 2016. Applied when required.	Strategic Direction (SD) 2
1.2	Annual review of infrastructure capacity in each region and update of contingency plans as appropriate	DELWP (process), Regional Groups (review)	SV	Local government, facility owners/ operators, peak bodies, EPA, Emergency Management Victoria	Annual	SD2, SD6
Goal 2	**Materials are made available to the resource recovery market through aggregation and consolidation of tonnes to create viability in recovering valuable resources from waste**					
2.1	Lead implementation of the *Victorian Market Development Strategy for Recovered Resources*	SV	Regional Groups, EPA	Reprocessors, regulatory bodies, users of end products, product stewardship organisations	Published 2016. Ongoing	Market Development Strategy
2.2	Develop and publish statewide guidance and deliver statewide programs to local government and industry to increase resource recovery	SV	Regionals Groups	Local government, private operators and peak bodies, significant waste generators	Ongoing	SD1, SD5 SD6
2.3	Lead implementation of the *Victorian Organics Resource Recovery Strategy*	SV	DELWP, EPA, Regional Groups	Organics facility operators and peak body, agriculture sector, government agencies, local government	Published 2015	Organics Strategy
2.4	Support local governments to procure, including through collaborative procurements, waste and resource recovery services and infrastructure that will achieve the goals of the SWRRIP and Regional Implementation Plans	Regional Groups	SV	Local government, Australian Competition and Consumer Commission	Ongoing	Procurement

	Action	Lead	Support	Key stakeholders	Timing	Reference
Goal 3	Waste and resource recovery facilities, including landfills, are established and managed over their lifetime to provide best economic, community, environment and public health outcomes for local communities and the state and ensure their impacts are not disproportionately felt across communities					
3.1	Integrate planning requirements and decision-making processes for waste and resource recovery infrastructure into application of Victoria's land use planning system and in other relevant Victorian Government plans. Support land use planners to apply the provisions	DELWP	SV, Regional Groups	Local government, government agencies (e.g. Victorian Planning Authority)	S Ongoing	SD4
3.2	Support local government to provide adequate and suitably located land with appropriate planning controls for waste and resource recovery activities	Regional Groups	SV	Local government, landholders	M	SD4
3.3	Facilitate strategic planning for hubs of state significance and regional or local hubs if required	Regional Groups	SV	Local government, facility operators in hubs, landholders, communities	S	SD4
3.4	Carry out research and establish statewide programs to inform a consistent statewide approach by portfolio agencies to: › increase the perception of waste management as an essential service › support facility owners and operators to undertake best practice community engagement, including improving understanding of the need for a social licence to operate	SV	EPA, Regional Groups	Waste and resource recovery industry, local government	S	Education
3.5	Provide statewide guidance and programs for facility owners and operators to support best practice management to minimise impact on community, environment and public health, including guidance in other publications and programs as relevant	EPA, SV	Regional Groups, SV	Local government, operators and owners of facilities	S	SD1
3.6	Carry out research and provide guidance to support industry and local government to: › reduce greenhouse gas emissions › mitigate the impact of climate change on waste and resource recovery facilities and services	SV	DELWP, EPA, Regional Groups	Operators, local government	S	SD5
3.7	Facilitate liaison between local government (and others) with responsibility for managing closed landfills (including local government) and the EPA to build capacity to manage closed landfills in accordance with statutory obligations, based on risk posed	Regional Groups	EPA	Local government (and others as relevant)	S–M	Regional Implementation Plans

	Action	Lead	Support	Key stakeholders	Timing	Reference
Goal 4	Targeted information provides the evidence base to inform waste and resource recovery infrastructure planning and investment at the state, regional and local levels by local governments, the waste and resource recovery industry and other government agencies					
4.1	Implement Regional Implementation Plans	Regional Groups	SV, DELWP	Local government, waste and resource recovery industry, community	L	SD6
4.2	Building on existing knowledge and capabilities, provide local government with fit-for-purpose planning tools, resources and advice to achieve the best economic, community, environment and public health outcomes, by using evidence to make planning decisions about waste and resource recovery services and infrastructure	Regional Groups	SV	Local government	S Ongoing	SD5 SD6
4.3	Develop, maintain and promote a comprehensive and accessible statewide waste dataset to inform waste and resource recovery planning and investment, which incorporates and communicates all available data from regions and regulators in accordance with a robust governance framework	SV	EPA, Regional Groups	Local government, waste and resource recovery industry	S Ongoing	SD6 Data
4.4	Work across government to ensure relevant policies, strategies, programs and functions consider the goals and strategic directions and the decision-making guidance of the SWRRIP	SV	DELWP, EPA, Regional Groups	Government agencies	Ongoing	SD6
4.5	Provide a statewide investment facilitation service which promotes regional and local opportunities and connects potential investors to Regional Groups, informs business cases for investment and coordinates relationships with the Victorian Government	SV	Regional Groups, EPA	Investors, local government, government agencies	Ongoing	
4.6	Lead implementation of the *Victorian Waste Education Strategy*	SV, Regional Groups (roll out)	Regional Groups	Local government, facility operators, schools, public place managers	Published 2016. Ongoing	Waste Education Strategy
4.7	Identify emerging and proven technologies that may support increased recovery and explore how they might be applied in Victoria	SV	Regional Groups, EPA	Waste and resource recovery industry, local government, investors	M	SD5

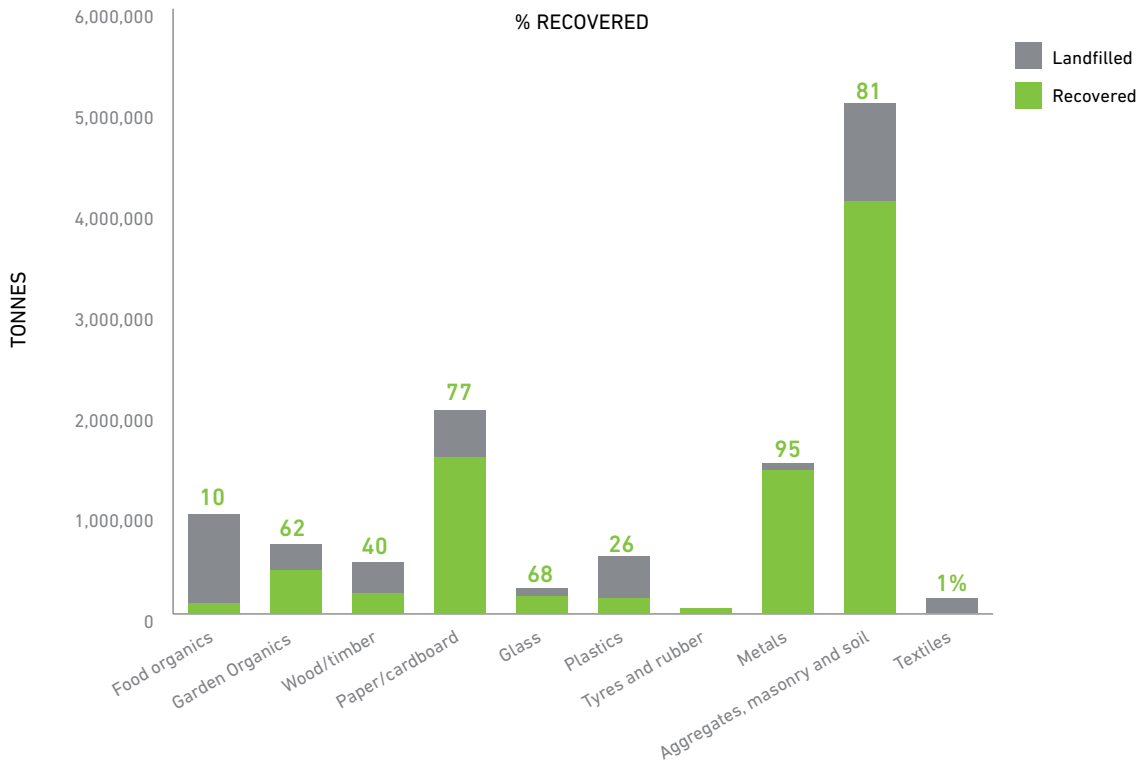
2.9 Key opportunities to increase recovery of materials

Achieving the goals and strategic directions of the SWRRIP relies on having the right infrastructure in the right places. The analysis carried out to develop the SWRRIP and Regional Implementation Plans provides an understanding of opportunities to increase recovery, and where current infrastructure may not have the capacity to realise the goals of the SWRRIP and Regional Implementation Plans. This section summarises the key findings of this analysis.

2.9.1 Materials recovery in 2015–16

In 2015–16, around 67 per cent of the materials managed by the Victorian waste and resource recovery system were recovered. Figure 2.4 shows a breakdown of the main material streams recovered and landfilled during this year. More detailed discussion can be found in Section 4.3.

FIGURE 2.4
RECOVERY OF MAIN MATERIAL STREAMS (2015–16) (TONNES AND PERCENTAGE RECOVERED)



Material stream recovery

Table 2.8 summarises opportunities to increase recovery of individual material streams as identified when developing the SWRRIP and Regional Implementation Plans. These opportunities are discussed in more detail in Chapter 5.

TABLE 2.8
SUMMARY OF OPPORTUNITIES IDENTIFIED TO RECOVER INDIVIDUAL MATERIAL STREAMS

Material stream	Tonnes		Opportunities
	Managed (2015–16)	Landfilled (2015–16)	
Organics			
Food	990,000	887,000	› Increase local government food and garden organics collection services to increase feedstock for reprocessing through collaborative and joint procurements between local governments › Distribute energy solutions using food materials from manufacturing processes and wastewater treatment plants › Build markets for products made from recovered food organics
Garden	688,000	259,000	› Facilitate collaborative procurements between local governments in regional Victoria › Build markets for products made from recovered organics in broadacre farming › Encourage small-scale, well managed, on-farm composting using low contaminated feedstocks and meeting regulatory requirements
Wood and timber	511,000	307,000	› Improve source separation at construction and demolition sites › Increase viability of collecting timber from resource recovery centres/transfer stations › Shred and process recovered untreated timber into briquettes, pellets or a dry woodchip › Use treated and untreated timber for WtE processes
Paper/cardboard			
Paper/ cardboard	2,024,000	473,000	› Improve separation of materials at materials recovery facilities (MRFs) from municipal sources and accept clean materials from commercial and industrial sources › Improve source separation at the point of generation › Investigate recovering paper and cardboard from residual waste
Glass			
Glass	253,000	80,000	› Improve colour sorting technologies at MRFs › Investigate viability of mobile glass crushers to produce sand replacement products › Investigate uses for recovered glass fines › Build end markets for recycled glass products by developing specifications for products made from recovered glass
Plastics			
Plastics – all	566,000	417,000	› Improve source separation and reduce contamination at the point of generation › Investigate use of plastics for feedstock for refuse derived fuels or WtE › Build end markets for recycled plastics products by developing specifications for products made from recovered plastics
Rigid plastics[a]	396,000	276,000	Improve collection and sorting of recovered rigid plastics from renovations, refurbishment and demolition of residential and commercial buildings

Material stream	Tonnes: Managed (2015–16)	Tonnes: Landfilled (2015–16)	Opportunities
Flexible plastics[a]	170,000	153,000	› Build capacity to collect flexible plastics through kerbside commingled systems › Set up viable collection systems for flexible plastics from agricultural activities › Investigate using materials and products made from recovered flexible plastics
Shredder floc	Estimated 350,000–400,000	Estimated 350,000–400,000[b]	› Investigate alternative uses for shredder floc available internationally for viability in the Victorian context › Investigate WtE options for shredder floc pre-sorted to remove materials that can be viably recovered including metals
Tyres and rubber			
Tyres/ Rubber[c]	Not available		› Investigate use of recovered tyre and rubber materials in line with the National Market Development Strategy › Build end markets by developing product specifications › Investigate local WtE opportunities using tyre derived fuels
Concrete, aggregates and soil			
Concrete, aggregate and soil	5,055,000	962,000	› Increase point source separation of materials on building and construction sites › Build end markets for recovered materials by developing product specifications › Increase local availability of recovered materials
E-waste			
E-waste[d]	108,000	61,000	› Strategic upgrade of the existing resource recovery centre/transfer station network to enable collection of e-waste materials › Support for industry to develop the capacity to improve separation and sorting of component materials › Develop a market for the recovered materials to ensure stockpiling does not occur
Residual waste			
Residual waste[e]	4,184,000	4,184,000	› Increase pre-sorting of the residual waste stream at landfills or residual waste consolidation centres › Establish MRFs that can sort residual waste › Treat residual waste to produce products such as energy, heat, biogas, biofuels and soil conditioners

a Tonnes modelled based on research for the Victorian Market Development Strategy using 2014–15 data.

b Sustainability Victoria, *Emerging market analysis*, prepared by Hyder Consulting (unpublished), Melbourne, May 2014.

c Information/data for tyre and rubber streams is incomplete. Work is underway as part of the national tyre stewardship program and is discussed further in Section 5.11.

d Based on worked undertaken for the *Victorian e-waste market flow analysis* (Sustainability Victoria, prepared by Randell Environmental Consulting (unpublished), Melbourne, 2015) using 2014–15 data.

e Victorian landfill levy data 2015–16.

Source: *Victorian Recycling Industry Annual Report 2015–16* (unless otherwise stated).

Organic materials, particularly food and timber, pose a significant opportunity for recovery, and are a government priority. Opportunities to increase recovery of plastics, both rigid and flexible, are also evident and are identified in Regional Implementation Plans.

Removing e-waste from landfill is another a Victorian Government priority. While the total amount of e-waste generated is small, it is made up of many different components, some of which are valuable and some that are hazardous and pose a risk to the community and environment if disposal is not managed appropriately.

Managing and recovering tyres is also prioritised as they pose a risk to the community when stored (whole tyres are banned from landfill).

2.9.2 Infrastructure gaps

Managing the materials entering the system to achieve the goals of the SWRRIP requires the right infrastructure. The strategic assessments completed by each region showed some gaps in the current infrastructure to realise the desired increase in recovery objectives of the individual regions and the SWRRIP.

Resource recovery network

We need an effective resource recovery network to enable the sorting, aggregation and consolidation of materials entering the system, so that materials can be reused directly or supply feedstock to support reprocessing. This recovery network is discussed in more detail in Section 6.5.

Table 2.9 summarises the gaps in the current resource recovery infrastructure network that limit the ability of each region to meet their needs in the next 10 years and increase recovery in line with the goals of their plans. More detail can be found in Chapter 6 and in the individual Regional Implementation Plans.

The Regional Implementation Plans identified adequate infrastructure to collect, store and process the current amount of e-waste entering the system. However, they identified that additional infrastructure capacity would be required to support the Victorian Government ewaste landfill ban. This is discussed further in Section 5.14.

TABLE 2.9
GAPS IN THE CURRENT RESOURCE RECOVERY INFRASTRUCTURE NETWORK

Gaps	Waste and resource recovery region						
	Barwon South West	Gippsland	Goulburn Valley	Grampians Central West	Loddon Mallee	Metropolitan Melbourne	North East
Strategic planning of resource recovery centre/transfer station upgrades to address influences such as population change, changes in materials being discarded by households and the proposed e-waste landfill ban, and to support better practice operation of facilities	•	•	•	•	•	•	•
Increased compaction capacity at resource recovery centre/transfer to reduce transport costs	•	•	•	•	•	•	•
Increased pre-sort capacity at landfills to divert recoverable materials from residual waste	•			•		•	
Large-scale sorting facility for multiple material streams from all sectors		•					
Bulk haul consolidation centres					•	•	
Improved sorting capacity at MRFs for commingled recyclables streams						•	
Improved infrastructure at MRFs to accept non-kerbside collected materials						•	
Pre-sort residual waste before additional recovery or disposal (not necessarily at landfills, examples could include increased functionality at resource recovery centres or a residual MRFs)	•	•	•	•	•	•	•

Reprocessing capacity

Achieving greater recovery of materials from our waste and resource recovery system relies on many factors, as discussed throughout the SWRRIP. One factor is having adequate capacity to reprocess the recovered materials into materials and products that can be used productively. Table 2.10 summarises the gaps in reprocessing capacity identified in Regional Implementation Plans. These are discussed in more detail in Section 6.6.

Note that the geographical location of new or existing infrastructure to meet capacity gaps will depend on where sufficient aggregation can be achieved to support viable recovery. The materials may flow from the region that identified the gap to a reprocessor in another region. This movement of materials is discussed in more detail in Section 4.9.

TABLE 2.10
GAPS IN REPROCESSING CAPACITY IDENTIFIED IN REGIONAL IMPLEMENTATION PLANS OVER THE NEXT 10 YEARS

Material stream	Waste and resource recovery region						
	Barwon South West	Gippsland	Goulburn Valley	Grampians Central West	Loddon Mallee	Metropolitan Melbourne	North East
Food organics			#				
Garden organics							
Combined organics[a]				#	#		#
Wood/timber							
Paper/cardboard							
Glass							
Plastics							
Tyres and rubber							
Metals							
Aggregates, masonry and soil							
Textiles							
Residual (reprocessing)							

a Includes combined food and garden organics from municipal collections and may include organics from other sources such as food manufacturing, agricultural activities and biosolids.

Some additional capacity is planned and awaiting appropriate approvals.

Additional capacity may be required in 1–5 years to meet needs

Additional capacity may be required within the 10-year planning horizon

2.10 Monitoring and evaluating the SWRRIP

SV coordinates and monitors implementation of the SWRRIP across the waste and resource recovery portfolio agencies through two plans:

- SWRRIP delivery plan:
  an overview of how the SWRRIP is being implemented by agencies on the ground
- SWRRIP monitoring and evaluation plan (M&E Plan):
  a structure to support ongoing performance assessments of the delivery and impact of the SWRRIP.

The M&E Plan provides a framework for evaluating the impact of government actions and will provide an evidence base to:

- assess the SWRRIP's effectiveness, efficiency, relevance and impact
- guide continuous improvement
- inform future annual planning and government investment
- inform the five-year review of the SWRRIP.

The M&E Plan establishes a suite of indicators (see below) to assess the performance of the SWRRIP and understand how well it is supporting the waste and resource recovery sector to achieve the goals of the SWRRIP. It monitors the implementation of government actions, while also capturing information to evaluate the effectiveness of these actions over time. It is underpinned by a robust program including an annual survey of key stakeholders, data analysis and measuring changes to the system and recovery of resources.

The M&E Plan collects the information and data required for the review of the SWRRIP within five years. Regional Groups will also review Regional Implementation Plans within five years, with a focus on infrastructure schedules.

2.10.1 Indicators

The following key indicators will track progress towards achieving the SWRRIP goals:

- local governments, industry and government departments using waste and resource recovery infrastructure data and information in their planning and investment decisions
- money invested (and/or jobs created) by local governments and industry in new or upgraded infrastructure
- overall diversion rate from landfill has improved (tonnes recovered over total waste generation) for all wastes and organic materials
- environmental, public health and/or amenity performance of waste management and resource recovery facilities has improved
- the Victorian Planning Provisions and other key strategic planning documents or policies are aligned with the long term strategic directions of the SWRRIP and the relevant Regional Implementation Plans
- industry report increasing market demand for end products made from priority materials
- government departments and agencies have strategies, plans, programs and functions that are consistent with the strategic directions of the SWRRIP.

Quantitative and qualitative data will be collected and analysed, and high-level progress reported to local government, industry and the community.

3. Integrated land use planning and hubs

3.1 Introduction

This chapter outlines the challenges and opportunities for greater integration with Victoria's land use planning system and the role of waste and resource recovery hubs.

It is critical to integrate land use, transport and waste and resource recovery planning to protect the community, environment and public health and the functionality of Victoria's waste and resource recovery system. Integration is required at state and local levels, and at different stages of land use planning.

As per Strategic Direction 4, ensuring land is available for essential waste and resource recovery infrastructure is critical to establishing and maintaining an effective waste and resource recovery system.

The waste and resource recovery hub concept (described in Section 3.3) further facilitates effective waste management and resource recovery. Land use planning that considers hubs and their functions is important and will demonstrate an integrated approach.

"It is critical to integrate land use, transport and waste & resource recovery planning"

... to protect the community, environment and public health.

3.2 Land use planning

Waste and resource recovery infrastructure and activities can affect the amenity, liveability, health and safety of local communities through impacts from odour, dust, noise, litter, gas emissions and the release of pollutants into surface and groundwater.

Land use planning can ensure adequate buffers and planning mechanisms are in place to protect communities and the environment from these adverse amenity impacts and enable facilities to operate efficiently. Appropriate zoning, creating adequate separation between industrial and sensitive uses, and using planning overlays are some of the mechanisms used to establish these buffers. Land use planning plays an important role in preventing incompatible land uses being established near waste and resource recovery facilities, which could affect the operating life and functionality of a site.

As outlined in Strategic Direction 2, the SWRRIP seeks to integrate waste and resource recovery and land use planning at a state level. This will enable local governments to act at the local level – aligning local planning schemes and Regional Implementation Plans, when considering hubs.

BETTER APARTMENTS DESIGN STANDARDS

The Better Apartments project is a joint initiative of the Department of Environment, Land, Water and Planning and the Office of the Victorian Government Architect. The Better Apartments Design Standards have been introduced to improve the livability and sustainability of apartments across Victoria.

Waste and recycling is one of 16 new apartment standards which aims to increase recycling and better manage waste in apartments. All planning schemes in Victoria have been amended to include the new apartment standards at Clause 55 and 58. Clause 55.07 applies to apartments four storeys and below, and Clause 58 applies to apartments five storeys or more.

3.2.1 Planning instruments

There are several land use planning instruments relevant to the waste and resource recovery system:

Planning and Environment Act 1987 (P&E Act)	› The P&E Act and the Planning and Environment Regulations establish the legal framework for the planning systems, including the use, development and protection of land in Victoria to meet current and future needs. › A key objective of the P&E Act is for land use planning and policy to be easily integrated with environmental, social, economic, conservation and resource management policies at state, regional and municipal levels. › As per Strategic Direction 4, integrating with the land use planning system is critical to achieving the goals of the SWRRIP. › As the population in Victoria increases, so too does the need to site new residential, commercial and industrial developments in appropriate locations. Land use planning seeks to regulate land use in an orderly, economic and sustainable way to balance these competing needs. › Planning authorities and responsible authorities (such as local governments) are responsible for planning and managing land use and development in their municipality for the broader interests of the community. This is done through strategic planning such as preparing structure plans, growth corridor or development plans, and assessing planning permit applications through the statutory planning system to achieve the objectives of the P&E Act.
Victoria Planning Provisions (VPPs) and State Planning Policy Framework	› The VPPs are a comprehensive set of planning provisions for Victoria, used to source and construct local planning schemes. All planning schemes in Victoria include reference to waste and resource recovery infrastructure policy. › Under Clause 19.03-5 relating to waste and resource recovery policy, planning authorities must consider the various policies, listed policy guidelines documents and regulations when making planning decisions including preparing planning scheme amendments and determining planning permits. › The SWRRIP and Regional Implementation Plans are included as policy guideline documents in Clause 19 (Infrastructure) of the State Planning Policy Framework, and more specifically, Clause 19.03-5: Waste and resource recovery. The relevant authority must consider the content of the various guideline documents where an assessment against the planning scheme is required. This provides integration between land use planning and the waste and resource recovery system. › Strategic land use planning needs to consider both existing and possible future facilities when undertaking long term planning. It is important to consider settlement planning holistically, including waste and resource recovery needs along with other required services. › Clause 52.45 of the VPPs deals with resource recovery. It sets out matters to be considered in an application for a planning permit for a transfer station and/or a Materials Recycling Facility, so that they are in appropriate locations with minimal impact on the environment and amenity of the area. › The VPPs use different terminology to the waste planning framework, SWRRIP and Regional Implementation Plans. Appendix 2 outlines the relationships between the two sets of terms.
Statutory land use planning	› Statutory planning has a role in siting and operational conditions for the waste and resource recovery industry through assessing planning permits. › Permit conditions may put parameters on the volumes of materials to be processed at a particular facility.

Strategic land use planning and planning policy	› Strategic land use planning is relevant where a proposed development, strategic plan, or planning scheme amendment facilitates industrial land uses for waste and resource recovery facilities, or where residential or other sensitive uses are proposed within the required buffer area of a facility. › Creating planning policy, strategic plans or planning scheme amendments at either a local or state level can influence the waste and resource recovery sector. When being developed they must consider the principles and goals of the SWRRIP and relevant Regional Implementation Plans, as relevant. › Planning policy should also encourage synergy with transport planning and transport networks to facilitate the efficient movement of waste or products. › Municipal Strategic Statements in the Local Planning Policy Framework of all planning schemes can be used to recognise waste and resource recovery industries as an important and essential service. The statements can also: – recognise individual waste and resource recovery facilities, such as those in a waste and resource recovery hub of local, regional or state importance – deal with any site-specific issues to consider in future planning. › Planning scheme overlay provisions can also be used to protect waste and resource recovery facilities from encroachment by sensitive uses.
Transport Integration Act 2010 (TI Act)	› Under the TI Act, all decisions affecting the transport system must be made within the same integrated decision-making framework and support the same objectives. › The TI Act recognises that land use planning and transport planning are interdependent. Strategic land use decisions are brought under the Act's policy framework by creating interface bodies and interface legislation. › The hubs concept described in Section 3.3 provides further context on the integration between land use planning and transportation. As outlined, hubs play a significant role in Victoria's waste and resource recovery system, and each hub has its own unique issues and opportunities.

3.2.2 Planning and environmental enforcement

Waste and resource recovery industries, like other industries, can affect local amenity through noise, odour, dust and gas migration risks from landfills, for example. Industry can also affect the environment including groundwater and wildlife habitat. It is important to operate these land uses to best practice with appropriate regulation, monitoring and controls.

Enforcement bodies such as local government planning enforcement officers, and EPA Environment Protection Officers need to work collaboratively to deal with non-compliance and unauthorised development issues. This will help minimise offsite impacts, and ensure industry operates to best practice.

3.3 Waste and resource recovery hubs

Providing for and supporting waste and resource recovery hubs is an important way to promote efficient waste and resource recovery and should be supported in appropriate locations.

Hubs are a facility or group of facilities that recover or manage material streams or waste. Collectively, hubs form a network of infrastructure where the activities and their location inform decisions made by investors, operators, land use planners and other decision-makers. Hubs may evolve as the facilities within them evolve, due to several factors, such as:

- market shifts
- commodity prices
- technology improvements
- local government strategic plans.

Land use planning needs to recognise the strategic importance of hubs in providing the essential services required to support Victorians communities, businesses and industry. Holistic and integrated forward planning for existing and future hubs will help ensure that appropriate buffers and protection are in place to minimise any impacts to communities, the environment and public health. It will also ensure adequate land is available for investment in the infrastructure required to provide the essential services needed to manage waste and material streams.

Understanding where existing hubs are located and the role they currently play in managing materials and waste streams is critical to future planning. Often these hubs are well developed with existing buffers and could support additional waste and resource recovery activities in the future.

The SWRRIP does not seek to only promote hubs of importance and exclude other sites which may be used for resource recovery activities. We acknowledge that sites other than those listed may also be suitable for waste and resource recovery facilities, subject to the required permits, approvals and buffers. Similarly, hubs are not exclusive to waste and resource recovery activities, and may include a range of other compatible land uses. Furthermore, including a site as a hub does not alter the need for compliance with relevant environmental legislation or standards, nor guarantee any future approvals or funding. The following chapter providing hubs guidance may also be applicable for waste and resource recovery sites more generally.

3.3.1 Local, regional and state hubs

The hubs network consists of a cascading series of hubs, with varying levels of significance to Victoria's waste and resource recovery system. Table 3.1 describes hubs at the local, regional and state level.

HUB CHARACTERISTICS

A well-located and well-functioning hub will:

- facilitate aggregation and consolidation of individual material streams to achieve the tonnages needed to maximise resource recovery
- attract investment in resource recovery infrastructure, particularly those relying on specific material streams
- have appropriate buffers to support the waste and resource activities (which may be shared with other activities requiring buffers)
- have good access to transport networks
- be collocated with, or close to complementary activities that provide feedstocks or markets for the products and services made from the activities
- minimise community, amenity, environment and public health impacts
- support employment and industrial activities to create additional job opportunities
- be integrated with a broader precinct with complementary activities in terms of land use planning
- operate over time to underpin the investment in infrastructure.

3.3.2 Hubs of state importance

Using the criteria in Table 3-1, the SWRRIP identifies 22 sites across the state as undertaking waste and or resource recovery activities which are important at the state level. Figure 3-1 identifies their general location and Table 3-2 lists these sites and explains why they are important at the state level. More information on these significant hubs can be found in the seven Regional Implementation Plans.

TABLE 3.1
DESCRIPTORS OF LOCAL, REGIONAL AND STATE HUBS

Hub level	Descriptors
Local	› Often the first point of aggregation, consolidation and recovery › Likely to include resource recovery centres and resale shops › May include facilities able to sort and consolidate local residual waste streams before transporting for recovery or landfill › Increasingly unlikely to include landfills due to the rising cost of operating, managing and rehabilitating best practice landfills › May provide a required service
Regional	› Service both their local area and beyond › May receive material streams from surrounding local hubs › Most likely include sophisticated infrastructure and one or more facilities undertaking sorting and/or recovery and possibly reprocessing › May carry out pre-sorting and some recovery before best practice residual waste management
State	› Provide a service to the local area, one or more regions and Victoria › May receive consolidated material streams from both local and regional hubs › May undertake higher order recovery, reprocessing or managing residual waste › Can be made up of one facility or several facilities that support each other

FIGURE 3.1
HUBS OF STATE IMPORTANCE

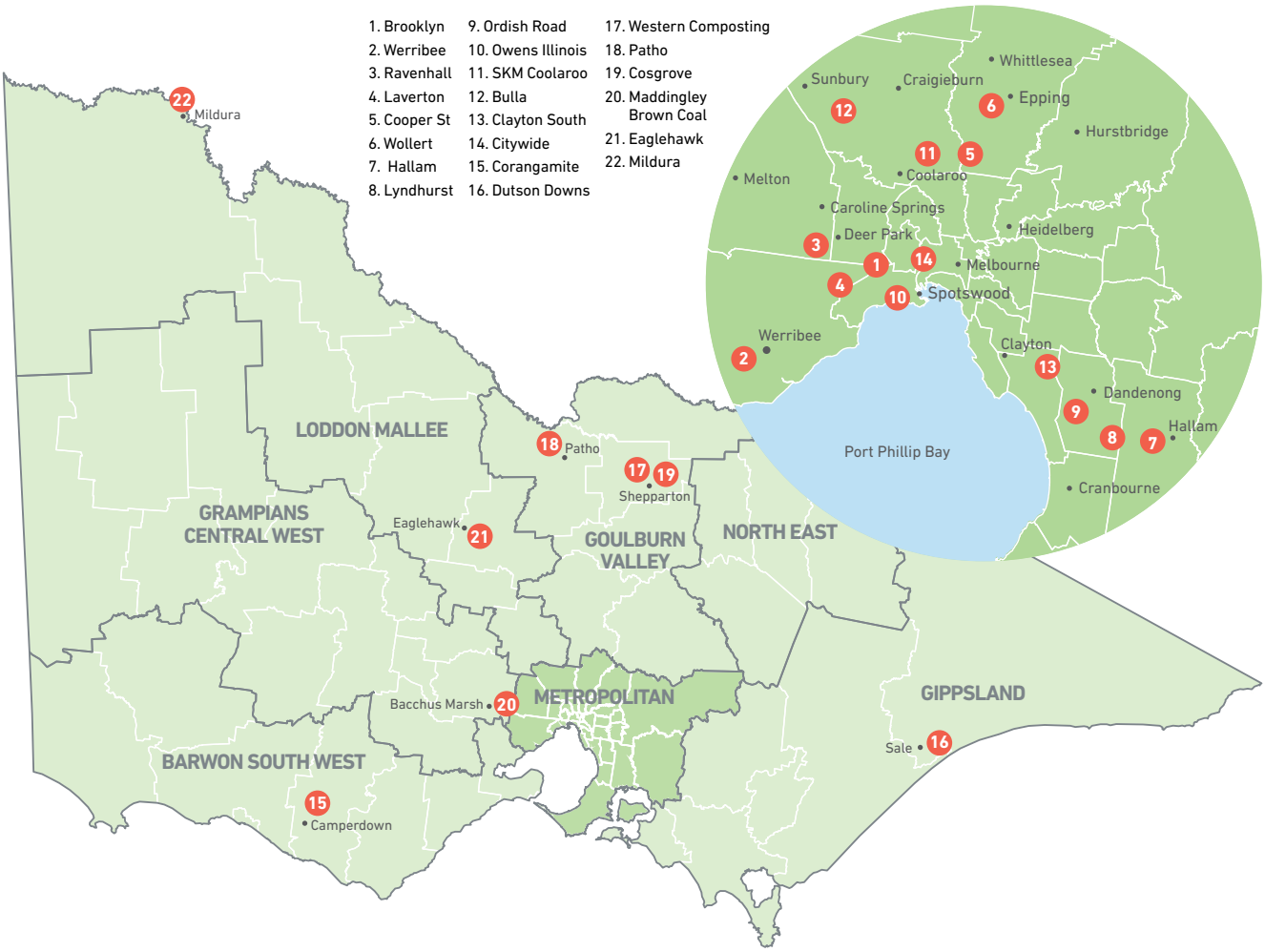


TABLE 3.2
HUBS OF STATE IMPORTANCE

Hubs	Description/Why is this of importance to the state system?
Metropolitan Melbourne	
1. BROOKLYN PRECINCT	
Location: Generally bounded by Sunshine Road, Geelong Road, the Western Ring Road and the rear of industrial properties on Somerville Road LGA: › Brimbank City Council › Hobsons Bay City Council › Maribyrnong City Council Land use planning zoning: Industry 1 Owner/Operator: Multiple	› The Brooklyn Precinct is a significant, well-established hub reprocessing around 40 per cent of the state's metals and more than one million tonnes of materials from the C&D sector. It is strategically located close to ports and freight networks. › The precinct supports a range of major industrial activities and other waste and recovery activities including putrescible and solid industrial waste landfilling, and recovery of organic materials. › The economic importance of this site extends beyond that of the precinct, and extends beyond that of waste and resource recovery industry. › Poor management in the past of issues such as odours, dust, stockpiles and truck movements and residential encroachment have put pressure on the precinct. If the advantages of maintaining this hub are to be realised, planning needs to preserve adequate buffer distances and ensure that all activities, including those related to waste and resource recovery, are compatible and conducted in a manner that does not impact on the community, environment and public health of surrounding land users. › To maximise the outcomes for this, ongoing dialogue is required between the existing industries, the surrounding community, regulators, the relevant councils and other relevant government agencies. › The Metropolitan Implementation Plan recognises the challenges associated with the hub and is committed to work with Brimbank, Maribyrnong, Hobson's Bay and Wyndham Councils and industry, to maintain a future role of this hub in the waste and resource recovery system.
2. WERRIBEE LANDFILL	
Location: 470 Wests Road, Werribee LGA: › Wyndham City Council Land use planning zoning: Special Use Schedule 6 Owner/Operator: Wyndham City Council	› The Werribee Landfill is a significant, putrescible and solid inert landfill servicing the Metropolitan Melbourne region and parts of the Barwon South West region. It has good transport connections due to its location adjoining the Princes Highway and access to the proposed outer metropolitan ring road. It is supported by a transfer station accepting municipal and commercial recyclable materials including organics. › As recognised in the Metropolitan Implementation Plan, its location and land use planning controls provide potential for the long term management of residual waste, increased recovery activities particularly organics onsite and establishing compatible surrounding land uses. › To ensure potential economic and recovery opportunities are maximised, it is essential that existing buffers be maintained, and that Wyndham City Council undertakes ongoing community engagement to communicate the potential benefits to the community of this site remaining available for resource recovery activities, and to reassure the community that activities will have minimal impact on local amenity. › Wyndham City Council is undertaking strategic planning to ensure and encourage development of land around the hub for activities compatible with its ongoing operation.

Hubs	Description/Why is this of importance to the state system?
3. RAVENHALL PRECINCT (including Boral Quarry, Cleanaway Melbourne Regional Landfill Ravenhall)	
Location: Quarry and landfill site generally bounded by Ballarat railway line, Christies, Middle and Hopkins Roads LGA: › City of Melton Land use planning zoning: Special Use Schedule 1 Owner/Operator: Cleanaway Boral Quarries and Resource Recovery Facilities	› The Ravenhall precinct supports the largest putrescible landfill in the state and receives significant tonnes of inert industrial waste as well as Category C soils and asbestos. Significant quantities of C&D material including aggregates, masonry and soil are reprocessed at the hub. › The hub is located within Metropolitan Melbourne and close to sources of waste generation, has good transport networks, and supports compatible activities including quarrying. › The hub is located within a state significant industrial precinct. Adjoining land is subject to precinct structure planning and is expected to provide for a mix of residential, business and industrial activity centres and railway stations. › Urban encroachment and balancing community expectations in relation to the operation of the site is a future risk to the functionality of the site. Planning needs to ensure the preservation of adequate buffer distances and that incompatible land uses are not established in proximity to the hub and activities on the site are conducted in a manner that does not impact on the community, environment and public health of surrounding land users. › There is significant community concern with the site's current operations, particularly odour, offsite litter and frequent and heavy truck movements through local roads. › The Metropolitan Implementation Plan recognises the potential over the long term of this hub to accommodate additional resource recovery operations. To ensure its long term functionality, the hub should be appropriately acknowledged in current and future precinct planning processes. › The operators lodged a proposal to expand the existing landfill. In May 2017, part of the site was granted a planning permit (PA2016/5118); the additional airspace, if developed and used, will provide capacity for about 20 years, at current fill rates. › An EPA Works Approval is also required. The EPA issued a works approval in March 2017; however, this decision is being appealed and is therefore pending the determination of Victorian Civil and Administrative Tribunal. › If this site does not continue its landfill operations in the medium term (beyond the currently approved airspace), the metropolitan region is at risk of having inadequate landfill to meet expected needs for disposal for materials for which there is no resource recovery capacity; a new landfill may need to be scheduled by 2021, and built and commissioned by 2026. › Engaging with surrounding communities is important when operating facilities. The Metropolitan Group supports promoting best practice operations at the site, including community engagement, at this site › As outlined in the Metropolitan Implementation Plan, the Metropolitan Group will continue to work with Cleanaway, Melton City Council and the EPA to establish appropriate buffers from the landfill and reprocessing operations.
4. LAVERTON PRECINCT	
Location: Western industrial node, Laverton North, Laverton and Altona industrial areas LGA: › City of Hobsons Bay › City of Wyndham Land use planning zoning: Industry 1 Industry 2 Owner/Operator: Multiple	› The Laverton precinct supports the major metals reprocessors for the state and significant reprocessing of materials from C&D activities. It has good access to transport routes and the Port of Melbourne. › As identified in the Metropolitan Implementation Plan, this hub is a key industrial precinct for growth across all sectors driven by its close location to transport networks and the affordability and availability of large parcels of suitably zoned land. It identifies potential for this hub to expand resource recovery activities and maintains its importance to the resource recovery and waste system. › In addition, if appropriate planning is maintained, the hub has capacity to increase other compatible activities that could provide both feedstocks for additional reprocessing activities and markets for recovered materials. › The Metropolitan Implementation Plan recognises that the Metropolitan Group will work with local governments to develop opportunities and, along with the EPA, will also work with owner/operators to ensure best practice and community expectations are met. › Community engagement is needed to gain acceptance for the ongoing functionality of the hub including demonstrating the potential benefits to the community of this hub remaining available for resource recovery activities, and to reassure them that activities will have minimal impact on local amenity.

Hubs	Description/Why is this of importance to the state system?
5. COOPER STREET PRECINCT, WHITTLESEA	
Location: Land adjoining Cooper Street and Hume Freeway from Merri Creek in the west to Northern Hospital/ Epping Plaza in the east **LGA:** › City of Whittlesea **Land use planning zoning:** Various including: Special Use Zone Farm Zone, Public Use Zone and Industrial 1 Zone. **Owner/Operator:** Multiple	› This precinct is a significant organics hub accepting garden organics mainly from the metropolitan area. It is also a significant hub for reprocessing materials from C&D activities in the northern metropolitan area of Melbourne. › Other activities at the hub include several operational inert landfills and two closed landfills that have been rehabilitated and are currently undertaking post-closure activities including monitoring. › This hub has the potential to take advantage of its access to the Hume Highway and Western Ring Road and surrounding industries generating feedstocks that could support additional resource recovery. › If adequate buffers and planning considerations are maintained to protect this precinct from residential encroachment and incompatible land uses, this hub could potentially be important to the waste and resource recovery system over the long term. In particular, encouraging compatible activities could provide both feedstocks for additional resource recovery activities and markets for the recovered goods. › The Metropolitan Implementation Plan supports a place-based approach to planning for managing waste and recovering resources in the future involving the industry within the hub, surrounding generators and the local community. › Community engagement is needed to gain acceptance for the ongoing functionality of the hub, including demonstrating the potential benefits of this hub remaining available for resource recovery activities, and to reassure them that activities will have minimal impact on local amenity.
6. HANSON LANDFILL AND QUARRY, WOLLERT	
Location: 55 Bridge Inn Road, Wollert Wollert landfill site is bounded by Masons Rd, Epping Road and Bridge Inn Road **LGA:** › City of Whittlesea **Land use planning zoning:** Green Wedge **Owner/Operator:** Hanson Construction Materials P/L	› The Hanson Landfill is a significant putrescible and solid inert landfill serving the metropolitan and neighbouring regions. There are existing planning and works approvals in place providing it with the potential to supply landfill airspace over the long term. › It is well located on the urban fringe and close to major transport routes. › The Metropolitan Implementation Plan identified potential for the hub to expand resource recovery activities to meet the needs of the surrounding growth areas including establishing a resource recovery centre and pre-sort. › It is important that urban planning allows adequate buffers and planning controls to protect the amenity of surrounding communities and prevent establishing incompatible uses that could impact on the functionality of the site over the long term. › The Metropolitan Implementation Plan has identified the potential for this site to operate over the long term. If this site does not continue its landfill operations, Melbourne is at risk of having inadequate landfill capacity to manage waste for which there is no current resource recovery capacity in the network. › Community engagement is needed to gain acceptance for the ongoing functionality of the hub including demonstrating the potential benefits of this hub remaining available for resource recovery activities, and to reassure them that activities will have minimal impact on local amenity.
7. SUEZ HALLAM (Ex Sita Hallam)	
Location: 274 Hallam Rd, Hampton Park **LGA:** › City of Casey **Land use planning zoning:** Special Use Schedule 1 **Owner/Operator:** SUEZ	› This is a major hub for reprocessing materials from C&D activities and is a significant putrescible and solid inert landfill serving the south-east area of Melbourne. › The site has works approval and planning approval for the whole site and the Metropolitan Implementation Plan recognises the potential of it providing landfill airspace servicing the metropolitan region over the medium term. › Closure of landfills in Clayton South and the Mornington Peninsula will see an increase in landfilling activities over the next five years. To maintain functionality the site will need to be carefully managed to ensure odour and dust impacts are managed and minimised due to the proximity of residential development surrounding the site. › The hub has capacity for improved resource recovery activities onsite, as maximising recovery will provide additional airspace for disposal. It is expected these opportunities will be further explored as the sites limited disposal capacity nears its end and landfill cells are progressively rehabilitated across the site. › In response to past odour and management issues, the EPA has worked with the owner to improve and achieve best practice management and undertake community based projects. › Community engagement is needed to gain acceptance for the ongoing functionality of the hub including demonstrating the potential benefits of this hub remaining available for resource recovery activities, and to reassure them that activities will have minimal impact on local amenity.

Hubs	Description/Why is this of importance to the state system?
8. SUEZ LYNDHURST (Ex Sita Lyndhurst)	
Location: 890 Taylors Road, Dandenong South **LGA:** › City of Greater Dandenong **Land use planning zoning:** Industry 1 **Owner/Operator:** SUEZ	› This hub is Victoria's only landfill licensed to receive Category B prescribed industry waste (PIW). It also receives some Category C PIW and is licensed to receive putrescible waste. › It is located within the Dandenong South Lyndhurst Industrial Precinct with good access to transport routes. › In addition to landfill, some soil remediation is undertaken onsite. › Due to a decrease in the PIW landfill tonnages the site is moving to increase its acceptance of putrescible wastes, which could affect the long term availability of PIW airspace in the state. While PIW currently is outside the scope of the SWRRIP it is important that it recognises that this hub is critical to managing PIW wastes and contaminated soils in Victoria. › As recognised in the Metropolitan Implementation Plan, this hub could play an important role in managing waste displaced from the closure of sites in the Clayton area and contingency planning for emergency events that could require the closure of Hallam Road site. › Community engagement is needed to gain acceptance for the ongoing functionality of the hub including demonstrating the potential benefits of this hub remaining available for resource recovery activities, and to reassure them that activities will have minimal impact on local amenity.
9. ORDISH ROAD PRECINCT, DANDENONG SOUTH	
Location: 80–88 Ordish Road Precinct, South Dandenong Dandenong South Industrial 2 Zone (IN2 Zone) is generally bounded by Greens Road, Hammond Road Including Ordish Road **LGA:** › City of Greater Dandenong **Land use planning zoning:** Industry 2 **Owner/Operator:** Multiple	› The Ordish Road precinct is a major hub for a range of resource recovery and waste management activities including commingled recyclable sorting, organics reprocessing and reprocessing aggregates masonry and soil. › It is one of only two sites in Victoria zoned industrial IN2 with a 1500 metre buffer and good access to transport networks. › As recognised in the Metropolitan Implementation Plan, the hub precinct sits within the Dandenong South Employment Cluster. The zoning of this precinct makes it a suitable location for future waste and resource recovery activities. › Pressure from residential encroachment and incompatible industrial and commercial activities could impact on the functionality of this site. If this site is to be maintained in the long term as a hub, planning needs to ensure adequate buffer distances are preserved and activities in the precinct are compatible and conducted in a manner that does not impact on the community, environment and public health of surrounding land users. › Community engagement is needed to determine the outcomes for this hub including demonstrating potential benefits of this site remaining available for resource recovery activities, and to reassure the community that activities will have minimal impact on local amenity.
10. OWENS ILLINOIS (OI), SPOTSWOOD	
Location: Industrial site in an IN1 zone bounded by Simcock Avenue, Booker and Hudsons Street **LGA:** › City of Hobsons Bay **Land use planning zoning:** Industry 1 **Owner/Operator:** Owens Illinois	› Owens Illinois is the only major glass reprocessor in Victoria that reprocesses used glass back into glass materials. › It is well located in an industrial zone with good access to transport networks and the Melbourne Port. Commodity values and availability of markets will impact on the viability of this facility to continue in the future. › As recognised in the Metropolitan Implementation Plan, working with feedstock providers to improve the quality of the glass cullet would improve the quality of the cullet (feedstock).

Hubs	Description/Why is this of importance to the state system?
11. SKM MRF, MAFFRA STREET, COOLAROO	
Location: Industrial site on Maffra Street adjoining the Upfield railway line **LGA:** › Hume City Council **Land use planning zoning:** Industry 1 **Owner/Operator:** SKM	› This hub is the largest MRF in Victoria, accepting commingled recyclable streams from metropolitan and regional areas. › It is well located with good access to transport routes. › Recent fires at this hub have impacted on the amenity of the surrounding communities. Ongoing functionality and viability of the hub will rely on operators working to re-establish community confidence that the operations meet all regulatory and planning requirements and are managed to reduce potential impacts › The Metropolitan Implementation Plan recognises this hub as continuing its current role in sorting commingled recyclable materials for the foreseeable future. Owners have made a commercial decision to plan for a new facility to manage increasing quantities of feedstock rather than expand at the current site.
12. VEOLIA ORGANICS FACILITY AND HI-QUALITY SOLID INERT LANDFILL, BULLA	
Location: 580 Sunbury Road, Bulla **LGA:** › Hume City Council **Land use planning zoning:** Special Use Schedule 1 **Owner/Operator:** Hi-Quality landfill and resource recovery operations Veolia In-vessel Composting Facility	› This is a major hub undertaking a range of waste and resource recovery activities including: – in-vessel composting of kerbside collected food and garden organics – recovery of C&D material, including category C soils and asbestos and other solid industrial waste – landfilling of solid materials including asbestos › Other activities in the hub include sand and stone quarrying. › The site is in located approximately 30km north of the city centre, and is therefore well suited to process associated waste and materials from Melbourne's metropolitan area. › To maintain functionality, adequate buffering needs to be preserved through the Sunbury South Precinct Structure Planning process. The co-location of compatible and supporting land uses should be considered. › The Metropolitan Implementation Plan identified that this site will continue to be a significant part of the metropolitan organics network. For this to be achieved it is important that surrounding land use activities are compatible with activities on the site.
13. CLAYTON SOUTH PRECINCT	
Location: General area including the area North of Fraser Road including the Clayton South Industrial Precinct that adjoins Fairbank and Clayton Roads **LGA:** › City of Kingston **Land use planning zoning:** Industry 1 **Owner/Operator:** Cleanaway (landfill and transfer station) Alex Fraser Resource Recovery Facility	› This hub has a long history associated with waste and resource recovery and has been a significant hub for the surrounding area for organics reprocessing, landfill and reprocessing materials from C&D activities. › It includes resource recovery operations and resource recovery centres (including the Alex Fraser resource recovery operations), making it a significant hub for the metropolitan region. Cleanaway has received planning permission on its Fraser Road site to construct its South East Melbourne Transfer Station. › As recognised in the Metropolitan Implementation Plan, this precinct is undergoing a transition influenced by the approval of the Planning Scheme Amendment C143 and City of Kingston's long-held intention to advance its open space strategy 'the Chain of Parks'. All landfills in the precinct are expected to have stopped accepting new waste and started rehabilitation by the end of 2017. › Closure of the landfills provides opportunities, particularly in the land zoned for industrial and commercial activities. In particular, opportunities to explore industrial ecology and place-based approaches to promoting increased resource recovery and connections between industries and potential users of waste streams should be considered. The food manufacturing industry is a priority sector that can take advantage of new organics recovery infrastructure being developed in the precinct. Strategic planning should also occur to ensure that the current volumes of materials managed and processed are able to be managed in the future. › As a result of the closure of the landfills in this precinct, materials and waste traditionally sourced from the region will need to find alternative management options. This presents an opportunity to establish sorting and consolidation facilities in or near the precinct to provide options to maximise transport efficiencies. The Metropolitan Group identified the need to work with the City of Kingston, community and industry to develop a long term plan for the next phase of resource recovery activities for this precinct. This includes ensuring that adequate buffers are maintained around closed landfills, those undergoing rehabilitation and resource recovery activities to minimise impacts on the surrounding community. › The site is also significant as it is located within the Monash National Employment and Innovation Cluster, which will see the general area develop as the second largest employment centre behind the city of Melbourne.

Hubs	Description/Why is this of importance to the state system?
14. CITYWIDE RESOURCE RECOVERY CENTRE, WEST MELBOURNE	
Location: 437 Dynon Road, West Melbourne Industrial site is adjoining Dynon Road, Footscray **LGA:** › City of Melbourne **Land use planning zoning:** Industry 1 **Owner/Operator:** Citywide	› This hub is a major consolidation point for the inner metropolitan area and provides public transfer station services for MSW and C&I waste principally from the inner metropolitan and central business district area. › It is well located for access by inner city government and businesses and is close to the freight activity centre and the port of Melbourne. › Expanding or improving the freight activity centre may affect the site's operational ability in the long term. › As identified in the Metropolitan Implementation Plan, if the site was affected by the expansion of the Port or other infrastructure development, the site would need to be relocated to a suitable site that ensure services are accessible to current users.
Barwon South West	
15. CORANGAMITE REGIONAL LANDFILL, NAROGHID (Naroghid Landfill)	
Location: County Boundary West Road, Cobrico **LGA:** › Corangamite Shire Council **Land use planning zoning:** Special Use Schedule 10 **Owner/Operator:** Corangamite Shire Council	› The Corangamite Regional landfill is a significant landfill accepting putrescible and industrial solid waste from the Barwon South West region. › It is co-located with a resource recovery centre and transfer station and composting facility. › Landfilling and composting activities may increase in the short term with the closure of smaller landfills in the region. › Both the Barwon South West Implementation Plan and the Corangamite Shire Council plan for the site identifies it maintaining current activities over the long term with potential to increase its organics reprocessing capacity and pre-sort before landfill. › Existing land use planning controls provide suitable long term protection to preserve the sites use for waste and resource recovery activities over the long term. › While the site is located in a rural setting, its functionality as a hub is dependent on consultation and engagement with the surrounding communities. The Council continues ongoing engagement with its community to communicate the potential benefits of this site remaining available for resource recovery activities, and to reassure the community that activities will have minimal impact on local amenity.
Gippsland	
16. DUTSON DOWNS SOIL AND ORGANIC RECYCLING FACILITY (SORF)	
Location: 1954 Longford-Loch Sport Road, Dutson Downs **LGA:** › Wellington Shire **Land use planning zoning:** Public Use Schedule 1 **Owner/Operator:** Gippsland Water	› This facility is a major organics reprocessing hub receiving organics from the metropolitan region, as well as surrounding regions. › Its composting processes use a range of organic streams including some PIW. Feedstocks include biosolids, tannery waste, commercial grease trap content, milk and food organics, poultry mortalities and manure and garden organics. › It is well located in terms of distance from sensitive land uses and unlikely to be threatened by residential encroachment. › The Gippsland Implementation Plan identified that due to its location and treatment process the hub has the capacity to deal with off-spec food products that can be problematic to reprocess due to associated amenity impacts. › The Metropolitan Implementation Plan recognises the significance of the hub in servicing the organic reprocessing needs of the metropolitan region. › While the site is located in a rural setting, its functionality as a hub is dependent on consultation and engagement with the surrounding communities to communicate the potential benefits of this site remaining available for resource recovery activities, and to reassure the community that activities will have minimal impact on local amenity.

Hubs	Description/Why is this of importance to the state system?
Goulburn Valley	
17. WESTERN COMPOSTING TECHNOLOGIES	
Location: 165 Daldy Rd, Shepparton **LGA:** › Greater Shepparton City Council **Land use planning zoning:** Public Use Schedule 1 **Owner/Operator:** Western Composting Technology Pty Ltd	› This is a hub for organics processing and accepts FOGO for in-vessel composting from the Goulburn Valley and surrounding regions. It is co-located with compatible activities and has effective buffers to increase organics processing activities. › The Goulburn Valley Implementation Plan identified opportunities to expand the facility to meet increasing demand for processing food organics. › If this site is to be maintained as a hub in the long term, planning needs to preserve adequate buffer distances, avoiding establishing incompatible uses close to the hub and ensure that activities in the precinct are compatible and conducted in a manner that does not impact on the community, environment and public health of surrounding land users. › While the site is well located, its functionality as a hub is dependent on consultation and engagement with the surrounding communities to communicate the potential benefits of this site remaining available for resource recovery activities, and to reassure the community that activities will have minimal impact on local amenity.
18. PATHO LANDFILL	
Location: Davis Rd, Patho **LGA:** › Campaspe Shire Council **Land use planning zoning:** Industry 1 **Owner/Operator:** Veolia	› The Patho Landfill is a significant landfill accepting putrescible and inert waste from the Goulburn Valley and Loddon Mallee regions. › It is well located in terms of distance from sensitive land uses and unlikely to be impacted by encroaching land uses. › The hub is expected to maintain activities over the long term with potential to expand recovery activities through additional landfill pre-sort and organics reprocessing using organic streams from surrounding agricultural activities. › The Goulburn Valley Implementation Plan also identified the potential for the landfill to accept additional cross-regional flows to meet the airspace needs of the regions which could affect available airspace in the very long term. › While the site is located in a rural setting, its functionality as a hub depends on consultation and engagement with the surrounding communities to communicate the potential benefits of this site remaining available for resource recovery activities, and to reassure the community that activities will have minimal impact on local amenity.
19. COSGROVE LANDFILL	
Location: Cnr Quarry Rd & Cosgrove-Lemnos Rd, Cosgrove **LGA:** › Greater Shepparton City Council **Land use planning zoning:** Public Use Schedule 6 **Owner/Operator:** Greater Shepparton City Council	› The Cosgrove Landfill is a significant hub accepting putrescible and inert wastes from the population centre and significant food processing sector in the greater Shepparton region and North East region. › As recognised in the Goulburn Valley Implementation Plan, the site is currently being expanded and is due for completion in 2018–19. Any delay in construction could affect the site's ability to have sufficient landfill airspace available to meet demands of the region's residual waste. › The Goulburn Valley Implementation Plan identified continuing the role of this hub over the long term. The site has potential to improve its pre-sort capacity to recover more materials from building and construction activities, concrete, timber and organics for recovery before disposal. › While the site is located in a rural setting, its functionality as a hub depends on consultation and engagement with the surrounding communities to communicate the potential benefits of this site remaining available for resource recovery activities, and to reassure the community that activities will have minimal impact on local amenity.

Hubs	Description/Why is this of importance to the state system?
Grampians Central West	
20. MADDINGLEY BROWN COAL	
Location: East Maddingley Rd, Bacchus Marsh **LGA:** › Moorabool Shire **Land use planning zoning:** Special Use Schedule 1 **Owner/Operator:** Maddingley Brown Coal Pty Ltd	› The Maddingly Brown Coal Landfill accepts significant amounts of solid inert waste from the metropolitan region. It is the only landfill licensed to accept metal recycling shredder residue (shredder floc). › The hub also supports organic composting and mulching, concrete and aggregate crushing and soil screening. › It is located strategically close to the edge of metropolitan region and the Bacchus Marsh transfer station. › The Grampians Central West Implementation Plan identified potential to increase future organics recovery at the site provided impacts on the amenity of the local community such as odour and truck movements can be managed. › The Metropolitan Implementation Plan recognised the importance of this hub as a disposal site for shredder floc. If it was unable to provide this service the reprocessing industry recovering materials from end-of-life whitegoods, cars and electronic equipment would be severely impacted and alternative disposal would be required. › If this hub is to continue over the long term, its functionality should be managed by preserving adequate buffers and planning to ensure the establishment of compatible activities conducted in a manner that does not impact on the community, environment and public health of surrounding land users. › Consultation and engagement with the surrounding communities is required to communicate the potential benefits of this site remaining available for resource recovery activities, and to reassure the community that activities will have minimal impact on local amenity.
Loddon Mallee	
21. EAGLEHAWK LANDFILL	
Location: 191–193 UPPER California Gully Road, Eaglehawk **LGA:** › City of Greater Bendigo **Land use planning zoning:** Public Use Schedule 6 **Owner/Operator:** City of Greater Bendigo	› The Eaglehawk Landfill houses a significant hub for reprocessing materials from C&D activities at the collocated quarry and the landfill accepts significant quantities of putrescible and inert waste from the greater Bendigo area. › As identified in the Loddon Mallee Implementation Plan, the landfill airspace will be exhausted by about 2021. This provides an opportunity to transition to additional resource recovery activities, particularly those related to consolidating, sorting and transferring material streams. › A consequence of the hubs long association with waste disposal activities (including mine tailings) is the difficulty in determining the location of some early closed landfill cells. › Transition of the site for any future activities, including those associated with resource recovery as well as those surrounding the site should include: – appropriate monitoring and assessment of risks associated with past waste-related activities within at least 500m from all landfill cells. – implement appropriate planning mechanisms to ensure adequate buffers are established and maintained and future developments are designed and maintained to meet any identified risks. › The Loddon Mallee Group will work with the City of Greater Bendigo to develop a long term management plan for the site that considers the impact of past activities and its potential to consist to support resource recovery activities. This should be developed in consultation with the community, industry, the EPA and state government.
22. MILDURA LANDFILL	
Location: 15 Scherger Drive, Mildura **LGA:** › Mildura Rural City Council **Land use planning zoning:** Public Use Zone Schedule 6 Comprehensive development zone, schedule 1 **Owner/Operator:** Mildura Rural City Council	› The Mildura Landfill provides service to the greater Mildura area accepting putrescible and inert wastes. › If this landfill closed or reduced functionality, there would be limited alternatives due to the cost of transporting wastes to other regional landfills in Victoria. The only viable alternative would most likely be to transport wastes interstate. › As identified in the Loddon Mallee Implementation Plan, this site has a number of planning constraints including the potential encroachment of recreation and residential activities close to the landfill. › Long term functionality of the site relies on appropriately managing potential impacts on the community. The potential relocation of organics reprocessing may help reduce the amenity impacts. › Potential opportunities to increase recovery include expanded ability to pre-sort before disposal. › Consultation and engagement with the surrounding communities is required to communicate the potential benefits of this site remaining available for resource recovery activities.

3.3.3 Relationship between land use and transport planning

The location of hubs is influenced by many factors including land use planning strategies and controls, proximity to feedstocks, markets and transport networks, geographical features and commercial decisions by owners and operators.

Due to the initial investment costs, waste and resource recovery infrastructure is expected to operate over the longer term. Planning decisions must consider any impact on the functionality of these sites that may influence their ability to provide the essential waste and resource recovery service to the community. Facilities within hubs may be licensed to accept and/or process specific materials and waste streams, and a change in this flow could disrupt the processes at a state level. Proximity of development sites to waste disposal should also be considered where a specific prescribed industrial waste needs to be disposed of for example, as there may only be a few sites licensed to accept a specific type of waste.

Both statutory and strategic planners play an important role in facilitating sustainable development. Planning assessments need to consider any relevant transport plans and strategies that may affect transport routes of a particular hub, or the waste and resource recovery sector more generally.

3.3.4 Transportation and economic development

Transport costs can play a significant role in the viability of resource recovery and disposal options. As identified in Regional Implementation Plans, improving transport efficiencies for resource recovery should be considered through land use planning.

Along with greater transport efficiency, the hubs concept was introduced, in part, to facilitate centralised points to aggregate materials, and to create economies of scale and make recovery of materials viable. Identifying hubs and encouraging their development is likely to lead to transport and economic benefits. For this reason, transport planning and land use planning must be considered concurrently in the decision-making process, as outlined in the strategic considerations below.

As discussed in Section 2.6, the cost of transport in relation to gate fees at landfill or recovery facilities can determine the viability of recovering individual material streams. Regional areas which are more sparsely populated, with fewer recovery facilities and greater distances geographically, may therefore be at a recycling disadvantage compared to more densely populated areas and areas with lower associated transport costs.

Transporting waste and material streams creates greenhouse gas emissions because of fuel usage. This can be offset if materials are recovered rather than sent to landfill, due to the reduction in methane and other greenhouse gases that would otherwise be generated from decomposition of materials at landfill. To maximise transport and operational efficiencies, new facilities should be located as close to their sources of waste generation as is feasibly possible. Being able to achieve this is influenced by factors such as existing development, land use planning requirements and potential impacts to existing communities.

3.3.5 Strategic considerations for decision-makers

When strategically planning for hubs, decision-makers should consider:

- integrating transport systems and land use planning to encourage appropriate development of hubs and transport networks
- encouraging industries that work in synergy, and facilitating economies of scale through planning policy and other strategic policy directions
- the future capacity, or lifespan of hubs and regional priorities when strategically planning within and/or near hubs
- establishing adequate buffers from facilities with the EPA, or in line with relevant EPA guidelines
- whether a planning mechanism such as an overlay or similar is appropriate to ensure suitable land uses, where buffers are required
- encouraging resource recovery land uses through planning policy and planning scheme amendments, where appropriate
- determining whether waste and resource recovery should be considered through planning scheme amendments, including amendments to Municipal Strategic Statements
- The decision-making guidance outline in Section 2.5 (as relevant).

3.3.6 Investment and employment

Investing in waste and resource recovery adds value to Victoria's economy as well as meeting waste and resource recovery needs. Hubs are often seen as industrial centres facilitating commercial activity and employment. SV's Investment Facilitation Service and other government programs that support investment may consider hubs and their potential as suitable locations for new facilities, when communicating with potential investors.

3.3.7 Planning for hubs

The SWRRIP and Regional Implementation Plans identify waste and resource recovery hubs, but we need a strategic and integrated approach to ensure their ongoing functionality and the opportunity to expand their role in Victoria's waste and resource recovery system. We need a shared understanding of their role and any opportunities or constraints, as well as an agreed approach to realise opportunities and address barriers to their functionality.

We may identify new hubs as the waste and resource recovery system develops and as we review the functionality and status of existing hubs. The criteria and process for reviewing hubs is outlined in Appendix 3. Regional Groups will lead the strategic planning and process for reviewing hubs in consultation with stakeholders.

Opportunities and potential barriers

Table 3.3 lists opportunities to develop hubs, how to realise these opportunities and potential barriers that could affect the functionality of hubs.

Roles and responsibilities

Table 3.4 lists the roles and responsibilities of the main stakeholders in relation to developing hubs.

TABLE 3.3
OPPORTUNITIES AND POTENTIAL BARRIERS TO DEVELOPING HUBS

Opportunities	How to realise opportunities	Potential barriers
Co-locate industries that operate in synergy with other waste and resource recovery industries and operators	› Through planning scheme amendments and planning policy that encourages co-location › Zone sites appropriately to facilitate co-location	This is largely left to the market. However decision-makers can help develop these industries through land use planning policy and zoning
Facilitate economies of scale to create viable and sustainable waste and resource recovery industries	› Create industry and operator networks and industry ecology › Co-location › Appropriate land use planning and zoning	Residential encroachment
Co-locate industry in current hubs to make use of existing infrastructure and established buffers	› Implement appropriate land use planning zoning and overlays to establish buffers	Additional infrastructure upgrades may be required
Create job and investment opportunities and facilitate growth of employment centres	› Funding and grant opportunities › Targeted engagement on available funding and grant opportunities for sustainable industries › Investment facilitation service	Competing land uses Not providing the required infrastructure Cost of processing often low-value materials
Reduce transport costs and associated transport emissions and environmental impacts	› Co-location › Use existing transport spokes › Integrated land use and transport planning	Transport planning and land use planning strategic directions not considered together during assessment processes
Increase volume of materials recovered	› Align strategic policies to facilitate economies of scale and co-location › Regional Implementation Plans	Contamination of associated materials

TABLE 3.4
HUB ROLES AND RESPONSIBILITIES

	Role and responsibilities
Community	› participation may occur during planning or other assessment processes where development proposals relate to hubs › participation is also likely during the consultation process for reviewing and including hubs and sites in Regional Implementation Plans
Waste and resource recovery industry, industry groups and investors	› responsible for managing facilities and ultimately provides the most infrastructure and investment › Industry bodies act as a voice for industry – they represent the interests of members on national and state issues, and may be involved in strategic planning for individual hubs as appropriate
Local governments	› have several hub roles and responsibilities including: – making local land use planning decisions and carrying out strategic planning, which can provide suitable land for waste and resource recovery activities and preserve community amenity – considering the broader objectives and community expectations in their area, often seeking to balance competing objectives – playing a role in ensuring that industry complies with relevant planning permits and conditions of development – providing education programs on waste and resource recovery, including communicating with residents on the role of the waste and resource recovery system as an essential service (often partnered with state government) – encouraging investment in suitable locations – deciding how to manage waste materials and recovery streams and residual waste collected through municipal services in their area › Local governments also own and manage some facilities in hubs
State government	› changes legislation and determines re-zoning applications › Several state government departments and agencies may be involved in developing strategic plans for specific hubs › Regulatory bodies, such as the EPA, monitor industry and carry out enforcement work to ensure it complies with legislation and regulations to achieve best practice to reduce air, noise and water amenity impacts › provide education programs on waste and resource recovery › Organisations responsible for developing policy or guidelines that may affect hubs should ensure consistency with the strategic directions of the SWRRIP
Sustainability Victoria	› has several hub roles and responsibilities including: – participating in developing strategic plans for hubs, including the review process – promoting waste and resource recovery infrastructure as an essential service and provides evidence and guidance for operators on engaging with communities – providing education and funding programs on waste and resource recovery – reviewing Regional Implementation Plans – monitoring the statewide system, including state hubs, as part of implementing the SWRRIP › involved in the planning process for planning permits and planning scheme amendments that relate to, or may be impacted by hubs of state significance and other waste and resource recovery sites.
Regional Groups	› identify local and regional hubs in their region › engage local government and operators to strategically plan for waste and resource recovery hubs in their region, including planning for and supporting community engagement › involved in the planning process for planning permits and planning scheme amendments that may affect the waste and resource recovery sector or hubs in the region
Victorian Planning Authority (VPA)	› facilitates integrated land use and infrastructure planning › works collaboratively with key partners to implement initiatives articulated in Plan Melbourne, and Victoria's eight regional growth plans › undertakes planning for urban renewal in Melbourne's inner and middle suburbs, designs new suburbs in Melbourne's growth areas, and supports local governments with planning work in regional cities and towns › focuses on land use and infrastructure planning for strategically important precincts and sites in urban renewal areas, greenfield growth areas and regional areas › considers the implications of developments on a range of functions, including waste and resource recovery In some instances this there may be implications for hubs, depending on their location

4. Materials managed by the waste and resource recovery system

4.1 Introduction

Victoria's waste and resource recovery system managed more than 12.7 million tonnes of materials in 2015–16. This chapter outlines the types and quantities of materials to inform planning for future infrastructure needs.

Materials managed by the waste and resource recovery system

To effectively plan to meet the future needs of Victorian communities, we need to understand what is currently being managed by the waste and resource recovery system and what our future needs are likely to be. The system's diverse nature means there many factors to consider.

The materials managed by the system are the solid materials discarded from household, business, industrial and agricultural activities. What they consist of is influenced by consumer buying patterns, areas of economic activity and even the seasons. For example, more garden organics enter the system in spring than winter.

SV has collected data and information on 12 of the major material streams (see Table 4.1), tracking them as they travel through the system. These major material streams can be made up of many different components, some of which can be recovered and some which are not viable for recovery and must be disposed of.

"Victoria's waste system managed more than 12.7 million tonnes of materials in 2015–16."

... we need to understand what is currently being managed by the waste and resource recovery system and what our future needs are likely to be.

4.2 Data considerations

The main sources of data in this chapter are:

- the Victorian Local Government Annual Waste Services Report 2015–16
- the Victorian Recycling Industries Annual Report 2015–16 (VRIAR 2015–16)
- landfill levy receipt data 2015–16.

The following data considerations are relevant to this chapter:

- The data and information available to understand the exact quantities and types of wastes and materials being managed varies. Some areas have comprehensive data, for example, wastes and materials collected through municipal kerbside systems and quantities going to landfill. In other areas, the information is less complete, usually due to the difficulty of collecting accurate data. For example, it is difficult to collect accurate generation data due to the large number of points where materials and wastes enter the system.
- The SWRRIP uses the best available data. We use modelled data for any gaps or to identify future needs. Modelled data is identified when used.
- Tonnes landfilled are derived from landfill levy data supplied by the EPA. It does not include prescribed industrial wastes or an allowance for daily cover.
- Data and infrastructure information has been referenced from Regional Implementation Plans and the Regional Waste Resource Recovery Database populated by the Regional Implementation Groups. This regional data has information about specific infrastructure functions and capacity, and includes data from local government and industry sectors.
- The recovered tonnes, unless stated, refer to tonnes of materials entering reprocessing facilities. This does not directly correlate with how much was reprocessed as there is no data on tonnes stockpiled or tonnes landfilled by reprocessors. For this reason, quantities are referred to as recovered, rather than reprocessed.
- SV collected much of the data from industry sources and cannot provide a breakdown by waste and resource recovery region. SV used modelling to estimate regional tonnes using a combination of state totals, landfill audit compositions and Australian Bureau of Statistics population figures. Accuracy of information and data depends on the source. SV verified information and data where possible, but all data should be considered as indicative only and provided as a guide or estimate of true values, unless otherwise stated.
- Most data is rounded for ease of reading. This may result in minor discrepancies between totals and line items. Graphs, charts and modelling were generated using non-rounded data. Any exceptions are referenced.

Further information on data sources can be found in Appendix 5.

4.3 How much are we currently managing?

The Victorian waste and resource recovery system managed an estimated 12,673,000 tonnes of materials in 2015–16, of which around 8,489,000 tonnes were recovered (67 per cent) and 4,184,000 tonnes sent to landfill.

Table 4.1 lists the quantities of the main material streams managed, recovered and landfilled in Victoria in 2015–16.

TABLE 4.1
MAIN MATERIALS MANAGED, RECOVERED AND LANDFILLED (2015–16)

Materials		Recovered (t)	Landfilled (t)	Total managed (t)	Recovered (% by weight) (%)
Organics	Food	103,000	887,000	990,000	10
	Garden	429,000	259,000	688,000	62
	Wood/timber	204,000	307,000	511,000	40
	Other organics[a]	300,000		300,000	100
Paper/cardboard		1,551,000	473,000	2,024,000	77
Glass		173,000	80,000	253,000	68
Plastics		149,000	417,000	566,000	26
Tyres and rubber[b]		54,000	6,000	60,000	n/a
Metals		1,425,000	69,000	1,494,000	95
Aggregates, masonry and soil		4,093,000	962,000	5,055,000	81
Textiles		2,000	154,000	156,000	1
Other		6,000	570,000	576,000	1
Totals		**8,489,000**	**4,184,000**	**12,673,000**	**67%**

a Includes agriculture waste, sawdust, bark and woodchips.

b Data for tyre and rubber streams is incomplete and should not be considered as a true representation of the current state for this material stream. Work is underway as part of the national tyre stewardship program (see Section 5.11).

Source: *Victorian Recycling Industry Annual Report 2015–16*

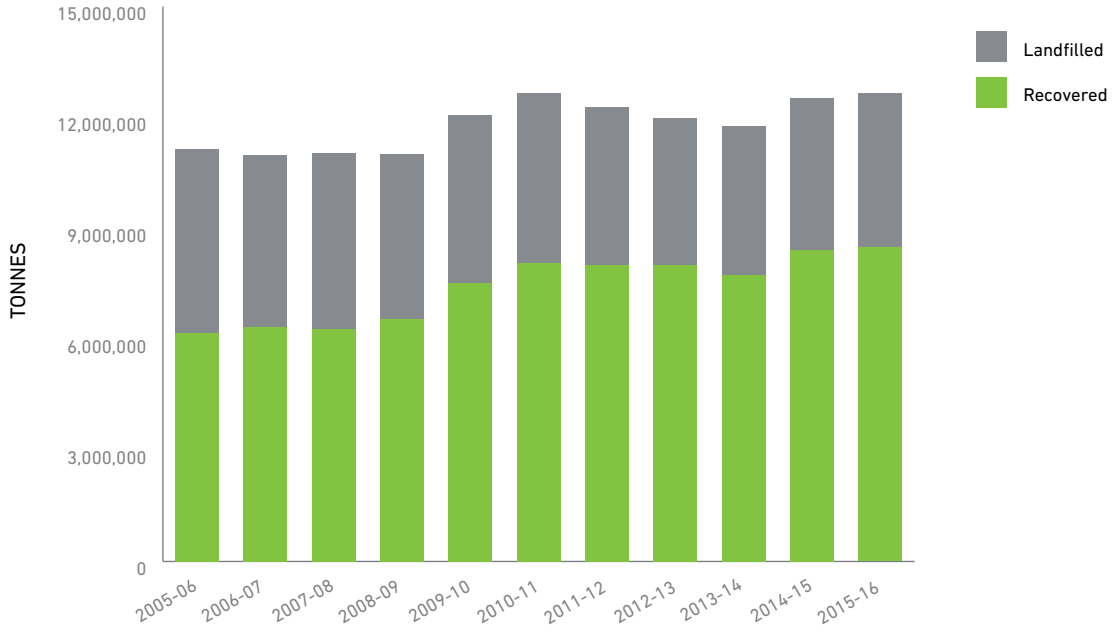
4.3.1 Trends in recovery

Figure 4.1 shows the trend in the quantity of materials being recovered and landfilled since 2005–06. The amount of materials entering the system is partly population dependant. During this time, the population in Victoria increased from 4.9 million to 6.2 million in 2015–16.[6]

There was an observed decrease of total materials entering the system between the years 2010–11 and 2013–14 of 321,000 tonnes (3 per cent). This most likely reflected a slight downturn in the construction industry which saw a decrease of 622,000 tonnes (13 per cent) in materials such as aggregates and masonry from construction and demolition activities. This trend has not continued in 2015–16.

However, even with the increase in population, the amount of materials being recovered has steadily increased showing improvements in our ability to divert materials from landfill to viable recovery.

FIGURE 4.1
MATERIALS BEING MANAGED ANNUALLY (2005–06 TO 2015–16) (TONNES)



Source: Sustainability Victoria, *Victorian Recycling Industries Annual Report 2015–16*

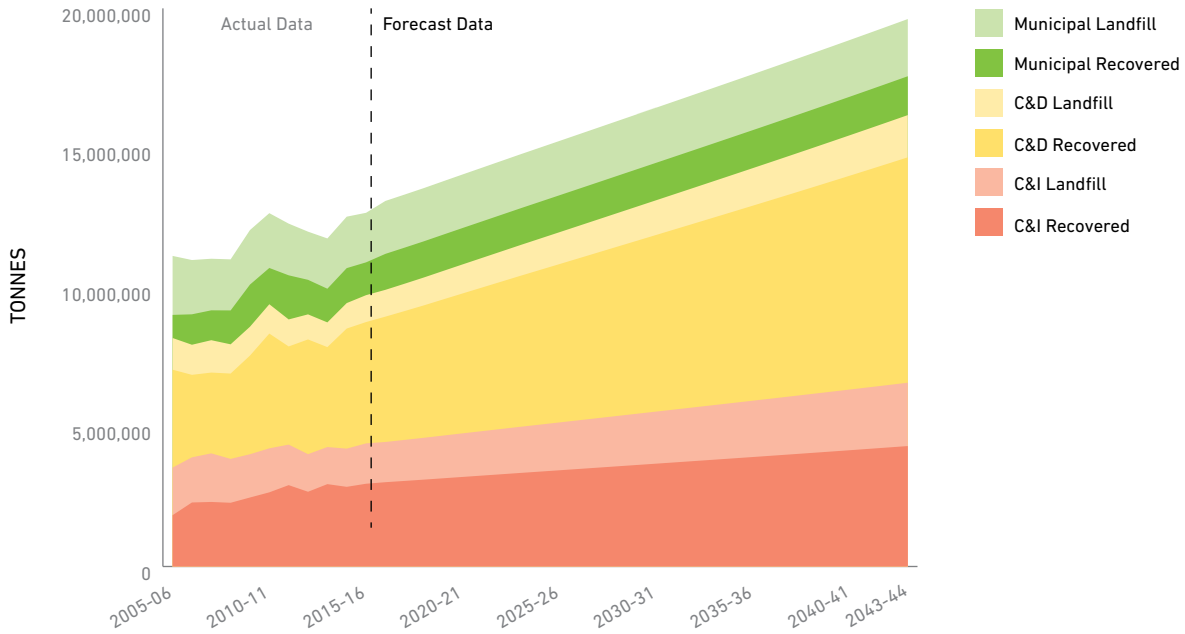
6 Source: *ABS Catalogue number 3101.0 Australian Demographic Statistics, Jun Qtr. 2016*, published December 2016. Table 4, Estimated Residential Population, Persons, Victoria.

4.3.2 Future projections

We used past trends and population predictions to model what the system is likely to need to manage over the life of the SWRRIP. More information on data modelling can be found in Appendix 5, including the assumptions underpinning the modelling and data sources.

Figure 4.2 shows the projected tonnes from the main generation sectors expected over the life of the SWRRIP (see Section 4.4 for a definition of the three sectors), assuming a business as usual scenario where the trends over the past 10 years continue. The SWRRIP strategic directions aim to increase the diversion rate over and above this.

FIGURE 4.2
PROJECTED WASTE AND MATERIALS RECOVERED AND LANDFILLED (TONNES), BUSINESS AS USUAL SCENARIO (2005–06 TO 2045–46)



Source: Sustainability Victoria, Waste & Resource Recovery Projection Model, *Victorian Recycling Industries Annual Report 2015–16*, EPA Victorian landfill levy data 2015–16

4.4 Where do materials come from?

To understand how to increase recovery and send less materials to landfill, we need to understand where waste and materials come from. Historically, data was collected based on three source sectors:

- **municipal solid waste (MSW):** materials generated and discarded from households and council activities
- **commercial and industrial (C&I):** materials generated and discarded from business and industry, agriculture and manufacturing
- **construction and demolition (C&D):** materials generated and discarded from building, construction and demolition activities.

The sector the materials come from influences how they enter the system, the types of contamination they may contain and the opportunities for reusing recovered materials.

Table 4.2 shows the percentage by source sector of the 12 material streams in 2015–16.

TABLE 4.2
PERCENTAGE OF MATERIALS SOURCED FROM EACH SECTOR (2015–16)

Materials		Total managed (tonnes)	Percentage source sector (approximate percentage by weight) (%)		
			MSW	C&I	C&D
Organics	Food	990,000	67	33	<1
	Garden	688,000	55	41	4
	Wood/timber	511,000	5	58	36
	Other organics[a]	300,000	5	95	<1
Paper/cardboard		2,024,000	21	78	<1
Glass		253,000	85	15	<1
Plastics		566,000	45	52	4
Tyres and rubber[b]		60,000	<1	98	<1
Metals		1,494,000	26	60	14
Aggregates, masonry and soil		5,055,000	1	4	96
Textiles		156,000	31	60	8
Other		576,000	86	13	n/a
Total		**12,673,000**			

a Includes agriculture waste, sawdust, bark and woodchips.

b Data for tyre and rubber streams is incomplete and should not be considered as a true representation of the current state for this material stream. Work is underway as part of the national tyre stewardship program (see Section 5.11).

Source: *Victorian Recycling Industry Annual Report 2015–16*

4.5 Materials and waste from household and municipal activities

In 2015–16, the Victorian waste and resource recovery system managed an estimated 2,951,000 tonnes of materials discarded from households and councils. Of this, approximately 1,175,000 tonnes (40 per cent) were recovered with the remaining 1,776,000 tonnes sent to landfill. This includes materials and wastes collected through municipal kerbside systems, materials dropped off at council resource recovery centres and from council activities such as landscaping, street sweeping and public place litter management and recycling.

Table 4.3 outlines the quantities of the 12 material streams coming from MSW.

Materials discarded from municipal activities reflect household purchasing patterns, and this changes over time. This stream contains valuable materials that could potentially be recovered. Table 4.3 shows that overall, around 60 per cent of the MSW stream is still going to landfill. However, materials collected through kerbside services tend to have better recovery rates because they provide a consistent supply of feedstocks, both in quantities and quality that makes them attractive feedstock for industry. In 2015–16, garden organics from the MSW sector achieved 65 per cent recovery and the commingled recyclables collected through kerbside systems 95 per cent. The critical role of local government services in managing municipal materials and wastes is discussed in Section 6.4.1.

Potential opportunities for reprocessing include a range of organic materials, paper and cardboard, glass, plastics and metals. Regional Implementation Plans identify improving the low recovery rate of organic materials from households as an opportunity to recover valuable resources, while also reducing future management risks from organics at landfills due to their putrescible nature.

TABLE 4.3
MATERIALS FROM THE MSW SECTOR (2015–16)

Materials		Recovered (t)	Landfilled (t)	Managed (t)	Recovered (% by weight) (%)
Organics	Food	27,000	639,000	667,000	4
	Garden	248,000	132,000	380,000	65
	Wood/timber	23,000	5,000	28,000	82
	Other organics[a]	14,000	..	14,000	100
Paper/cardboard		239,000	193,000	433,000	55
Glass		164,000	50,000	214,000	77
Plastics		88,000	165,000	254,000	35
Tyres and rubber[b]		<1,000	<1,000	<1,000	n/a
Metals		352,000	30,000	382,000	92
Aggregates, masonry and soil		11,000	23,000	33,000	33
Textiles		2,000	47,000	49,000	4
Other		6,000	490,000	496,000	n/a
Totals		**1,175,000**	**1,776,000**	**2,951,000**	**40**

a Includes agriculture waste, sawdust, bark and woodchips.

b Data for tyre and rubber streams is incomplete and should not be considered as a true representation of the current state for this material stream. Work is underway as part of the national tyre stewardship program (see Section 5.11).

Source: *Victorian Recycling Industry Annual Report 2015–16*

4.5.1 Future trends

Due to expected population growth across Victoria, particularly in Metropolitan Melbourne and larger regional towns, the amount of materials and waste entering the system from the MSW sector is unlikely to decrease in the short term. However, as we increase recovery in line with the goals of the SWRRIP and Regional Implementation Plans, we should see an increase in the recovery rate from MSW.

Materials in the MSW stream are likely to change over time reflecting consumer purchasing patterns, changes in manufacturing and government policy. Probable trends include:

- more flexible plastics reflecting the increased use of this material for packaging, particularly food
- more plastic bottles and less glass due to the trend of using plastic containers rather than glass (and even cans) for packaging
- increased white goods and e-waste reflecting purchasing patterns.

The Victorian Government has committed to an e-waste landfill ban to respond to the latter trend. This is discussed further in Section 5.14.

Recovering materials from white goods and e-waste can be problematic as they have many different components and materials that require complex sorting and separation before they can be reprocessed. Product stewardship schemes such as the National Television and Computer Recycling Scheme can be effective in supporting increased recovery. These schemes look at the different stages in the life of the product including design, manufacture, distribution, use and end of life. They develop partnerships to maximise opportunities to recover materials and resources from the product at end of life, or if this is not feasible, facilitate responsible disposal.

4.5.2 Driving increased recovery

Since most materials discarded by households and municipal activities are managed by local governments, they will play a major role in increasing resource recovery and providing better service delivery to their ratepayers. The Regional Implementation Plans identified several opportunities where local governments could support increased recovery.

Amalgamate individual material streams and jointly procure services

Local governments can partner with other councils to consolidate individual material streams and work with Regional Groups to jointly procure services and infrastructure. Consolidating material streams provides service providers with more surety of supply for a given period on which to base their business model. Councils would need to consider existing long term contracts and managing lead times.

Determine local and regional priorities

Local governments can work with their communities, neighbouring councils and Regional Groups to determine local and regional priorities and desired outcomes from resource recovery and residual waste service provision. Priorities could include meeting community expectations around service levels, using innovative recovery techniques, ensuring end destinations comply with best practice management protocols and local job creation.

This allows industry to respond to the desired outcomes when tendering and develop options that are both commercially viable and meet local government requirements.

Improve source separation

Local governments can work with householders and businesses to improve source separation to reduce contamination in the commingled and organics bins and reduce the amount of recyclable materials in the residual waste bin.

Collect organics through kerbside collection systems

Local governments can increase recovery of organics by collecting food organics through kerbside collections systems. This is discussed further in Section 5.4.

Increasing resource recovery from the MSW sector will be driven by demand for the products and services made from recovered materials. The Victorian Market Development Strategy (discussed in Section 2.4.2) explores how to support strong market demand. Local governments can play a significant role by looking at their own purchasing power and working with communities to make informed purchasing decisions.

The Regional Implementation Plans recognise the need to provide cost-effective services that balance community expectations with viability. This will be achieved by optimising service delivery models and infrastructure as discussed in Section 6.4.2 and in Regional Implementation Plans.

4.6 Materials from commercial and industrial activities

The Victorian waste and resource recovery system managed an estimated 4,411,000 tonnes of materials from C&I activities in 2015–16. Table 4.4 shows that 2,965,000 tonnes (67 per cent) were recovered with the remaining 1,446,000 tonnes sent to landfill.

As shown in Table 4.4, the recovery rates for paper and cardboard and metals are quite high for this sector. This reflects established collections systems and markets for these materials.

C&I activities generate significant amounts of organic materials. It is the major source of feedstocks for the recovery of food organics, largely from the food manufacturing sector. When sourced from activities such as food manufacturing, these feedstocks can have low contamination rates and a consistent supply. This makes them attractive as baseloads for reprocessing. In 2014–15, the establishment of a new organics reprocessor saw a 37 per cent increase in recovery, which was maintained in 2015–16.

The 'Other organics' stream in Table 4.4 consists largely of agricultural materials, sawdust, bark and woodchips. There is a strong market for these materials for compost and soil conditioners. Data on how much of these materials end up landfilled is unavailable but is considered to be low.

4.6.1 Driving increased recovery

Increasing resource recovery from materials generated from C&I activities needs to include:

- working with generators to encourage and improve source separation and to reduce contamination
- improving collection services to provide cost-effective services to generators and reduce contamination through the collection process
- developing markets for products and services made from recovered materials as outlined in the Victorian Market Development Strategy.

TABLE 4.4
MATERIALS FROM THE C&I SECTOR (2015–16)

Materials		Recovered (t)	Landfilled (t)	Managed (t)	Recovered (% by weight) (%)
Organics	Food	74,000	248,000	322,000	23
	Garden	181,000	101,000	282,000	64
	Wood/timber	110,000	188,000	298,000	37
	Other organics[a]	286,000	n/a	286,000	n/a
Paper/cardboard		1,311,000	271,000	1,582,000	83
Glass		9,000	29,000	38,000	24
Plastics		58,000	234,000	292,000	20
Tyres and rubber[b]		52,000	6,000	59,000	n/a
Metals		870,000	32,000	902,000	96
Aggregates, masonry and soil		14,000	168,000	182,000	8
Textiles		<1,000	94,000	94,000	<1
Other		<1,000	73,000	74,000	n/a
Total		**2,965,000**	**1,446,000**	**4,411,000**	**67**

a Includes agriculture waste, sawdust, bark and woodchips.

b Data for tyre and rubber streams is incomplete and should not be considered as a true representation of the current state for this material stream. Work is underway as part of the national tyre stewardship program (see Section 5.11).

Source: *Victorian Recycling Industry Annual Report 2015–16*

4.7 Materials from construction and demolition activities

The Victorian waste and resource recovery system managed an estimated 5,312,000 tonnes of materials from C&D activities in 2015–16. Of this, 4,348,000 tonnes (82 per cent) were recovered and the remaining 964,000 tonnes were sent to landfill, as shown in Table 4.5.

Most of the materials (93 per cent) from the C&D sector are aggregates, masonry and soils which includes a large component of used concrete. Because of their weight, transporting these materials is expensive and most recovery occurs locally. This is discussed further in Section 5.13.

4.7.1 Future trends

As shown in Figure 4.2, the amount of materials being managed from C&D activities has increased since 2005–06, but the increase has not been constant. The peaks and troughs most likely represent a lagged response to peaks and troughs in the building and construction industry. This trend is likely to continue and may be strongly influenced by large planned infrastructure projects in Victoria.

4.7.2 Driving increased recovery

To increase resource recovery from the C&D sector, we need to overcome the low commodity value of many of the material streams and the high transport costs, which can make viable consolidation difficult. In addition, most C&D material streams are considered inert and can access solid inert landfills which tend to have lower gate fees. This makes disposal to landfill relatively inexpensive compared to many reprocessing options.

The Victorian Market Development Strategy investigates options to increase resource recovery in this sector, particularly of aggregates, masonry and soils.

TABLE 4.5
MATERIALS FROM THE C&D SECTOR (2015–16)

Materials		Recovered (t)	Landfilled (t)	Managed (t)	Recovered (% by weight) (%)
Organics	Food	<1,000	<1,000	<1,000	<1
	Garden	<1,000	26,000	26,000	<1
	Wood/timber	71,000	114,000	185,000	38
	Other organics[a]	<1,000	<1,000	<1,000	<1
Paper/cardboard		<1,000	8,000	8,000	<1
Glass		1,000	1,000	2,000	50
Plastics		3,000	18,000	21,000	14
Tyres and rubber[b]		n/a	n/a	n/a	n/a
Metals		203,000	7,000	210,000	97
Aggregates, masonry and soil		4,069,000	771,000	4,840,000	84
Textiles		<1,000	13,000	13,000	<1
Other		<1,000	7,000	7,000	<1
Totals		**4,348,000**	**964,000**	**5,312,000**	**82**

a Includes agricultural waste, sawdust, bark and woodchips.

b Data for tyre and rubber streams is incomplete and should not be considered as a true representation of the current state for this material stream. Work is underway as part of the national tyre stewardship program (see Section 5.11).

Source: *Victorian Recycling Industry Annual Report 2015–16*

4.8 Where do we manage materials and waste?

Understanding where we generate and manage waste and materials helps us to plan infrastructure more effectively for the future. Because of the inability to collect accurate generation data by region, we use modelled data to plan for future needs based on tonnages entering recovery and management facilities and population figures.

Table 4.6 shows the quantities of materials managed in each of the waste and resource recovery regions in Victoria in 2015–16. The metropolitan region managed 75 per cent of all waste and materials, including 75 per cent of all materials recovered and 74 per cent of all materials landfilled.

Table 4.6 reflects both the population of each region and the amount of waste and materials that flow in or out for reprocessing or disposal. For example, the high figure for the metropolitan region is expected given the high population base.

The degree to which a material or waste will move from its point of generation varies for each and is influenced by a range of factors including:

- characteristics of the material such as weight or putrescible nature which affect the cost of transport and storage time
- the amount of material needed to establish enough tonnes to support viable recovery – this can reflect the commodity value of the material
- collection service contracts particularly related to kerbside collected materials and waste
- the location of reprocessors, transport routes and freight networks.

4.9 Cross-regional flows

Regional Implementation Plans identified many of the major flows between regions in 2013–14. More detailed information on these flows is available in the relevant Regional Implementation Plans. While there are some gaps, it gives a general understanding of the major movement of materials and waste across the State.

Table 4.7 details some of the flows of significance to the statewide waste and resource recovery system identified in Regional Implementation Plans.

TABLE 4.6
MATERIALS MANAGED BY WASTE AND RESOURCE RECOVERY REGION IN (2015–16)

Region	Recovered[a] (t)	Landfilled[b] (t)	Total managed (t)	Total managed by region (% by weight) (%)
Barwon South West	542,000	177,000	719,000	6
Gippsland	376,000	137,000	513,000	4
Goulburn Valley	271,000	161,000	432,000	3
Grampians Central West	349,000	511,000	861,000	7
Loddon Mallee	381,000	111,000	492,000	4
Metropolitan	6,398,000	3,064,000	9,462,000	75
North East	170,000	24,000	194,000	2
Totals	**8,488,000**	**4,185,000**	**12,673,000**	

a Modelled data for 2015–16 financial year based on the Victorian Waste Projection Model 2015–16.

b Landfill levy data 2015–16.

Note: Discrepancies between totals and line items relate to rounding.

TABLE 4.7
CROSS-REGIONAL FLOWS SIGNIFICANT TO THE STATEWIDE SYSTEM (2013–14)

Materials	Flow
Commingled recyclables	› Between 100,000–130,000 tonnes of unsorted aggregated commingled recyclables travelled from several regions to MRFs in the metropolitan region for sorting and consolidation › Most materials sorted and consolidated at regional MRFs flowed to the metropolitan region for reprocessing › Some small amounts flowed into Loddon Mallee from across the New South Wales border
Organics	› Over 140,000 tonnes of primarily garden organics from the metropolitan region were reprocessed into compost-related products in other regions including Gippsland and Barwon South West. This trend is likely to continue with the development of organic facilities in areas accessible to, but outside peri-urban areas due to the availability of appropriately located and zoned land. › 8,000–16,000 tonnes of garden and combined food and garden organics (FOGO) flowed to Goulburn Valley for reprocessing into compost-related products. This was sourced from the metropolitan region and the newly established FOGO collections in the North East region. This trend is likely to continue as it is linked to kerbside collection contracts. › Two WtE facilities in the North East region received over 20,000 tonnes of timber, wood and garden organics and 29,000 tonnes of other organics.
Paper/cardboard	› Much of the paper and cardboard from regional areas flowed into the metropolitan region. › Approximately 100,000 tonnes flowed from the metropolitan region to Gippsland. It is unknown if some of this is materials was from metropolitan MRFs but originally sourced from other regions.
Glass	› Most glass flowed into the metropolitan region.
Plastics	› Plastics tended to move both in and out of many regions. This probably reflects how they were collected and the ability to sort and consolidate into individual plastic types for transport to reprocessors that can handle that type. › The metropolitan region received at least 2,000 tonnes of primarily kerbside collected plastics from other regions. Anecdotal evidence also suggests larger flows of plastics into the region to support metropolitan plastic reprocessors. › The Goulburn Valley and Grampians Central West regions received flows from other regions, probably sorted streams reflecting the type of plastics reprocessed by facilities in their region. It is unknown if some of the materials from the metropolitan region were originally sourced from rural and regional areas.
Metals	› All metals flowed into the metropolitan region for reprocessing. This is supported by the high commodity value which allows it to be transported larger distances.
Aggregates, masonry and soil	› The flow of aggregates, masonry and soils across regions was minimal due to their weight making transport expensive. There are small amounts of local flows across regional boundaries. › A significant local flow of more than 68,000 tonnes moved from New South Wales into the North East region. › Some local flows of around 16,000 tonnes moved from Loddon Mallee into New South Wales.
Residual waste	› The closure of small rural landfills has increased residual waste flows to larger regional landfills. In part, this reflects greater community expectations that any adverse impacts from managing waste are minimised and managed to protect community amenity, the environment and public health. As a result, larger tonnages are required to underpin the viable management of best practice landfills. This trend is likely to continue with more consolidation of residual waste before transport to reduce transport costs. › Some of the major flows included: – 40,000–50,000 tonnes of putrescible waste from the Barwon South West region and around 8,000 tonnes per year from Loddon Mallee to the metropolitan region – approximately 30,000 tonnes of kerbside collected putrescible waste from the Loddon Mallee region to the Goulburn Valley region. Variability in this flow is expected in the near future with a potential increase in volumes when the Eaglehawk Landfill in Bendigo ceases to accept waste and the potential decrease in volumes as kerbside FOGO collections begin – more than 31,000 tonnes of kerbside collected putrescible waste went from the North East region to the Albury landfill in New South Wales – between 350,000–400,000 tonnes of solid inert waste (primarily shredder floc) flowed into the Grampians Central West region from reprocessing end-of-life cars and whitegoods in the metropolitan region.

4.10 Interstate and export flows

In a market-based economy, material streams flow to wherever the best economic outcomes can be achieved. Freedom of trade between the states is enshrined in the Australian Constitution.

Most material streams and waste generated in Victoria remains in the state for reprocessing and management. However, some streams are exported overseas and some move across state borders. Although limited, our data shows the following cross-border and export flows.

4.10.1 Interstate flows

We have limited data to accurately interpret the extent of material flows across state borders, particularly for materials generated by business and industry and managed by private contracts. Table 4-7 details some of the flows identified in Regional Implementation Plans, particularly those linked to local government contracts or handled through local government facilities.

Most flows are likely managed by commercial service providers and destinations will change in response to changes in gate fees at reprocessors and landfills. Given this, anecdotal evidence suggests that around 50,000 tonnes of materials flow out of the State each year, including 31,400 tonnes of residual waste from the North East region and 16,000 tonnes from Loddon Mallee region to landfills in New South Wales. These flows may be important at the local level, but are not significant at the statewide level.

While destination end points for waste materials are determined by many factors, there are some issues and complexities around moving materials out of the state:

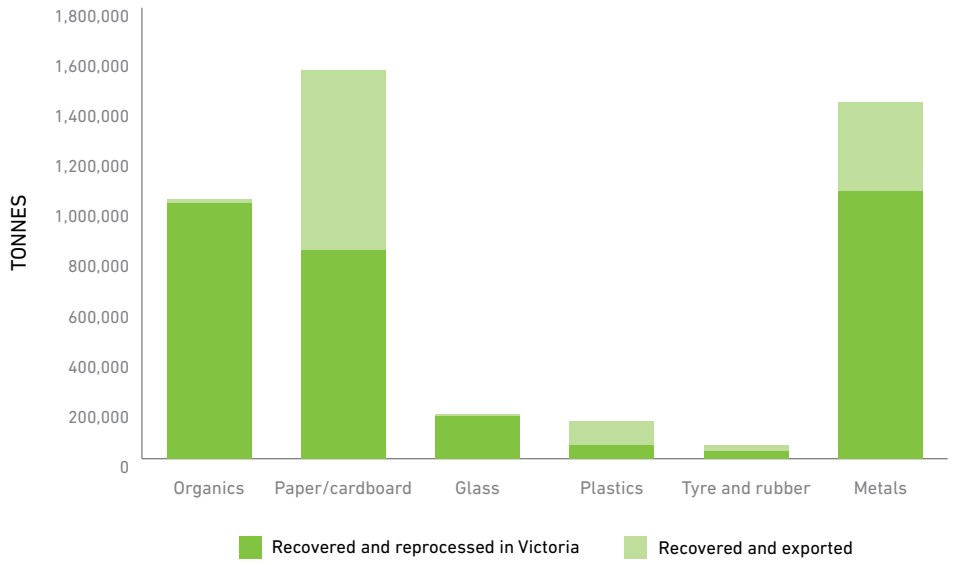
- the end destinations may not need to meet the same regulatory requirements as in Victoria. This could increase potential community, environment and public health impacts at the destination.
- Gate fees offered by interstate service providers may be cheaper than Victoria, a key driver for interstate movement. This may represent lost opportunities for Victorian service providers and may undermine Victoria's efforts to increase recovery.
- For some towns, the closest service provider is across the border.

4.10.2 Export flows

In 2015–16, an estimated 1,214,000 tonnes or 14 per cent of the materials recovered in Victoria were exported overseas (VRIAS 2015–16). Table 4.8 details the tonnes of the major materials exported, being paper and cardboard, metals, plastics, tyres and rubber, textiles and organics.

The value of these materials on the export market directly competes with reprocessing options in Victoria. Figure 4.3 shows the proportion of these materials that were exported in the context of the total amount of these materials recovered. It should be noted that whilst the export of these materials represents an opportunity lost for recovery within Victoria, some of these materials may have gone to landfill if there was not an export market. Building local markets for these materials and the products made from the recovered materials is a priority of the SWRRIP and the Market Development Strategy as discussed in Section 2.4.2.

FIGURE 4.3
MATERIALS RECOVERED IN VICTORIA FOR EXPORT (2015–16)



Source: Victorian recycling industries annual report 2015–16

TABLE 4.8
MAIN RECOVERED MATERIALS EXPORTED FROM VICTORIA 2015-16

Materials	Total
Glass	3,000
Metals	358,000
Organics	14,000
Paper/Cardboard	720,000
Plastics	97 000
Tyre and rubber	22,000
Textiles	186
Totals	**1,214,000**

5. Improving recovery of individual materials

5.1 Introduction

This chapter examines each of the main material streams in more depth, looking at current status and opportunities and barriers to increasing recovery.

Diverting materials from landfill for viable recovery relies on (among other things) the willingness of industry and service providers to invest in the infrastructure required to manage, recover, reprocess and, where required, dispose appropriately of the remaining waste. Opportunities to increase recovery should aim to achieve the highest order recovery possible in line with the wastes hierarchy and be viable over the long term.

To achieve this, we need:

- a positive business case
- reliable feedstock of the right quantity and quality to support recovery
- a market for recovered materials, energy or products
- a level of acceptance from the surrounding community to locate a facility in the area
- minimal impacts to community amenity, the environment and public health over the life of the facility including any rehabilitation or long term management of the site.

“ Increasing recovery... relies on the willingness of industry & service providers to invest. ”

... in the infrastructure required to manage, recover, reprocess and, where required, dispose appropriately of the remaining waste.

5.2 Data considerations

The main source of data for this chapter is the Victorian Recycling Industries Annual Report 2015–16.

Additional data was sourced from Regional Implementation Plans, phone conversations and site visits to businesses that collect and reprocess any materials. While most businesses willingly provided information about the types and quantities of materials they handle, some chose not to participate. Consequently, the data is comprehensive and a good representation of the Victorian reprocessing industry but is not complete.

The following data considerations are relevant to this chapter:

- Recovered tonnes, unless stated, refer to tonnes of materials entering reprocessing facilities. This does not directly correlate to quantities reprocessed as there is no data on tonnes stockpiled or landfilled by reprocessors. For this reason, quantities are referred to as recovered rather than reprocessed.
- Textiles data was considered as a subsection of organics data in previous publications. As most recovered textiles are synthetic, it is now considered in a category of its own. However, detailed data is limited so textiles are not discussed in this chapter.
- Infrastructure numbers are sourced from Regional Groups and are accurate as at 30 June 2017. This updated data comes from the infrastructure schedules in the Regional Implementation Plans and Regional Groups.
- Maps of resource recovery and residual waste infrastructure can be found on the SV website at **www.sustainability.vic.gov.au**

More information on surveys and data considerations can be found in Appendix 4.

RESOURCE RECOVERY INFRASTRUCTURE FUND (RRIF)

The RRIF aims to increase the recovery of priority materials, reduce waste to landfill, decrease greenhouse gases associated with waste management and create jobs in the waste and resource recovery sector.

Successful round one applicants were announced in July 2017. Fourteen projects received over $5 million from the Jobs and Innovation in Resource Recovery and the Investing in Waste and Resource Recovery for a Growing Victoria packages.

Projects aim to increase recovery of priority materials including timber, food waste, polystyrene, ridged and flexible plastics and tyre crumb. Projects include installation and/or upgrades to reprocessing equipment, washing plants, refuse derived fuel and upgrading facilities to expand capacity and improve standards.

Funded projects are expected to recover 17,000 tonnes of plastics each year, 3,500 tonnes of food organics, 100,000 tonnes of end-of-life tyres, 100,000 tonnes of timber and reduce landfilling by over 200,000 tonnes each year.

- Round two opened in October 2017.

For more information on the RRIF and other grants, visit www.sustainability.vic.gov.au

5.3 Overview of organic materials

Organic materials are plant or animal matter from domestic or industrial sources. Organics contain valuable resources including nutrients and energy. Increasing recovery of these materials not only captures these resources but reduces potential adverse impacts on the environment and community and contributes to the economy of the state.

Organics are putrescible in nature. When they decompose they present risks that, if not managed properly, can impact on the community, environment and public and animal health. Risks include:

- generating odours which can be offensive
- generating leachate which can contaminate waterways
- generating methane adding to greenhouse gas emissions
- attracting vermin and pests which can transfer pathogens.

Because of the putrescible nature of organic materials, strict management protocols are required to manage risks.

Considerations for reprocessing opportunities

Recovery and reprocessing should only be considered when there is a market for the end product and better community, environment and public health impacts can be achieved. The following needs to be considered:

- The movement of organic materials, in particular food and garden organics, can cause biosecurity issues related to the spreads of contaminants, weeds, plant viruses and pathogens.
- Reprocessing options need to be supported by efficient and cost-effective collection systems that manage potential community, environment and public health impacts.
- To be viable, organics reprocessors needs consistent tonnes of low contaminated feedstocks. The tonnes required depend on the type and scale of technology being used.
- Contamination of feedstocks affects the ability to reprocess and the quality of the end product. Upstream source separation needs to be well managed.
- Reprocessing facilities must be located on sites with appropriate buffers and zoning. They must be designed, operated and managed to meet EPA regulatory requirements, land use planning requirements and community expectations.

5.3.1 Products from recovered organics

In 2015, the Victorian Government released the *Victorian Organics Resource Recovery Strategy* (Organics Strategy) to support improved recovery of organics in Victoria (discussed in Section 2.4). Organics are also recognised in the Market Development Strategy as a priority material for the next five years.

Victoria has an active organics recovery industry that produces a range of products such as mulches, soil conditioners, composts, salvage timber, process derived fuels and energy.

Recovering energy by producing process derived fuels, heat or electricity from organics is likely to increase over the lifetime of the SWRRIP. Higher order recovery in line with the wastes hierarchy defined in the EP Act needs to be ruled out before considering energy-related options.

A significant opportunity is capturing energy from the organics in the residual waste stream that remain after all materials that can be diverted for a higher order recovery have been extracted. This is discussed further in Section 5.15.

5.3.2 Different types of organic materials

Numerous types of organic materials enter Victoria's waste and resource recovery system. Characteristics such as their putrescible nature, nutrient value and potential to generate energy influence how they are managed and recovery options. Table 5.1 shows the main categories of organic materials currently used for data collection.

TABLE 5.1
MAIN CATEGORIES OF ORGANIC MATERIALS

Category	Sources	
Food	Municipal food organics	Mainly from households through kerbside combined food and garden organics collection systems
	Pre-consumer	Materials from manufacturing and food processing plants
	Post-consumer	Materials from restaurants and food services
Garden organics	Mainly from household and municipal activities	
Wood/timber	Includes structural, packaging and treated timber, and sawdust mainly from the C&I and C&D sectors	
Other	Waste from agricultural activities (including manure and crop residue) and waste from wastewater treatment plants (biosolids)	

TABLE 5.2
ORGANIC MATERIALS MANAGED (2015–16)

Materials	Recovered (t)	Landfilled (t)	Managed (t)	State recovery rate (% by weight) (%)
Food	103,000	887,000	990,000	10
Garden	429,000	259,000	688,000	62
Wood/timber	204,000	307,000	511,000	40
Other organics[a]	300,000	<1,000	300,000	100
Total	**1,035,000**	**1,453,000**	**2,489,000**	**42**

a Includes agricultural waste, sawdust, bark and woodchips.

Source: *Victorian Recycling Industry Annual Report 2015–16*

5.3.3 Recovery of organic materials by type

In 2015–16, more than 2,489,000 tonnes of organic materials were managed by the Victorian waste and resource recovery system. As shown in Table 5.2, 1,035,000 tonnes or 42 per cent were recovered and 1,453,000 tonnes sent to landfill.

As discussed in the Organics Strategy, not all organic materials enter the waste and resource recovery system. Agricultural wastes are generally handled on-farm and some organic materials from manufacturing activities are diverted for alternative uses such as stockfeed. Some food organics, sourced from supermarkets and restaurants, are redirected through other channels such as charitable reuse and directly to agriculture. A significant quantity of organic material currently unaccounted for in the system is the organics from wastewater treatment facilities, such as sewerage sludge or biosolids.

Figure 5.1 shows the trend in the amount of organic materials being managed by the waste and resource recovery system since 2005–06. Kerbside garden organics have been a large component of these materials over this time. The annual variations are partly explained by the influence of climatic conditions on the generation of garden organics.

Recovering and reprocessing organics occurs across Victoria. Transporting organics to facilities for re-processing and transport of the end product is a significant element of organics recovery. As Victoria's organics processing infrastructure expands, consideration of the location of facilities will be critical to underpin viability and minimise potential risks to the system as a result of transportation of organic material across the State.

THE BACK TO EARTH INITIATIVE

The Back to Earth Initiative was developed and launched in 2013. It is run by the Metropolitan Waste and Resource Recovery Group in partnership with 19 metropolitan councils and four regional councils in northern Victoria, to support the successful operation of organics processing facilities.

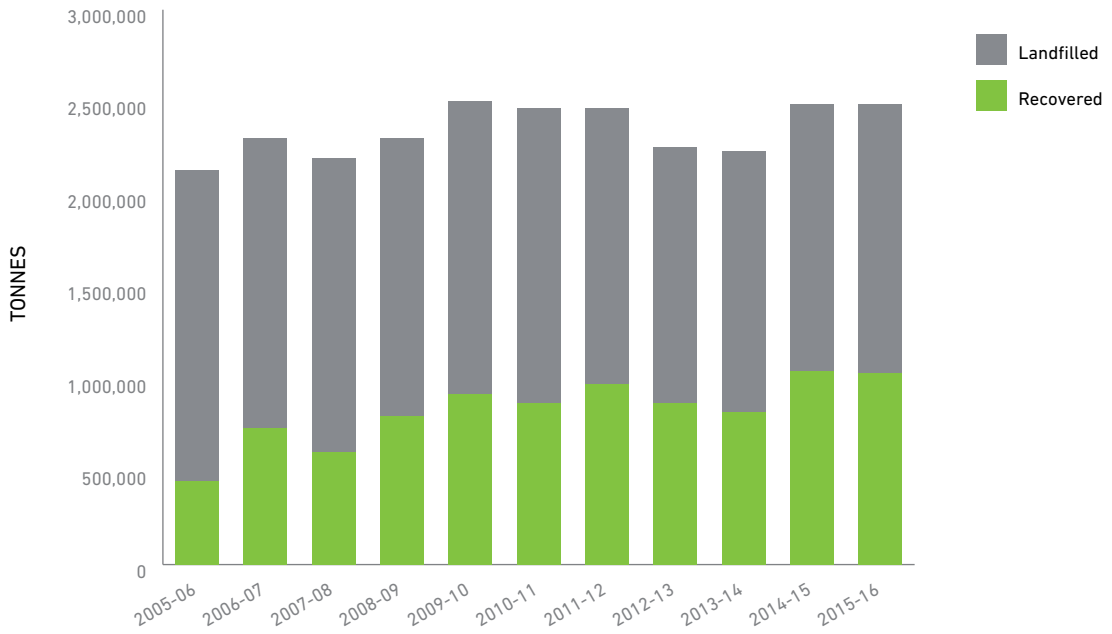
Evaluation to date has found the program is effectively meeting the following objectives:

- building awareness of what happens when organic waste leaves the kerbside
- building awareness of the benefits of recycling organic waste
- increasing understanding of why it is important to only put correct materials in the bin.

To encourage community engagement and grow the campaign reach, The Back to Earth Initiative ran two competitions in 2014 and 2016 involving schools, early learning centres and community groups. The campaigns generated lots of community engagement with more than 160 projects nominated, a substantial increase in website traffic, and a large database of subscribers for the Metropolitan Group and councils to contact with future waste minimisation initiatives.

In 2017, the Back to Earth Initiative extended the campaign by releasing a series of farmers' story videos via Facebook advertising, showcasing the innovative way farmers are using compost collected from Melbourne households.

FIGURE 5.1
ORGANIC MATERIALS ENTERING THE WASTE AND RESOURCE RECOVERY SYSTEM (2005–06 TO 2015–16)



Source: Historical SV data sets including the Victorian Local Government Waste Service Reports (previously known as VLGAS) and the Victorian Recycling Industry Annual Report (Previously known as VRIAS)

5.4 Food organics

In 2015–16, an estimated 990,000 tonnes of food organics were managed by the waste and resource recovery system in Victoria. Of this, only 103,000 tonnes (10 per cent) were recovered with 887,000 tonnes going to landfill.

Improving recovery of food organics is a priority of the SWRRIP and Regional Implementation Plans because food organics are highly putrescible and contains nutrients and energy which are lost when disposed of at landfill. Decomposition produces odours, leachate and greenhouse gases which can adversely affect community amenity, the environment and public health. Managing these issues at landfills is a long term imposition on current and future generations.

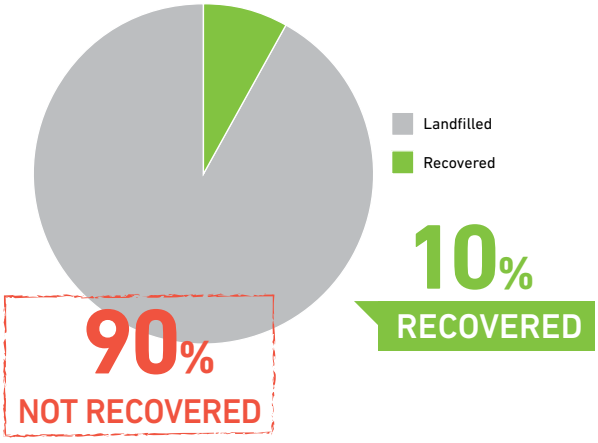
The three main sources of food organics entering Victoria's waste and resource recovery system are:

- food organics discarded by households, primarily in the residual bin
- food organics discarded by small business and commercial entities
- food-related materials from food manufacturers.

Regional Implementation Plans identified combined food organics and garden organics (FOGO) collection systems as an opportunity to increase recovery of food organics from households. In June 2016, 11 councils operated a FOGO service.

Data collection on the tonnes recovered through FOGO systems began in 2015–16. Early indications estimate that around 7,000 tonnes of food organics may have been collected through these services. We expect to see an increase in local governments offering FOGO kerbside collection service.

A market summary fact sheet for recycled organics can be found on the SV website at **www.sustainability.vic.gov.au**



5.4.1 Opportunities to improve recovery of food organics

Some food organics from both commercial and food manufacturing activities are used as feedstock for livestock. This can provide a revenue source or a cheaper option than landfill for generators. However, using food organics for animal feed can present serious risks related to the spread of disease and should only be carried out under strict controls. Generators using this option have a duty of care to meet requirements under relevant legislation and regulations, including the *Victorian Livestock Disease Control Act 1994* and the EP Act.

A significant amount of food is also wasted in the period after manufacturing and before it reaches the consumer. This can be due to damage during distribution and retail, not being sold or reaching the consumer before the end of its use-by date. Facilities such as Castlegate James in Ballarat turn some of these into meat-free feedstock additives.

Some food organics is recovered for human consumption if suitable (e.g. by Second Bite and FareShare) but the tonnages are very small.

Table 5.3 explores ways to increase recovery of food organics.

TABLE 5.3
OPPORTUNITIES TO INCREASE RECOVERY OF FOOD ORGANICS

Opportunities	Considerations
Increase FOGO collection services to increase feedstock for reprocessing Options include the potential to supplement tonnes collected by offering small business and commercial entities access to services on a user pays basis	› Providing a cost-effective service for ratepayers requires optimising all kerbside services when a FOGO service is introduced › Transitioning from a garden to FOGO collection system needs to accommodate both the increased tonnes collected and the change in composition of the material – food is not only more putrescible but is likely to contain more packaging-associated contamination like plastic and glass › Councils may need to provide ongoing education to the community to keep contamination rates low enough to ensure feedstock can be used to produce high-quality products › In some regional and rural areas, FOGO collections will not be cost-effective due to transport distances and/or the low tonnes available because of established localised solutions such as household composting
Use food organics from manufacturing processes and wastewater treatment plants for distributed energy solutions	› Small-scale systems using materials from food manufacturing and agricultural activities could be used to generate energy products for local use, including using anaerobic digestion to produce biogas and soil conditioners › Facilities will need to meet regulatory and planning requirements. Risks can be minimised by collocating with compatible industries including wastewater treatment plants › Energy options should only be considered when it is not viable to recover feedstock material for reuse back into the community › There is a potential risk involved in committing feedstocks for long term WtE contracts as materials may become viable for higher order recovery over the term of the contract
Increase collection from C&I activities	› Some food manufacturing processes have existing commercial arrangements to reuse their food organics, primarily for stockfeed › There is a lack of collection services for restaurants, hotels and pre-consumer food organics › Contamination, particularly from packaging materials can cause reprocessing issues
Increase use of recovered organics products in broadacre farming for soil beneficiation	› Broadacre farming can use a range of recovered organic products ranging from mulches, soil conditioners and compost › Cost of transporting feedstock or reprocessed materials to the broadacre market affects viability
Collective procurements between local governments for reprocessing solutions for kerbside collected FOGO and/or garden organics	› The Metropolitan Waste and Resource Recovery Group has successfully established collective procurements with more under development › Effective communications and support for households to use the garden bin correctly is critical to success of the procurement › Helps aggregate materials to establish the tonnes required to support viable reprocessing › Potential to include user pays schemes for commercial and small business to feed into kerbside › It can be complex to establish procurements with multiple partners › Potential biosecurity risks from the transportation of organic materials need to be understood › Needs to be supported by developing market demand for end products
Reducing contamination in feedstocks	› Education programs for households and businesses are needed and must be ongoing for continuous improvement of point source separation

5.5 Garden organics

In 2015–16, approximately 688,000 tonnes of garden organics were managed by Victoria's waste and resource recovery system. Of this, 429,000 tonnes or 62 per cent were recovered with the remaining 259,000 tonnes sent to landfill. Kerbside garden collection services play a critical role in the collection of garden organics.

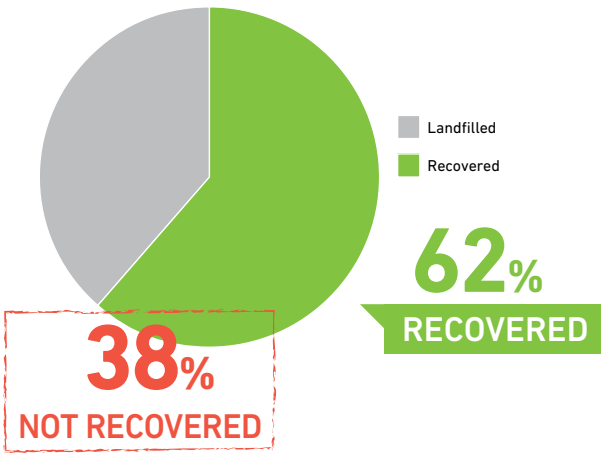
Composting is likely to remain the most viable option for garden organics. The lack of appropriately located sites with sufficient buffers in metropolitan areas is likely to move more composting activities into rural and peri-urban areas and establish bulk haul consolidation centres to reduce the cost of transporting materials to reprocessors.

Using combined FOGO for composting requires additional management protocols. This is likely to see an increase in in-vessel composting, both as a preliminary additional stage to traditional windrow facilities and new facilities.

Composting can potentially affect the amenity of surrounding land uses particularly through generation of odour. Facilities must use best practice technology and land use planning protection buffers around existing and potential locations for organics processing facilities. Support mechanisms include:

- local governments identifying and protecting current and potential future sites through planning schemes where appropriate
- co-locating organics facilities with compatible activities including landfills and wastewater facilities where appropriate
- encouraging compatible land uses to provide feedstock or use the products produced from the organics processing facilities.

Another significant barrier to effective composting is contamination of feedstocks which affects the quality of the end product. Any composting activity needs to be supported by upstream education programs to improve source separation and lower contamination rates.



5.5.1 Opportunities to improve recovery of garden organics

Strong market demand for the products made from reprocessed garden organics is critical to achieving increased recovery. Barriers to building this market include contamination of end products, consistency of nutrient levels and surety of supply and cost. The Victorian Market Development Strategy investigates the barriers and the mechanisms needed to develop this market.

Table 5.4 explores some options to increase recovery of garden organics. A market summary fact sheet for recycled organics can be found on the SV website at **www.sustainability.vic.gov.au**

TABLE 5.4
OPPORTUNITIES TO INCREASE RECOVERY OF GARDEN ORGANICS

Opportunity	Considerations
Compost garden organics on farms to produce soil enhancers to supplement or replace fertiliser use	› If managed properly, on-farm composting can provide local solutions in regional areas. Higher value options should be explored first, and source separated material streams with very low contamination need to be available. › Contamination is a major problem, causing environmental impact and inferior product quality, largely due to poor sorting before materials arrive at the farm. It needs investment in infrastructure and better sorting to reduce source material contamination. › Contamination levels in municipal garden organics are generally too high to be suitable for on-farm composting. Feedstock is more likely to come from C&I activities. › Strict processes must be in place to control adverse community, environment and public health impacts including adequate environmental monitoring. › On-farm composting may require a planning permit and EPA works approval and licence depending on the size of the operation. Operators will need to establish mechanisms to meet EPA regulations and prevent substandard practices affecting the viability of properly managed operations. This includes providing farmers with access to supportive composting expertise and ongoing education programs.
Build markets for end products – including increasing the use of recovered organics products in broadacre farming in regional Victoria for soil beneficiation and to replace or supplement fertiliser use	› Broadacre farming can use a range of recovered organic products ranging from mulches, soil conditioners and compost. › Cost of transporting feedstock or reprocessed materials to the broadacre market affects viability.
Collective procurements between local governments for reprocessing solutions for kerbside collected garden organics	› The Metropolitan Waste and Resource Recovery Group has successfully established collective procurements with more under development. › Helps aggregate materials to establish the tonnes required to support viable reprocessing. › Potential to include user pays schemes for commercial and small business to feed into kerbside. › It can be complex to establish procurements with multiple partners. › Potential biosecurity risks from transporting organic materials needs to be understood and may need to be mitigated › Needs to be supported by developing market demand for end products.
Increasing tonnes of feedstock available for reprocessing	› Education programs for households and businesses are needed and must be ongoing for continuous improvement of point source separation. › Improve reprocessing efficiency and pre-sort at landfills. › Improve pre-sorting at landfills and garden organics consolidation centres.

5.6 Wood and timber

In 2015–16, an estimated 511,000 tonnes of wood and timber organics were managed by Victoria's waste and resource recovery system. Of this, 204,000 tonnes or 40 per cent were recovered with the remaining 307,000 tonnes disposed of to landfill.

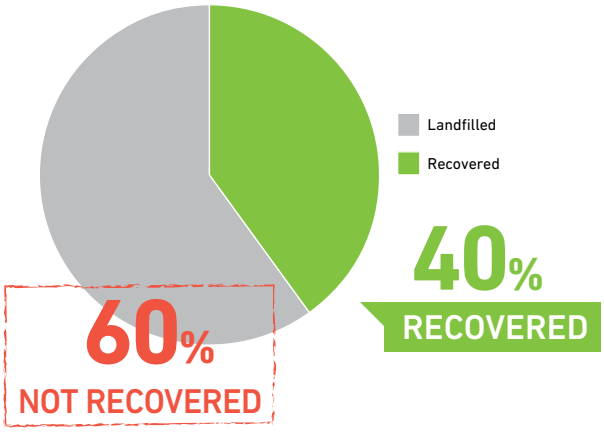
Most wood and timber came from C&I activities (298,000 tonnes or 58 per cent) and C&D activities (188,000 tonnes or 36 per cent). A very small portion of wood and timber came from municipal activities.

Wood and timber enter the system in numerous different forms including untreated timber, preservative-treated timber, engineered wood products, coated or painted timber, timber pallets, timber packaging, sawdust, timber shavings and timber offcuts.

Most untreated timber is chipped for particle board manufacture, mulch or woodchips or shredded for animal bedding. There are some localised markets for high-quality recycled timber such as hardwood flooring and structural timber. However, recovery is generally only considered viable when large tonnes are available, for example, when a warehouse, rather than a residential house, is demolished.

Traditional markets for recovered timber are mulch for the home garden, landscaping and large road projects. Road projects are the larger market for using recovered timber as mulch, but it is also prone to boom-bust cycles. Mulch is a mature market with some growth opportunities. Potentially not enough, however, to increase timber recovery to the desired level.

The chemicals used to preserve timber can cause issues in both reprocessing and in the use of end products. Sorting the treated and untreated timber is both difficult and time-consuming. As a result, significant tonnes of untreated timber are landfilled along with treated timber.



5.6.1 Opportunities to improve recovery of wood and timber

Regional Implementation Plans highlighted opportunities to recover additional wood and timber from residual streams. At smaller landfills, it is often removed manually from the residual waste stream. This is not feasible at larger landfills. Both Gippsland and Metropolitan Melbourne identified that their existing infrastructure is unlikely to have additional capacity to increase recovery to meet the priorities of their plans.

Barriers affecting the viability of recovering wood and timber include:

- costs of labour and capital required to separate timber material streams
- options for recovering treated timber
- securing a consistent, cost-effective recycled timber stream
- transport costs and locations to consolidate timber waste
- competition from cheap virgin timber.

A market summary fact sheet for recycled timber can be found on the SV website at **www.sustainability.vic.gov.au**

Table 5.5 lists opportunities to increase recovery of wood and timber.

TABLE 5.5
OPPORTUNITIES TO INCREASE RECOVERY OF WOOD AND TIMBER

Opportunities	Considerations
Improve source separation at C&D sites through education and appropriate infrastructure (e.g. separate skips) to increase availability of quality feedstocks for reprocessing	› Helps achieve the economies of scale to support viable reprocessing › Needs ongoing education programs and guidance on appropriate signage and bin or skip systems to support continuous improvement of point source separation
Increase viability of collecting timber from resource recovery centres/ transfer stations by improving sorting and separating of treated and untreated timber, shredding to reduce transport costs and aggregating tonnes from multiple facilities	› Upgrading infrastructure to support improved diversion can be costly › Separating treated timber from untreated timber can be problematic and time-consuming › Shredding reduces the impact of transport costs on return on investment › Stockpiling to achieve the required amounts to make transport viable needs to be done in a way that prevents impacts to the amenity of the community, reduces the fire risk and minimises impact on the environment
Shred and process recovered untreated timber into briquettes, pellets or a dry woodchip for multiple uses including equine bedding, producing MDF (medium-density fibreboard) and as a fuel source for domestic heating and industrial processes	› Separating treated timber from untreated timber can be problematic and time-consuming › Higher order recovery of timber products for reuse back into the community should be explored before energy-based solutions › Sourcing the required tonnes of quality feedstocks to underpin viable recovery is problematic due to the lack of collection and sorting systems
Use treated and untreated timber for WtE processes that extract a highly combustible synthetic gas (syngas), heat and capture emissions	› Further investigation is required to translate international examples into the Victorian context to demonstrate a positive business case › Sourcing the required tonnes of quality feedstocks to underpin viable recovery is problematic due to the lack of collection and sorting systems › Due to the potential generation of emissions, protocols are required to ensure facilities and operations meet regulatory requirements › Incineration or the use of other thermal technologies without energy or material recovery is not considered WtE – they remove the opportunity to recover value and have been identified as a form of infrastructure that is inconsistent with achieving of the goals of the SWRRIP

5.7 Commingled recyclable stream

The commingled recycling stream is a mixed material stream consisting of paper, cardboard, cans, plastics and glass. It is discussed in this section as a single stream as it is primarily collected through municipal kerbside collection systems (the 'second bin') and drop-off services. It is the major route for these materials to enter the waste and resource recovery system when discarded by households.

The commingled recycling stream is a mixed material stream consisting of paper, cardboard, cans, plastics and glass. It is primarily collected through the municipal kerbside collection system and drop-off services. It is the major route for these materials to enter the waste and resource recovery system when discarded by households.

In 2015–16, just over 609,000 tonnes of commingled materials entered the waste and resource recovery system through local government provided collection services. Of this, around 559,000 tonnes were recovered for reuse or reprocessing.

Table 5.6 shows the tonnes of individual materials collected through municipal kerbside collection and drop-off services in 2015–16.

5.7.1 Opportunities to increase recovery from the commingled recycling stream

Recovering more materials from the commingled recycling stream over the life of the SWRRIP is likely to be influenced by:

- the ability to upgrade infrastructure to improve sorting capacity and separate new materials responding to need (discussed further in Section 6.5.5)
- reducing contamination of feedstocks entering facilities.

Reducing contamination needs ongoing awareness campaigns to improve point source separation. Households and businesses need to understand the importance of using the right bin and how it affects recovery when they use the wrong bin.

The viability of recovery is also influenced by the commodity value of individual material components. When tied to local government contracts, the supply of feedstock is guaranteed. However, low commodity values for a particular material can result in stockpiling or landfill. In addition, the local market for some materials can be low and results in some materials, including plastics, being consolidated and sent overseas.

Table 5.7 lists the opportunities to increase the recovery from the commingled stream

TABLE 5.6
INDICATIVE BREAKDOWN OF MATERIALS IN THE COMMINGLED STREAM FROM MUNICIPAL COLLECTION SERVICES (2015–16)

	Kerbside collection (t)	Drop-off services (t)	Total (t)
Paper	348,000	12,000	361,000
Glass containers	171,000	3,000	173,000
Plastics	52,000	1,000	53,000
Aluminium	6,000	<1,000	6,000
Steel	14,000	2,000	15,000
Total	**590,000**	**18,000**	**609,000**

Source: Victorian Local Government Annual Waste Services Report 2015–16

TABLE 5.7
LISTS THE OPPORTUNITIES TO INCREASE THE RECOVERY FROM THE COMMINGLED STREAM

Opportunities	Considerations
Reduce contamination by educating waste generators and providing signage and bins	› Ongoing education programs for households and businesses are needed for continuous improvement of point source separation
Improve ability to separate commingled recyclable streams by improving sorting capacity of infrastructure at MRFs	› Improving facilities can require upgrading technology which can be expensive – larger amounts of feedstocks may be required to support viability › Facilities need to adapt to changes in the composition of material streams, for example increasing amounts of flexible plastics
Build capacity of MRFs to separate paper and cardboard from C&I streams	› This could provide additional materials to establish the amount of materials needed to support viable recovery › Streams from office-based activities may be less contaminated than those from households, particularly when supported by effective guidance on point source separation › May require changes in the way material streams can be received at facilities, for example, the ability to receive skip bins as well as kerbside collection vehicles

5.8 Paper and cardboard

In 2015–16, approximately 2,024,000 tonnes of paper and cardboard were managed by the waste and resource recovery system. Of this, 1,551,000 tonnes or 77 per cent were recovered with the remaining 473,000 tonnes disposed of to landfill.

C&I activities were the main source of this material, contributing over 1,582,000 tonnes or 78 per cent of the total managed.

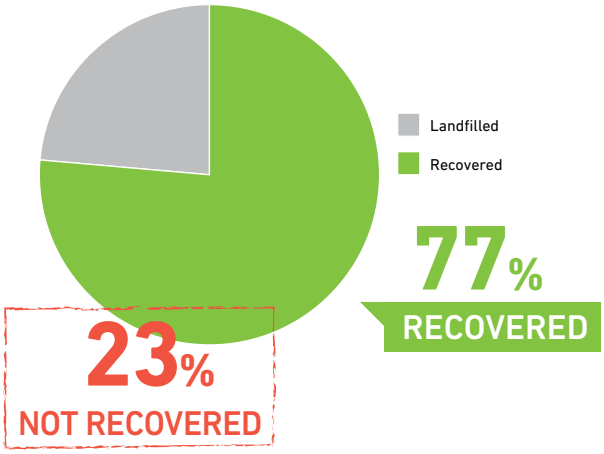
Victoria recovers high levels of paper and cardboard and this is closely linked to commodity value. In 2015–16, approximately 720,000 tonnes or around 46 per cent of the paper and cardboard recovered were exported overseas, as discussed in Section 4.10.2.

Paper fibre is a sufficiently valuable commodity and recovered paper and cardboard can be economically transported over considerable distances.

The main categories of paper and cardboard of value for reprocessing in Victoria are cardboard and paper used for packaging (boxes), newspapers, magazines and printing and writing paper. Feedstocks flow to Metropolitan Melbourne from all over the state. There is a significant flow of consolidated paper and cardboard from MRFs in Melbourne to the reprocessor in Gippsland. It is unknown if some of this material was originally sourced in regional Victoria.

Materials from recovered paper and cardboard are reused to manufacture recycled paper, packaging material and boxes. Material exported is usually baled, compacted mixed paper.

Metropolitan Melbourne is the main reprocessing hub for paper and cardboard, supported by a major facility in Gippsland and one in the North East region. These are discussed further in Chapter 6.



5.8.1 Opportunities to increase recovery of paper and cardboard

Because of its wide use in the community, particularly for packaging, the amount of paper and cardboard entering the waste and resource recovery system is likely to increase in line with population. Increasing recovery relies partly on improving the ability to separate, sort and consolidate streams to maximise diversion from landfill.

Since a large portion of recovered materials are exported, stockpiling can be an issue when commodity prices are low. Building the capacity of reprocessing in Victoria could provide an alternative to export when export conditions are unfavourable.

Table 5.8 outlines the major opportunities to increase recovery of paper and cardboard.

TABLE 5.8
OPPORTUNITIES TO INCREASE RECOVERY OF PAPER AND CARDBOARD

Opportunities	Considerations
Increase the quality and quantity of feedstocks available for reprocessing by improving separation of materials from municipal sources at MRFs and accept clean materials from C&I sources	› Improving facilities can require upgrades of technologies which can be expensive – larger amounts of feedstocks may be required to support viability › May provide additional materials to establish the amount of materials to support viable recovery › Streams from office-based activities may be less contaminated than those from households, particularly when supported by effective guidance on point source separation › May require changes in the way material streams can be received at facilities, for example, the ability to receive skip bins as well as kerbside collection vehicles › Viability needs to cope with fluctuations in commodity value
Improve source separation at the point of generation including households, businesses and industry through education and using appropriate infrastructure (e.g. separate skips) to increase the availability of quality feedstock for reprocessing	› We need ongoing education programs for households and businesses to establish continuous improvement of point source separation
Investigate options to recover paper and cardboard from residual waste streams including via dirty or wet MRFs	› Investigate the viability of higher order recovery that achieves reuse of the feedstock back into the community › Further investigation is required to translate international examples into the Victorian context to demonstrate a positive business case

5.9 Glass

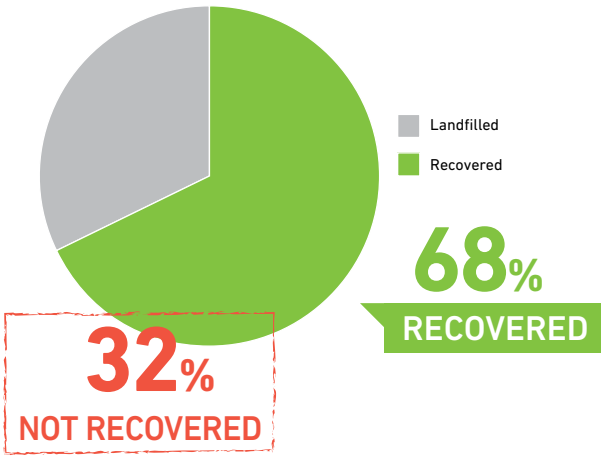
In 2015–16, approximately 253,000 tonnes of glass were managed by the waste and resource recovery system. Of this, 173,000 tonnes or 68 per cent were recovered. The remaining 80,000 tonnes were landfilled. Overall, 85 per cent or 214,000 tonnes of the glass managed were sourced from MSW, primarily through the commingled kerbside collection systems.

Of the glass recovered for reprocessing in 2015–16, 84 per cent was from glass containers. Around 98 per cent of this container glass was collected through municipal commingled kerbside systems. This material is collected throughout Victoria and transported to Metropolitan Melbourne for reprocessing.

The current price for mixed glass makes transporting glass from the furthest parts of the state to Metropolitan Melbourne a marginal proposition, and local markets for crushed glass products are emerging. It is also likely that some glass containers from western Victoria are going to South Australia to claim the redeemable container deposit, but there is no evidence that it is happening in significant tonnages.

Kerbside collected glass is generally a mix of cullet (broken glass) and fines (small pieces of glass). It is sorted by colour and size through a process called beneficiation to produce the cullet required for reprocessing into glass containers. Colour separation is critical for feedstocks for container glass production. Compaction of feedstocks to reduce transport costs can lead to glass fines that are too small to be colour sorted at MRFs.

Sheet and laminated glass accounted for around 9 per cent of the glass recovered in 2015–16 and was mainly from windscreens, broken windows and offcuts from the manufacture of glass products. This is likely to reach reprocessors in larger pieces and can be easier to sort. The lamination process however, reduces the ability to reprocess the glass.



STOCKPILING GLASS FINES

More than an estimated 300,000 tonnes of glass fines are stockpiled in Metropolitan Melbourne. Developing viable options to recover these materials is recognised as a priority in the Victorian Market Development Strategy.

These fines are contaminated with materials such as ceramics, stoneware, Pyrex and plastics. The stockpiles can impact on community amenity and the environment as they attract vermin and generate runoff contaminated with materials from the original use (leachate).

5.9.1 Opportunities to increase recovery of glass

The market for reusing recovered glass to manufacture new glass is influenced by its low commodity value. It competes with the relatively low cost of sand; the main raw material for glass.

Glass fines, including those too small to be effectively colour separated in the beneficiation process, are used to generate products to replace sand in asphalt production, concrete, pipe and railway sleeper bedding, glass wool insulation and non-slip surfaces.

As identified in the Victorian Market Development Strategy, the low economic value of glass fines and challenges with sorting and contamination can result in stockpiling when prices are low.

Metropolitan Melbourne is the major hub for glass reprocessing. Owens Illinois, located in the metropolitan area, is the only site in Victoria that uses recovered glass to produce container glass. This site is identified as a site of state importance to the waste and resource recovery system. If it could no longer accept recovered glass, then significant tonnes would either be stockpiled, landfilled or exported interstate or overseas if the commodity value allowed.Several other facilities use glass fines to make sand replacement products in both the metropolitan and regional areas. Glass reprocessing infrastructure is discussed further in Section 6.6.

Table 5.9 outlines the major opportunities to increase recovery of glass in Victoria.

TABLE 5.9
OPPORTUNITIES TO INCREASE RECOVERY OF GLASS

Opportunities	Considerations
Improve the ability of colour sorting technologies at MRFs to separate smaller size fines to reduce stockpiling and provide more high-quality feedstock for reprocessing	› Commingled kerbside collection generally involve compaction to reduce transport costs – excessive compaction, exacerbated by the trend for lightweight glass packaging, can result in high levels of glass breakages reducing the ability to sort › The viability of new technologies to improve beneficiation is affected by the commodity value for glass › Increasing the ability to collect materials from non-municipal sources would facilitate increased feedstock for reprocessing › We need ongoing education programs for households and businesses to establish continuous improvement of point source separation to reduce contamination of feedstock coming to MRFs
Investigate viability of mobile glass crushers to produce sand replacement products close to the point of generation for local reuse	› Using recovered materials locally reduces impact of transports costs on viability › Different ownership and management models should be explored including joint agreements between local government areas to reduce costs
Investigate and research using materials made from recovered glass fines in a range of products including: › paving materials › concrete › pipe bedding	› Developing options to use recovered glass materials will develop a pull from the market for feedstocks
Build end markets for recycled glass products by developing product specifications for a range of products made from recovered glass including container glass, pipe and sleeper bedding, pavement and road products	› Developing standards and specifications that enable the use of recovered glass provides assurance of their technical performance and safety to users and consumers

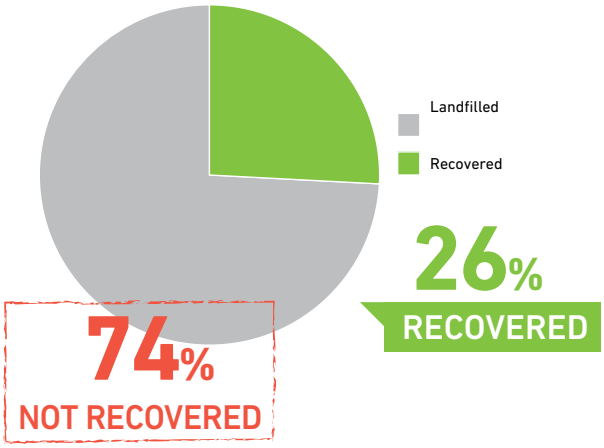
5.10 Plastics

In 2015–16, approximately 566,000 tonnes of plastic materials were managed by Victoria's waste and resource recovery system. Of this, only 149,000 tonnes or 26 per cent were recovered with the remaining 417,000 tonnes disposed of to landfill. Most of the plastic materials entering the system came from households and C&I activities.

The amount of plastics recovered increased from 109,000 tonnes in 2005–06 to 149,000 tonnes in 2015–16. The export market plays a large role in driving recovery with an estimated 97,000 tonnes of recovered material exported in 2015–16.

However, the low recovery rate and recent landfill audits completed for the Metropolitan Waste and Resource Recovery Group estimate that around 15 per cent of materials going to landfill are plastics. Plastics from households achieve a higher recovery rate of 34 per cent than plastics collected from C&I activities. This is partially because the kerbside collection contracts offer a constant feedstock for reprocessing.

Plastics are made from a wide range of polymers, largely from petrochemical sources with various additives depending on their desired functionality and use. This affects how they are recovered and what recovered materials can be used for. The major plastic polymer types are identified by a Plastics Identification Code number from 1 to 7. Broadly they can be grouped as either rigid or flexible plastic.



5.10.1 Rigid and flexible plastics

Rigid plastics are widely used in the community for products such as bottles, containers, toys, pipes and window frames. Being lightweight, they have a strong advantage over more conventional products in reducing transport and handling costs. Most plastics collected from households through the kerbside commingled system are rigid plastics.

Flexible plastics are increasingly used for packaging film, plastic bags, shrink wrap, builder's film and agricultural products such as silage wrap and wheat bags. Some film products are made by laminating different polymers with metal foils to produce packaging which is lightweight and strong. This trend is expected to continue over the life of the SWRRIP.

Research for the Victorian Market Development Strategy identified that an estimated 398,000 tonnes of rigid plastics were managed by Victoria's waste and resource recovery system in 2014–15, equivalent to about 70 per cent of the total plastics managed by the system. Only 144,000 tonnes or 30 per cent were recovered.

Flexible plastics made up the remaining 30 per cent with 172,000 tonnes of flexible plastic. Only 16,900 tonnes or 9.8 per cent were recovered, as shown in Figure 5.2.

The Victorian Market Development Strategy identifies film plastics as a priority material based on its increasing use in the community and low recovery rate.

Challenges for recovery include:

- most flexible plastics being made of thermoplastics, which are inherently more difficult to recover as the polymer structure is degraded by reprocessing
- the availability of enough good quality feedstocks to support viable reprocessing
- contamination, particularly with food and soil materials
- high cost of transport
- competition with export markets and virgin plastics
- the perception that products made from recovered plastics are lower quality, such as products that could replace timber in applications such as decking.

A market summary fact sheet for flexible plastics can be found on the SV website at **www.sustainability.vic.gov.au**

Shredder floc

Shredder floc is the residual shredded material from reprocessing end-of-life cars and whitegoods. It is a mixture of plastics (up to 55 per cent) and rubber, textiles, metals and inert materials such as dirt and glass. It is generally contaminated with heavy metals, mineral oils and hydrocarbons.

Research in 2014 suggested that about 350,000 to 400,000 tonnes of shredder floc is generated every year.[7] This material is classed as solid inert waste and there is only one landfill in Victoria currently licensed to accept it. Dependency on this landfill poses a risk to Victoria's waste and resource recovery system; if this landfill was unable to accept this waste, it would affect the upstream recovery of cars and whitegoods. Increasing diversion of materials from this stream for viable recovery would capture valuable materials and/or energy while also reducing this risk.

A market summary fact sheet for shredder floc can be found on the SV website at **www.sustainability.vic.gov.au**

5.10.2 Opportunities to improve recovery of plastics

Metropolitan Melbourne is the major plastics reprocessing hub with 17 reprocessors supported by an additional five in regional areas.

Increasing recovery needs the infrastructure to support collection, sorting and reprocessing of additional tonnes. Compacting to decrease material volumes is most likely needed to reduce the impact of transport costs on the return on investment.

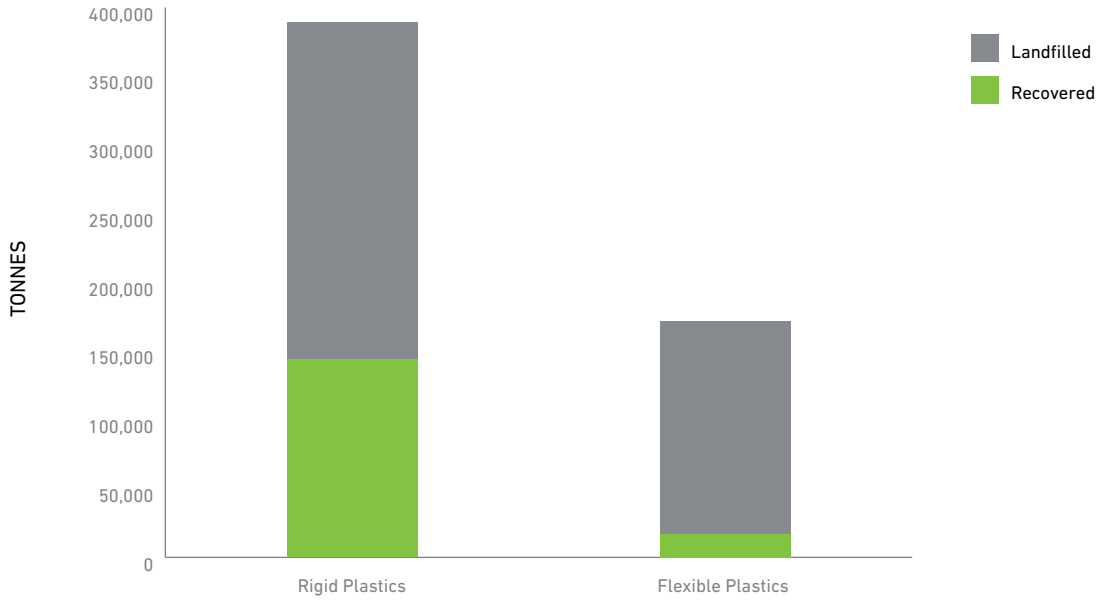
Table 5.10 outlines opportunities to increase recovery of plastics.

COMMON PLASTICS POLYMERS

The most common rigid plastics are made of polyethylene terephthalate (PET), high density polyethylene (HDPE), poly-vinyl chloride (PVC), and polypropylene (PP).

Most flexible plastics are made of low density polyethylene (LDPE) or linear low-density polyethylene (LLDPE). However other polymers, including high density polyethylene (HDPE) and polypropylene (PP), may be used to produce film.

FIGURE 5.2
QUANTITY (TONNES) OF FLEXIBLE AND RIGID PLASTICS MANAGED (2014–15)



7 Sustainability Victoria, *Emerging Market Analysis*, prepared by Hyder Consulting (unpublished), Melbourne, May 2014.

TABLE 5.10
OPPORTUNITIES TO INCREASE RECOVERY OF PLASTICS

Opportunity	Considerations
Plastics – all	
Improve source separation and reduce contamination at the point of generation by educating households and businesses to use appropriate signage and bins	› Source separation at the point of generation would divert more recoverable plastics from the residual bin, increasing the feedstocks available for reprocessing › Ongoing education programs for households and businesses would establish continuous improvement of point source separation and reduce contamination › Source separation at commercial, industrial and building sites can be limited by: – the space available for bins and skips – awareness of appropriate options for recovering plastics – awareness of the true costs of disposing of waste materials to landfill
Investigate use of plastics for feedstock for refuse derived fuels or WtE	› Plastics have a high calorific value making them attractive for energy generation › Potential to use streams contaminated with food or soil, or with mixed plastics that are difficult to separate › Should only be considered when recovery of plastics for reuse back into the community is not viable – potential risk involved in committing feedstock for long term WtE contracts which may become viable for higher order recovery over the term of the contract
Build end markets for recycled plastics products by developing product specifications for a range of products made from recovered plastics including pavements, road materials and railway sleepers	› Developing standards and specifications that enable the use of recovered plastics provides assurance of their technical performance and safety to users and consumers
Rigid plastics	
Improve the ability to collect and sort recovered rigid plastics from renovations, refurbishments and demolition of residential and commercial buildings	› Source separation at building and renovation sites is time-consuming and can require hiring multiple bins and engaging several service providers

Opportunity	Considerations
Flexible plastics	
Build the capacity for flexible plastics to be collected through kerbside commingled systems	› Increased tonnes of film plastics recovered from kerbside collections will provide a reliable source of feedstock to support reprocessing › Contamination can be an issue particularly from food organics – needs to be supported by ongoing education programs with householders › Upgrading sorting technologies may be required as they can be difficult to handle because the plastics get caught in mechanical sorting machinery
Establish viable collection systems for flexible plastics from agricultural activities	› Regional Implementation Plans identified opportunities to recover flexible plastics used for agricultural activities such as silage wrap and on-paddock wheat storage › Amounts available vary, depending on the season and the success of the harvest › Contamination with organics materials and soils can be an issue › Ability to aggregate and consolidate tonnes to achieve quantities viable for transport is critical for viable reprocessing › High cost of transport and effective collection mechanisms have resulted in inappropriate disposal of some of these materials on farms through burning
Investigate using materials from flexible plastics to create a range of products including paving materials, concrete materials and railway sleepers	› Researching innovative uses for recovered film plastics will drive markets for feedstocks › Products under development include paving materials, railway sleepers and enhancing the properties of concrete › Some projects including combining recovered film plastics and glass fines
Shredder floc	
Investigate alternative uses for shredder floc available internationally for viability in the Victorian context including use in cement materials, road base and asphalt production	› Contamination with residual oil and other volatile hydrocarbons is a major risk associated with handling and recovering this material › Recovery technologies need to minimise or capture vapours and fumes to reduce risks to community amenity, the environment and public health › Upstream recovery of oils would improve the viability of recovery but result in additional costs particularly for the deconstruction of cars › The mixed composition of shredder floc makes recovery more complex and there is a lack of viable technology › While current disposal costs are considerable, they are not yet adequate to drive market demand for alternatives
Investigate WtE options for shredder floc that has been pre-sorted to remove materials that can be viably recovered including metals	

5.11 Tyres and rubber

Collecting accurate data on managing tyre and rubber materials in Victoria is problematic, as only a portion of the material, particularly tyres, is thought to enter the system and therefore be accounted for. In 2015–16, an estimated 60,000 tonnes of rubber and tyres were managed by the Victorian waste and resource recovery system. Of this, 54,000 tonnes were recovered and 6,000 tonnes landfilled. All this material came into the system through commercial collection contracts.

At the national level, work is underway to understand what happens to tyres when they reach end of life. The actual number of end-of-life tyres in Victorian is still being determined, but is likely to be more than the 60,000 tonnes identified using current data collection. Figure 5.3 indicates what could be happening to these tyres in Victoria.

While tyres are the main source of rubber and tyre material in Victoria, additional rubber material such as conveyer belts are also managed by the waste and resource recovery system. Data limitations do not allow quantification of these materials. Recovery is likely to be similar to tyres.

Tyres are a manufactured product and vary in composition depending on manufacturer and tyre type. There are three main tyres used for vehicles – passenger (cars, motorcycles, and caravans), truck (light and heavy vehicles, buses) and off-the-road (agricultural, mining, construction and demolition). Most tyres contain approximately one-half rubber, one-fifth carbon black and one-fifth steel, with minor proportions of textiles and other additives.

Recovery generally involves deconstructing the tyre, removing the steel and fabric and recovering the steel and rubber for reuse. Table 5.11 outlines the major products possible from recovered tyres and their potential uses.

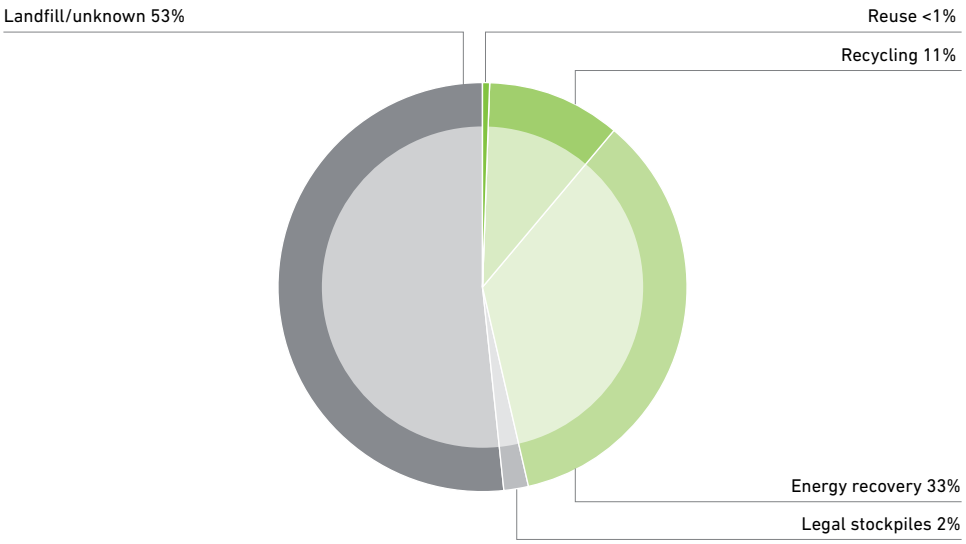
Export plays a large role in recovering tyres. It is understood that all the energy recovery from tyres occurs overseas as fuel sources, largely in Asia. Tyres for export are usually compacted and baled to reduce transport costs.

In Victoria, whole tyres are not allowed in landfills and must be shredded. Figure 5.3 shows that a significant portion of end-of-life tyres are most likely either going to landfill or an unknown fate. This is a significant recovery opportunity.

Since 2014, a voluntary industry-led product stewardship scheme has been in place in Australia managed by Tyre Stewardship Australia. The scheme is funded by a levy of 25 cents per Equivalent Passenger Unit on the sales of new tyres sold by participating tyre companies. The scheme aims to work across all levels of the tyre supply chain to increase resource recovery and recycling and minimise the environmental, health and safety impacts of end-of-life tyres generated in Australia.

Melbourne is a key hub for the Australian tyre recycling industry with two of the country's largest producers of crumb rubber and rubber granule based to the north of the city. In addition, there are three other tyre recyclers collecting and processing considerable volumes of baled tyres and tyre derived fuel for export.

FIGURE 5.3
INDICATION OF POSSIBLE END USES OF TYRES IN VICTORIA



Source: *National Market Development Strategy for Used Tyres 2017–2022*, Randell Environmental Consulting 2017

Stockpiling

Stockpiling is a major issue for the recovery of tyres. The impact of commodity values on the export market can see large amounts stockpiled when prices are low. In addition, particularly in rural areas, tyres are often stored until the critical mass is achieved to support viable consolidation and transport for reprocessing or export. However, problems with the tyre supply chain can contribute to stockpiling tyres beyond this and have resulted in significant legacy stockpiles in Victoria.

Stockpiled tyres pose a significant fire risk. If they catch fire they are difficult to extinguish and pose considerable health risks to firefighters and the local community through air pollution and contamination of waterways, groundwater and soil. Large tyre stockpile sites pose a potential financial risk to the state if they are abandoned. And importantly, operators that are stockpiling only (i.e. no further processing) are receiving unfair market advantage over legitimate operators in avoiding the true cost of end-of-life tyre management.

The recent introduction of tyre storage regulations in Victoria in 2015, has improved the management of end-of-life tyres across the State with operators now required to be licensed to store more than 40 tonnes.

TABLE 5.11
PRODUCTS POSSIBLE FROM RECOVERY OF TYRES

Type	Potential end use markets	
Whole tyres	› Tyre derived fuels	› Civil engineering
Cut/shredded tyres	› Tyre derived fuels	› Civil engineering
Tyre chip	› Tyre derived fuel	› Civil engineering
Rubber granulate	› Soft surfacing and matting › Moulded products	› Explosives › Mulches
Crumb rubber/powder	› Road surfacing – asphalt and sprayed bituminous surfacing › Adhesives	› General rubber mixing › Elastomers
Steel	› Established metal recycling market	› Concrete reinforcing
Textile	› Carpet backing	

5.11.1 Opportunities to increase recovery of tyres and rubber

Because of our reliance on motor vehicles for domestic and freight travel, the Victorian waste and resource recovery system will most likely need to manage significant quantities of tyres and rubber materials over the life of the SWRRIP. This includes managing existing stockpiled materials.

SV has identified a range of opportunities for using recovered tyres and rubber. A market summary fact sheet for end-of-life tyres can be found on the SV website at **www.sustainability.vic.gov.au**

Table 5.12 outlines opportunities to increase recovery of tyres in Victoria.

TABLE 5.12
OPPORTUNITIES TO INCREASE RECOVERY OF TYRES AND RUBBER

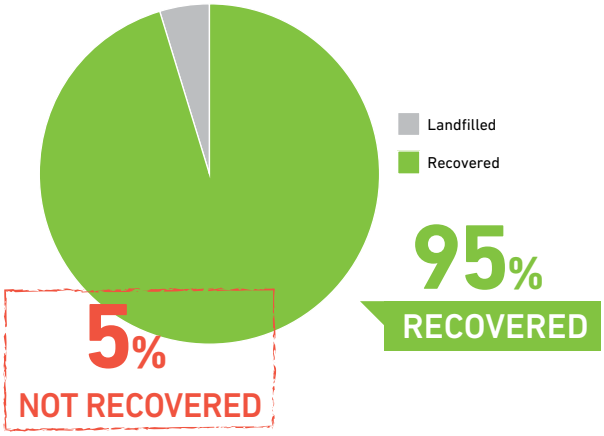
Opportunities	Considerations
Investigate using recovered tyre and rubber materials in products for activities such as road and rail construction and civil engineering	› Cost of collection and transport to establish tonnages required to support viable reprocessing affects viability › Some collection service providers are not accredited resulting in poor practices › Using crumb rubber in sprayed bituminous surfacing is fairly well established in Victoria – opportunities for its use in other applications such as asphalt is not
Build end markets for recovered tyre and rubber materials by developing product specifications for uses such as road, rail and civil engineering projects	› Developing standards and specifications that enable the use of recovered rubber and tyre materials provides assurance of their technical performance and safety to users and consumers
Investigate local WtE opportunities using tyre derived fuels	› These technologies are unproven in the Victorian and Australian context › Developing these technologies in Victoria needs to ensure: – economic viability – facilities will be operated to meet best practice standards and community expectations – an end market for products – mechanisms are in place to prevent perverse outcomes such as stockpiling or market failures leading to increased material going to landfill

5.12 Metals

In 2015–16, 1,494,000 tonnes of metals were managed by Victoria's waste and resource recovery system. Of this, 1,425,000 tonnes or 95 per cent were recovered with the remaining 69,000 tonnes landfilled. Nearly 60 per cent of these materials came from C&I activities. Around 26 per cent were sourced from the municipal sector largely through the kerbside commingled collection system.

Metals reprocessing is driven by the international commodity value and the value of the Australian dollar. Industry has invested in the recovery infrastructure needed to keep pace with the growth in generation of metal materials. This is expected to continue for the foreseeable future, due to the high commodity value of ferrous and nonferrous metals.

Metals reprocessing is supported by a well-established network of scrap metal yards and collection services, which are critical to aggregating and consolidating feedstocks for reprocessors. They also facilitate the return of some metal products back into the community.



Metropolitan Melbourne is the major metals reprocessing hub for Victoria. Feedstocks come in many forms including aluminium cans, batteries, car bodies, steel cans and lead pipes. Reprocessing ranges from simply crushing and baling for export, to shredding and blending into end products such as alloys and ingots, reinforced steel, wire and rail products.

5.12.1 Opportunities to increase recovery of metals

Metals reprocessing will continue to be linked to international commodity value for the foreseeable future.

5.13 Aggregates, masonry and soils

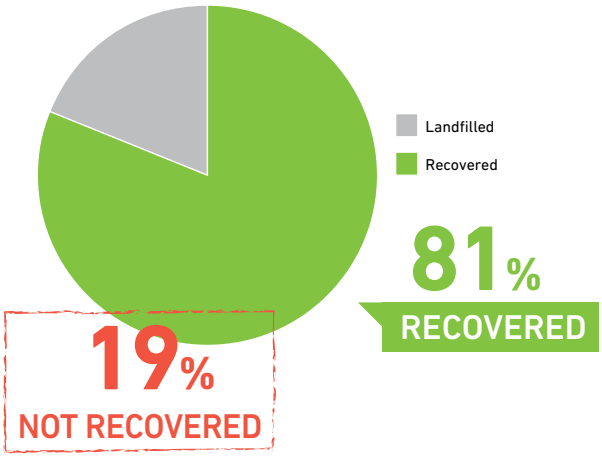
In 2015–16, around 5,055,000 tonnes of aggregate, masonry and soil materials were managed by Victoria's waste and resource recovery system. Of this, 4,093,000 tonnes or 81 per cent were recovered with the remaining 962,000 tonnes disposed of to landfill. Most of these materials were from building, renovation and construction activities.

Current recovery focuses on materials from commercial and demolition activities. Table 5.13 outlines a range of materials recovered from aggregates, masonry and soils and their uses.

Because of its weight, the cost of transport (between the location of the source material, the reprocessor and the end user) affects the viability of recovery. Additionally, as the use of recovered materials such as aggregate directly competes with the use of virgin materials, the availability of virgin materials in the same geographic location to end users can be a governing factor in viability.

Aggregate masonry and soil reprocessors are spread fairly evenly throughout the state. More information on their locations can be found in Table 6.10 (Section 6.6.1)) and in Regional Implementation Plans.

The Victorian Market Development Strategy (see Section 2.4.2) identifies concrete and bricks as priority materials. A market summary fact sheet for concrete and bricks can be found on the SV website at **www.sustainability.vic.gov.au**



5.13.1 Opportunities to increase recovery of aggregate, masonry and soils

Aggregates, masonry and soil reprocessing is a high-volume, low-margin business. It is probable that recovery rates of these very heavy materials have increased in tandem with rises in the landfill levy. The industry has invested significantly in reprocessing capacity over the past decade with all the major reprocessors investing in new facilities at existing and new sites.

Developing the pull from the market for products and materials made from recovered aggregates, masonry and soils will support increased recovery. However, the activities that generate these materials are not necessarily the same as the ones that can reuse the recovered materials. For example, high activity in the demolition sector does not always correspond to large infrastructure projects. Economic activity in the two sectors does not always coincide which can lead to a supply and demand imbalance resulting in both shortages and stockpiles.

The trends in the use of recovered aggregates, masonry and soil reflects construction activity. Developing guidance and specifications for using recovered materials for purposes such as road construction and pavements also supports market acceptance for using recovered materials. For example, the Code of Practice on using crushed rock mixes released by VicRoads (*Registration of Crushed Rock Mixes*, RC 500.02, June 2017).

Some Regional Implementation Plans identified that while there appeared to be adequate existing reprocessing infrastructure, the existence of stockpiles indicates a lack of mechanisms to drive recovery. Table 5.14 outlines opportunities to increase recovery of aggregates, masonry and soils in Victoria.

TABLE 5.13
PRODUCT AND MATERIALS MADE FROM RECOVERED AGGREGATES, MASONRY AND SOILS

Recovered materials	Description and uses
Various aggregates including crushed concrete	› Single streams or blends › Various sizes depending on screening › For use in a range of products such as fresh concrete, road subbase, drainage, irrigation and landscaping
Recovered bricks	› Intact bricks can be used in housing and construction › Damaged bricks can be reused in non-structural applications or crushed
Metal reinforcing	› Extracted from reinforced concrete during the crushing process › Can improve the financial viability of concrete recycling operations depending on commodity value
Plasterboard	› Crushed to create more plasterboard › Can be used as soil conditioner by the agricultural sector
Recovered soils	› Primarily used as clean fill on construction sites and landscaping

TABLE 5.14
OPPORTUNITIES TO INCREASE RECOVERY OF AGGREGATES, MASONRY AND SOILS

Opportunities	Considerations
Increase the point source separation of materials on building and construction sites	› Identified in some Regional Implementation Plans as an opportunity › Industry has developed and implemented inspection protocols and systems to minimise asbestos contamination
Build end markets for the recovered materials by developing product specifications for uses such as road base and pavements	› Developing standards and specification that enable the use of recovered materials provides assurance of their technical performance and safety to users and consumers
Increase local availability of recovered materials	› Making materials available near point of generation where users are identified reduces transport cost › Innovative business models for mobile crushers may prove viable in some situations and should be investigated

5.14 E-waste

Electronic and electrical waste, or 'e-waste' comprises electronic equipment with a plug or battery that needs an electric current to operate and that has reached its end of life. It includes, but is not limited to televisions, computers, monitors and whitegoods such as fridges and washing machines. These items can contain both hazardous and/or valuable materials, many of which can be recovered when they reach the end of their working life.

The Victorian Government is committed to banning e-waste from landfills in Victoria because e-waste:

- is growing three times faster than general municipal waste in Australia due to increased technology trends, reduced product lifespan and consumer demand for new products
- contains hazardous materials, which if not managed properly can pose risks to the community, environment and public health
- contains valuable materials some of which are scarce and worth recovering.

Recent research to understand how e-waste is currently being managed in Victoria estimates that 106,000 tonnes of e-waste entered the Victorian waste and resource recovery system in 2014. This is projected to grow to 259,000 tonnes by 2035.[8] An estimated 53,000 tonnes of materials were recovered for recycling. The fate of the remaining 53,000 tonnes is uncertain but likely to have been landfilled, illegally dumped, stockpiled or exported overseas without an export permit.

Currently there are two main methods for reprocessing e-waste in Victoria:

- manual disassembly into intact subcomponents for sale as feedstocks for further reprocessing and/or recovery
- mechanical processing including methods such as crushing, shredding and magnetic, density, optical or x-ray sorting into feedstocks for further reprocessing and/or recovery.

Recycling e-waste in Victoria (and nationally) is centred on televisions, computers and computer-related devices such as keyboards and screens. Victoria supports the National Television and Computer Recycling Scheme. This is the first co-regulatory product stewardship scheme established under the Product Stewardship Act 2011. It requires the television and computer industries to fund collection and recycling of a proportion of the televisions, computers and computer peripheral products disposed of in Australia each year. Further information on the scheme can be found at www.environment.gov.au/protection/national-waste-policy/television-and-computer-recycling-scheme.

Since the scheme began in 2012, 229 collection points have been established across the State and an estimated 20,000 tonnes of material collected for recycling.

5.14.1 Opportunities to increase recovery of e-waste

A legislated ban of e-waste material from landfill will provide a guaranteed source of feedstocks for reprocessing. Ensuring that these feedstocks can be viably recovered and reprocessed into goods and materials for reuse back into the community needs a multifaceted approach that enables:

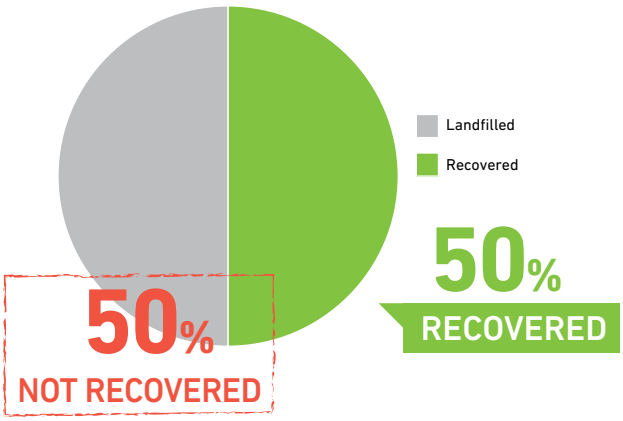
- cost-effective collection of e-waste materials
- efficient sorting and separation to provide the quality and quantity of feedstocks to support viable reprocessing
- demand for products and materials from recovered e-waste.

To support this, e-waste is recognised as a priority material in the Victorian Market Development Strategy, as discussed in Section 2.4.2.

The e-waste ban will introduce minimum requirements for all Victorians through a new Waste Management Policy (WMP), which will specify how e-waste must be managed. Additional WMP requirements will apply to organisations involved in collecting, managing and treating e-waste. For example, organisations involved in treating e-waste may need to keep more extensive records of waste sources, conduct due diligence on downstream purchasers, achieve certain minimum recovery of materials from e-waste received, provide support to upstream providers to aid compliance and meet minimum material recovery rates.

Most e-waste reprocessors already meet the minimum requirements and some of the additional requirements as part of running a reprocessing business.

Table 5.15 outlines some opportunities to maximise the viable recovery of e-waste materials diverted from landfill through an e-waste ban.



8 Sustainability Victoria, *Victorian e-waste market flow analysis*, prepared by Randell Environmental Consulting (unpublished), Melbourne, 2015.

TABLE 5.15
OPPORTUNITIES TO INCREASE RECOVERY OF E-WASTE

Opportunities	Considerations
Strategic upgrade of the existing resource recovery centre/ transfer station network to enable collection of e-waste materials from households and businesses	› Regional Implementation Plans identified that some existing facilities do not have appropriate infrastructure to effectively manage e-waste in line with industry standards (AS/NZS 5377:2013 Collecting, storing, transporting and treating e-waste) › Additional infrastructure could include concrete pads, bunding, e-waste collection units and roofing › Strategic planning for upgrades needs to balance how far users of the service are required to travel with the need to collect the tonnes of materials needed to support viable transport and reprocessing › E-waste contains hazardous materials which can harm the environment and human health
Support industry to develop the capacity to improve separation and sorting of component materials to provide the feedstocks required by the reprocessing industry	› Improving facilities can require upgrades of technologies which can be expensive › Storing materials to achieve the quantities needed for viable transport must be undertaken in a way that minimises harm to the environment and maintains the quality of the feedstock › Operators should aim to align with standard AS/NZS 5377:2013
Develop a market for recovered materials to prevent stockpiling	› Developing standards and specification that enable the use of recovered materials will provide assurance of their technical performance and safety to users and consumers

5.15 Waste to energy

As previously discussed in section 1.3.6 and throughout this chapter, opportunities exist to produce a range of energy products from individual and mixed material streams (including residual waste) managed by Victoria's waste and resource recovery system. Products include fuels (gaseous, liquid or solid), heat and electricity.

WtE will only be viable where there is a consistent supply of the required feedstock, a market for the energy products (and other recovered materials if produced) and the process has better outcomes for the environment, public health and community than landfilling.

WtE is lower in the wastes hierarchy than recovery. As such, the benefits from WtE are best realised when the feedstock is a material stream or waste that cannot viably be recovered for higher order recovery, that is, for reuse or recycling.

The viability of large-scale WtE plants is likely to depend on large amounts of feedstocks committed for long periods of time. While it may not be viable to recover some of these materials now, over the life of the SWRRIP this may change. For example, plastics in the residual waste stream have calorific value useful in WtE options. It is currently hard to sort these from the residual waste stream. Improved sorting technologies may change the business case for recovering and recycling these plastics. However, if the residual waste stream is committed to a commercial contract for WtE, the possible feedstocks will not be available for recovery.

In rural areas where the volumes of individual material streams may make achieving the economies of scale for viable recovery difficult, WtE options should be explored. However, in doing so, it should be noted that incineration or using other thermal technologies without energy or material recovery is not considered WtE. They remove the opportunity to recover value and have been identified as a form of infrastructure that is inconsistent with achieving of the goals of the SWRRIP.

5.16 Residual waste

In 2015–16, around 4,184,000 tonnes of residual waste were disposed of at landfills in Victoria. This represents the materials and resources that enter Victoria's management system but were not diverted for viable recovery. In total, 42 per cent of these materials enter the system from the municipal sector primarily through kerbside garbage collection services.

Residual waste is a mix of putrescible and inert materials. It contains materials and valuable resources, including nutrients and energy that could be recovered if the right conditions were in place to make it viable. Figure 5.4 demonstrates the types and quantities of materials going to three large putrescible landfills in Metropolitan Melbourne in 2014. While not a comprehensive study, it provides a good indication of the composition of residual waste being discarded by our households, businesses and industry.

Currently, the only acceptable method to manage residual waste in Victoria is to dispose of these materials to landfill. If we are to realise the goals of the SWRRIP and Regional Implementation Plans, we need to change the way we manage residual waste. We need a paradigm shift that:

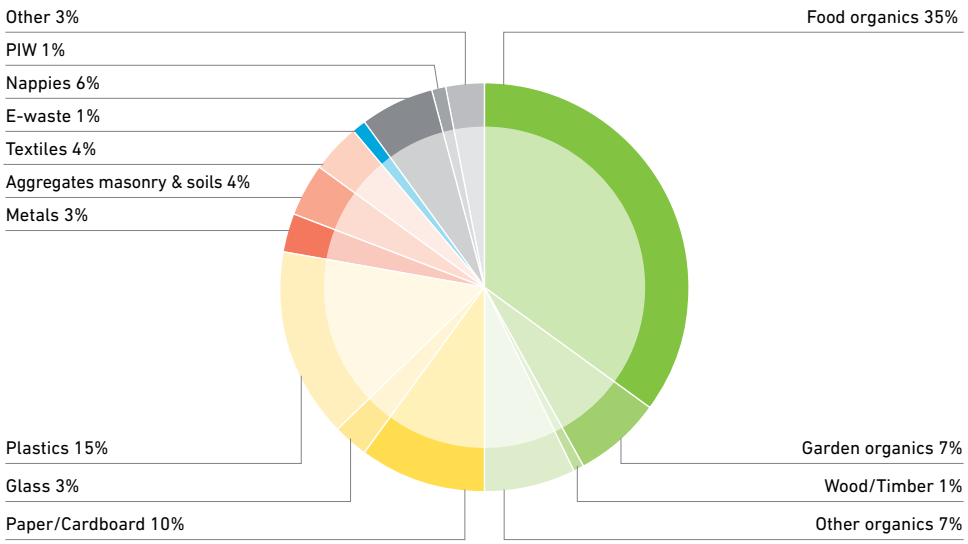
- prioritises recovery of materials in line with the wastes hierarchy for reuse where possible
- recovers the energy component from waste where recovery of individual material streams is not viable
- minimises the impact on community amenity, the environment and public health from any recovery option
- disposes of any remaining waste to a properly engineered landfill that meets regulatory requirements, preferably with gas capture and conversion to energy.

5.16.1 Opportunities to increase recovery of materials from residual waste

Projections based on recovery trends since 2005–06 suggest that we will generate around 5,900,000 tonnes of residual waste in 2045–46. This increase is largely due to expected population growth, particularly around Metropolitan Melbourne and larger regional centres. While the aim of the SWRRIP and Regional Implementation Plans is to reduce this by diverting materials for viable recovery, we still expect to see a residual waste component that needs to be managed during the life of the SWRRIP.

Table 5.16 lists opportunities to increase recovery of materials from residual waste.

FIGURE 5.4
INDICATIVE COMPOSITION OF MUNICIPAL AND C&I MATERIALS ENTERING LANDFILLS (2014)



Source: *Metropolitan Regional Waste and Resource Recovery Implementation Plan* (2016).

TABLE 5.16
OPPORTUNITIES TO INCREASE RECOVERY OF MATERIALS FROM THE RESIDUAL WASTE STREAM

Opportunities	Considerations
Increase pre-sorting of the residual waste stream at landfills or residual waste consolidation centres	› Pre-sorting at landfill sites could remove obvious materials such as metals, wood and timber and aggregates, masonry and soils – the sophistication of this pre-sorting infrastructure will vary from site to site › Extracting recoverable materials at residual waste consolidation centres could reduce transport costs
Establish MRFs with the ability to sort residual waste	› These are known as residual, dirty or wet MRFs › Increase diversion of materials including plastics, metals, garden organics and wood and timber for reuse back into the community › Technology and management practices need to be able to handle the putrescible nature of residual waste › Can be at the front end of WtE facilities
Treat residual waste to make products such as energy, heat, biogas, biofuels and soil conditioners	› Capture resources including nutrients and energy › Able to use mixed contaminated feedstocks that are difficult to sort › Consistent feedstocks (quantity available, contamination levels and calorific value) will assist viability › Potential risk involved in committing feedstock for long term WtE contracts which contain materials that may become viable for higher order recovery during the term of the contract › Most technologies will have a concentrated residual waste that will still require landfilling – in some instances, contaminations levels may result in the residual becoming a prescribed waste › Technologies and management practices will need to meet community expectations and regulatory requirements including emissions capture › Some technologies are eligible for carbon credits under the Carbon Farming Initiative (refer to the Carbon Credits (Carbon Farming Initiative—Alternative Waste Treatment) Methodology Determination 2015, available from **www.legislation.gov.au**)

6. Infrastructure supporting the waste and resource recovery system

6.1 Introduction

This chapter provides an overview of Victoria's' waste and resource recovery infrastructure.

Victoria's waste and resource recovery system is underpinned by a complex network of infrastructure that collects, sorts, reprocesses and disposes of the materials discarded by our households and businesses. This infrastructure plays a critical role in maximising recovery of valuable materials and managing our residual waste.

In 2015–16, Victoria's system managed more than 12.8 million tonnes of material at more than 630 sites. Sites range from small facilities accepting individual waste streams, complex reprocessors providing materials and products from recovered materials to best practice landfills servicing large areas of the state. Figure 1.1 shows the activities carried out as part of the system in a circular economy.

We need to build on our existing integrated system to ensure it has the optimal infrastructure mix to achieve the goals of the SWRRIP and Regional Implementation Plans. We need the capacity to divert as much of our viable materials as possible away from landfill for recovery. As identified in the Victorian Market Development Strategy this relies on:

- Our recovery industry having a consistent and reliable supply of the quality and quantities of feedstock required to support viable reprocessing
- Our recovery industry producing the quantity and quality of products from the recovered materials that the market demands.

To achieve this, we need to attract investment in the right mix of infrastructure and plan for infrastructure that follows the SWRRIP's strategic directions as discussed in Chapter 2.

This chapter examines the four major groups of infrastructure that support the waste and resource recovery system, as outlined in Table 6.1.

"Victoria's infrastructure network managed more than 12.8 million tonnes in 2015–16."

Over 630 sites across Victoria provide the essential services required to support our waste and resource recovery system.

6.2 Data considerations

The main sources of data in this chapter are the:

- Victorian Recycling Industries Annual Report 2015–16
- Victorian Local Government Annual Waste Services Report 2015–16
- Regional Implementation Plans.

The following data considerations are relevant:

- There is robust data on material streams collected via municipal kerbside collection systems but less granular data on materials collected from C&I and C&D sectors.
- Infrastructure numbers are sourced from the Regional Groups and are accurate as at 1 June 2017. They are updated using the information in Part A and Part B of the infrastructure schedules published in Regional Implementation Plans.
- Maps of resource recovery and residual waste infrastructure dated March 2013 can be found on the SV website at www.sustainability.vic.gov.au

More information on surveys and data considerations can be found in Appendix 4.

TABLE 6.1
THE FOUR MAJOR GROUPS OF WASTE AND RESOURCE RECOVERY INFRASTRUCTURE

Infrastructure group	Function
Collection infrastructure	Facilitates recovery of materials at the point of generation by collecting and transporting to facilities for sorting, consolidation or disposal
Recovery facilities	Facilitates recovery of resources primarily through segregating, sorting, consolidating and aggregating before transporting for reuse, reprocessing or disposal
Reprocessing facilities	Facilitates recovery of resources primarily by converting materials into products that can be used again or energy
Disposal infrastructure*	Final repository of waste after the extraction of all materials that can be viably recovered

* Disposal is the terminology used in the EP Act wastes hierarchy, and includes landfill. While other mechanisms for disposal exist, such as incineration of hazardous waste, landfills are the only mechanism for disposal of residual waste recognised in the SWRRIP. Landfills are expected to operate in accordance with regulations including managing greenhouse gas emissions.

6.3 Existing infrastructure network

Currently there are more than 630 sites housing operational infrastructure that support Victoria's waste and resource recovery system. Table 6.2 provides a breakdown of numbers by waste and resource recovery region. Note that collection services rely on a combination of infrastructure and systems and are not included in Table 6.2 but are discussed in Section 6.4.

TABLE 6.2
NUMBER OF RESOURCE RECOVERY AND RESIDUAL WASTE INFRASTRUCTURE BY REGION AS AT 1 JUNE 2017

Region	Recovery facilities	Reprocessing facilities	Operating landfills	Total
Barwon South West	52	21	6	79
Gippsland	97	21	10	128
Goulburn Valley	41	22	5	68
Grampians Central West	74	13	16	103
Loddon Mallee	47	8	13	68
Metropolitan	69	69	18	156
North East	21	10	4	35
Total	**401**	**164**	**72**	**637**

Note: There are an additional 497 closed landfills listed in Regional Implementation Plans that no longer receive waste.

Source: Regional Groups, unpublished data (1 June 2017).

6.4 Collection

Collection systems play a pivotal role in the waste and resource recovery system by removing the materials no longer wanted by households, businesses and industry. This service is critical to protecting the amenity and public health of our communities. It is also one of the primary conduits between generators and reprocessors for the feedstocks that support recovery of valuable materials.

6.4.1 Municipal collection services

Local governments provide a range of services to households and small businesses. Services provided by local governments were responsible for managing more than 2.14 million tonnes of materials and waste in 2015–16.

In 2015–16, 97 per cent of Victorian households had access to a kerbside garbage collection, and 96 per cent to a commingled recycling collection. Areas not serviced are generally remote and where a kerbside system is not viable. Table 6.3 lists the municipal collection services in Victoria in 2015–16.

The kerbside collection of organic materials has increased considerably over the last 15 years with 70 per cent of households able to access a kerbside garden waste collection service. Combined FOGO collection services commenced more recently with 11 local governments across the State offering the service in 2015–16, primarily as part of a three-bin service.

In regional areas, materials dropped off and collected at resource recovery centres play a large role in supplementing kerbside collection systems, particularly for garden organics. In 2014–15, 15 per cent of household streams entered the system through resource recovery centres and drop-off facilities in regional areas compared to four per cent in Metropolitan Melbourne.

TABLE 6.3
MUNICIPAL COLLECTION SERVICES IN VICTORIA (2015–16)

Service	Tonnes collected in 2015–16	Details
Kerbside garbage (residual)	1,160,000	› Residual waste that contains both putrescible and inert materials › Bin sizes include 80, 120, 140 and 240 L with 120 L being the most common › Weekly collection services are the most common › Offered by all local governments and available to 97 per cent of households › Some local governments provide limited services to commercial customers
Kerbside commingled	590,000	› Commingled glass, metals, plastic and paper/cardboard › Bin sizes include 120 and 240 L bins › Predominantly fortnightly collection of 240 L bins (89 per cent of services) › Offered by all local governments and available to 96 per cent of households › Some local governments provide limited services to commercial customers
Kerbside FOGO	7,000 (estimate)	› Combined food and garden organic materials › Offered by 11 of the 79 local governments (as at 30 June 2017) › Weekly collections are the most common › Predominantly source separated in kitchen caddies and placed in 240 L organics bins › Tonnages based on estimates
Kerbside garden organics	382,000	› Garden organic materials › Bins range from 120 to 240 L bins (with 240 L most common) › Loose stacks and tied bundles are also widely used › Predominant system is a 240 L bin collected fortnightly › Offered by 50 of the 79 local governments and available to 70 per cent of households
Hard waste	94,000	› Solid waste (non-putrescible) that is not accepted or does not fit into garbage bins such as furniture and white goods › Offered by 42 of the 79 local governments
Drop-off facilities	154,000	› Play a significant role in rural areas where access to kerbside services may be limited › Materials accepted vary greatly depending on the site and can include glass, steel, plastics, paper, cardboard, e-waste, chemicals, garden organics and residual waste

Source: *Victorian Local Government Annual Waste Services Report 2015–16*

Figure 6.1 shows the tonnages of materials that entered the resource recovery and residual waste system from the main municipal collection services.

6.4.2 Opportunities to improve recovery from municipal kerbside collected materials

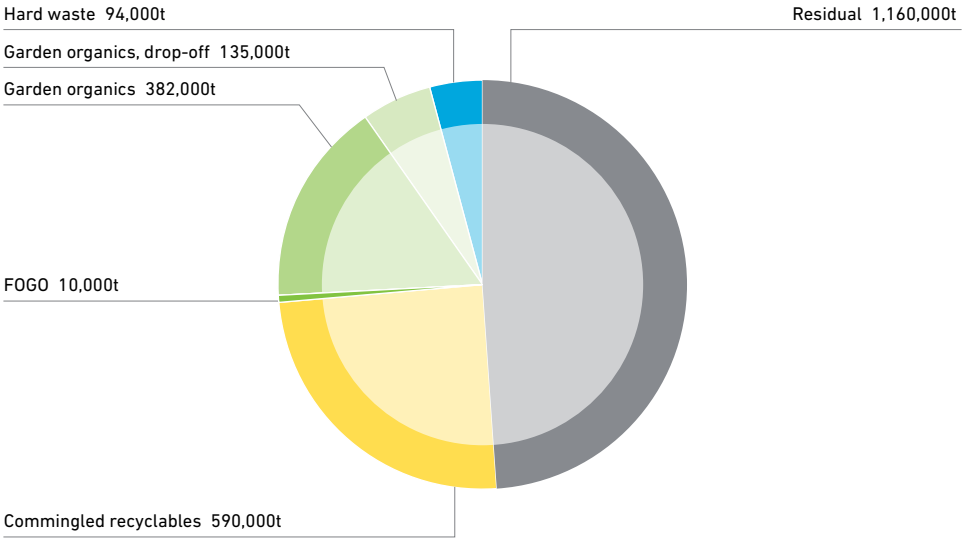
Table 6.4 outlines opportunities identified in Regional Implementation Plans to improve the recovery of materials collected through municipal kerbside services.

6.4.3 Commercial collection services

Commercial collection services are varied and generally rely on a contract between the generator and the collection service provider. While they do provide some services to households, they mainly service businesses, manufacturing and industry. Like municipal collection services, they play a pivotal role in protecting community amenity, the environment and public health and providing feedstock to reprocessors.

Services range from 'on demand' collection to dropping off different-sized skip bins, hoppers or trailers tailored to the quantity and type of material, for pick up when bins are full. There are services available for most materials, with the cost reflective of the destination and value of the materials to reprocessors and/or cost of disposal.

FIGURE 6.1
QUANTITY (TONNES) OF MATERIALS FROM MUNICIPAL COLLECTION SERVICES (2015–16)



Source: *Victorian Local Government Annual Waste Services Report 2015–16.*

6.4.4 Opportunities to improve recovery from commercial collection services

Changes to these collection systems will be driven by market demand. Service providers will respond to demand from reprocessors for specific feedstocks by making cost-effective collections. This in turn is driven by a demand in the market for the products made from the reprocessed materials. For example, if demand increases for products made from lightweight aggregate and masonry, there will be a corresponding increase in demand for feedstock and collection providers will respond by offering more services.

The Regional Implementation Plans identified opportunities to improve the effectiveness of commercial collections, in particular by increasing the amount of materials going to reprocessors rather than landfill. These are outlined in Table 6.5.

TABLE 6.4
OPPORTUNITIES TO IMPROVE MUNICIPAL KERBSIDE COLLECTION SERVICES

Opportunities	Considerations
Improve uptake of existing garden services and/or transition to combined FOGO collections where feasible	› A reliable market for the materials collected is required to support viability of service › Optimising collection regimes needs to balance frequency of bin pickups and bin sizes with minimising impacts on the amenity of households and costs to councils
Maintain low levels of contamination so materials collected can be viably reprocessed into marketable products	› Adopting standardised colours for bins and bin lids in line with the Australian Standard AS4123 could provide consistency, avoid confusion and enable consistent messaging across the state › Ongoing education programs for households are needed to establish continuous improvement of point source separation to minimise contamination
Build flexibility into collection systems to respond to localised circumstances and changes in communities	› In low-density rural areas, the feasibility of kerbside collections is affected by the cost of pickups › In these areas, solutions are likely to be community specific and may include onsite solutions for organics and local consolidation points for other materials › In areas of aging population, the ability of residents to access traditional service models may become limited and alternative options could be required › Increasing multi-unit developments in some areas, particularly high-rise apartments, need customised infrastructure and developing suitable and effective collection service models

TABLE 6.5
OPPORTUNITIES TO IMPROVE RECOVERY FROM COMMERCIAL COLLECTION SERVICES

Opportunities	Considerations
Increase market demand for goods and materials made from reprocessed materials	› Increasing market demand will stimulate demand for feedstocks
Reduce contamination of materials being collected	› Needs a multifaceted approach including improving onsite sorting at the point of generation › On many sites, separation can be constrained by the area available for multiple bins and the perceived time required for sorting › Educating generators on where cost savings may be achieved helps with improvements
Extend access to existing kerbside collections services to small businesses and commercial operations on a fee for service basis	› Increase amounts collected › Options for mixed use developments

6.5 Recovery facilities

Recovery facilities play a critical role in the system by aggregating, sorting and consolidating materials and making them available for recycling or reprocessing. This helps achieve the tonnages of individual material streams required to support viable recovery and reduces the cost of transporting these materials and the remaining waste for reprocessing or appropriate disposal.

Recovery facilities can vary greatly depending on their location and the community they service, materials accepted and the function of the facility. They range from small facilities consisting largely of sorting bins and trailers to larger, more sophisticated centres that accept a wide range of materials and include a retail shop. Table 6.6 provides a general description of some of the more common types of recovery facilities in Victoria.

TABLE 6.6
MAJOR TYPES OF RECOVERY INFRASTRUCTURE ACROSS VICTORIA

Function (can include)	Service provided	Materials accepted	Infrastructure	Ownership
Drop-off centres*				
› Unload of materials › Point source separation › Aggregation for transfer	› Aggregation point for households not serviced by kerbside collections predominantly in small communities and remote areas › May sit at front of landfill to reduce materials that could be recycled being deposited in the landfill	Depends on the facility, and can include residual waste	Small trailers or material specific bins	Usually council owned and operated, sometimes community managed
Resource recovery centres (also called transfer stations)				
› Unload of materials › Point source separation and sorting › Aggregation and consolidation for transfer › Consolidating kerbside collected material for bulk haul (increasing trend) › Some resale to public	› Predominantly for aggregating and sorting goods and materials unable to be collected through kerbside collections › Some removal of contamination from individual streams may occur, mainly through manual sorting › Some offer specialised services such as DrumMUSTER and the Household Chemical Collection Service › May be co-located with landfills and serve as a final option for diverting materials before landfill › Aggregated and consolidated materials are transported to other facilities for further sorting, reprocessing or disposal › Often include a resale shop	Wide range of materials depending on the facility including garden organics, wood, timber, commingled recyclables, batteries, e-waste, whitegoods, tyres, mattresses and residual waste	Range of bins, storage containers, hard stand, bunded and covered areas, compactors and sheds depending on the materials accepted	Usually council owned and operated by local government, though in some cases the operation of facilities has been contracted out to a private service provider
Bulk haul consolidation centres				
› Consolidation of kerbside collected materials for bulk haul transfer	› Consolidating kerbside collected materials to reduce transport costs to the appropriate facilities for sorting or disposal › Usually closed to the public › Some removal of contamination from individual streams may occur, mainly through manual sorting	Kerbside collected commingled recyclables, garden organics, combined FOGO and residual waste	Unloading bays, sheds and hard stand	Usually private, often owned by kerbside collection service provider and/or MRF operators

Function (can include)	Service provided	Materials accepted	Infrastructure	Ownership
Specific materials recovery centres				
› Unload of specific material streams › Sorting and some separation of components › Aggregation and consolidation for transfer › Some resale to public	› Market driven aggregation of materials usually either valuable to the generator or operator or not collected by kerbside collections › Predominantly located in larger towns and metropolitan areas, often catering to the non-municipal sector › Serve an important role in providing feedstocks to reprocessors › May include some removal, often manual, of contaminants and separation into individual components › May include a retail shop	Most facilities will only accept certain types of materials. For example, scrap metal yards or C&D materials or paper and cardboard. They generally do not accept residual waste.	Depends on the materials accepted and will include a range of bins, storage containers, hard stand, bunded and covered areas, compactors and sheds	Nearly exclusively owned by the private sector, sometimes by the reprocessor
Material recovery facilities (MRF)				
› Sorting › Aggregation and consolidation for transfer	› Sorting mixed streams into their constituent materials, and removing contaminants for aggregation and consolidation for transport to reprocessing facilities, export or appropriate disposal › Provide a critical role in providing feedstock for reprocessing › May include resale centres	Currently primarily kerbside collected commingled streams. Some facilities also cater for mixed streams of materials from C&I and C&D activities.	Usually a range of mechanical processes to separate materials using characteristics such as weight, size, magnetism and optical density. Also includes compactors, balers, hard stand and sheds.	Nearly exclusively privately owned

* A large network of charity collection bins and opportunity shops provide an important role in recycling textiles and other goods. Due to difficulty collecting data on how these are managed and how much is recovered, they are not included in the SWRRIP.

6.5.1 State overview

In 2015–16, there were 401 recovery facilities supporting the Victorian waste and resource recovery system. These facilities managed around 619,000 tonnes of materials. Table 6.7 lists recovery facilities by major type and region.

6.5.2 Resource recovery centres and drop-off facilities

The number of resource recovery centres has increased significantly in the last 15 years, due to population growth and the need to service communities after the closure of small landfills. The Regional Implementation Plans identified that overall the existing resource recovery centre network probably has enough capacity to meet the projected need for the next 10 years. However, some limitations need to be addressed to maintain viability and cost effectiveness, provide best practice service delivery and increase diversion of materials from landfill as guided by the SWRRIP and Regional Implementation Plans.

To this end, as outlined in Regional Implementation Plans, Regional Groups will work with local governments and industry operators to maximise the ability of the resource recovery network to service communities and maximise diversion of materials from landfill for viable recovery. Table 6.8 outlines common factors that need to be addressed to achieve this.

TABLE 6.7
NUMBER OF RESOURCE RECOVERY FACILITIES BY TYPE AND REGION

Waste and resource recovery region	Drop-off facilities	Resource recovery centres	Bulk haul consolidation centres	Specific material recovery centres	Materials recovery facilities	Total
Barwon South West	7	42	0	1	2	52
Gippsland	19	44	2	30	2	97
Goulburn Valley	0	36	1	3	1	41
Grampians Central West	5	55	3	9	2	74
Loddon Mallee	0	43	0	3	1	47
Metropolitan	4	44	2	7	12	69
North East	1	18	1	0	1	21
Total	**36**	**282**	**9**	**53**	**21**	**401**

Source: Regional Groups, unpublished data (1 June 2017).

Storage stockpiles

Regional Implementation Plans and the EPA identified that storing materials at resource recovery centres can pose risks to the community and the environment, due to:

- the time it takes to aggregate a sufficient quantity of each material stream for cost-effective transport – this varies for each material
- no viable market for a material stream, which may be influenced by transport costs and distance to reprocessing sites
- market failure or demand for the material changes, leaving facilities with stockpiles.

Materials that need to be stockpiled for a period of time to achieve economies of scale, must be stored to meet the appropriate planning and regulatory controls. Site-specific protocols are also required to minimise degradation of the material and control risks such as fire, vermin, discharges to the environment (both odours and leachate) and litter.

A summary of the gaps identified in the resource recovery infrastructure network is provided in Table 2.9.

6.5.3 Bulk haul consolidation centres

Bulk haul facilities are being established largely to reduce the cost of transporting kerbside collected materials and waste to recovery or disposal facilities. This has been driven by several factors:

- Larger amounts of commingled recyclables are required to achieve economies of scale at MRFs due to the cost of upgrading infrastructure to separate and sort a wider range of individual materials from the feedstock streams. As a result, the viability of transporting commingled materials long distances has increased. For example, the kerbside collected material from Mildura is transported to a MRF in Metropolitan Melbourne for management.
- Many small landfills in regional areas have closed and those reaching the end of their operational life in metropolitan and regional centres are being replaced with fewer and larger landfills. This has seen the need to bulk haul residual waste over greater distances to larger regional landfills. This trend will continue and will see a resulting increase in the number of bulk haul residual consolidation centres to meet this need.
- Organic reprocessing facilities have been relocated out of metropolitan areas due to the pressure of operations from residential encroachment or incompatible uses within buffer areas. This trend is likely to continue with the number of organic bulk haul consolidation centres expected to increase.

TABLE 6.8
FACTORS AFFECTING THE OPTIMISATION OF THE RESOURCE RECOVERY CENTRE NETWORK

Factor	Considerations
Optimising the location of facilities	› Need to achieve a balance between the distances residents are required to travel with cost-effective facilities that can manage sufficient volumes to be viable › Impacts on surrounding communities must be minimised › Need to meet current and projected changes in population (e.g. declining populations in rural areas and increases in peri-urban areas)
Upgrading infrastructure	› Improving the ability to consolidate material streams reduces storage requirements and transport costs › Divert more organic materials for viable reprocessing in line with the priorities of the SWRRIP and Regional Implementation Plans › Build capacity to meet the proposed landfill ban on e-waste › Build in flexibility to respond to changes in consumer goods and packaging, for example, upgrading equipment to capture increasing quantities of soft plastics used for packaging › Upgrade to increase the range of materials that can be accepted
Improve the operation of facilities	› Facilities working to achieve better practice operations and comply with regulated operating standards will provide the surrounding community with reassurance that potential impacts on community amenity, the environment and public health are minimised › Ongoing education of staff to improve performance › Reducing contamination improves the quality of feedstocks › Maximising the efficiency of operations will improve the return on investment for facility owners

The main function of these facilities is to consolidate, but opportunities to recover materials or reduce contamination at the point of consolidation should be encouraged. Benefits include:

- reducing the amount of materials requiring transport
- providing a potential additional income stream from the recovered materials
- improving the quality of the consolidated stream.

6.5.4 Specific material recovery centres

These facilities vary hugely in size, management model and materials handled. Their viability is highly dependent on the commodity value of the materials they accept. They are however, a pivotal component supporting the viability of recovery for specific material streams. The high recovery rate for metal in Victoria is largely dependent on the network of metal scrap yards across the state.

Their flexible business models also allow them to provide services for niche markets or stakeholders that find accessing more conventional services difficult. As result, services can sometimes be quite tailored to meet the specific needs of a region or area.

6.5.5 Materials recovery facilities (MRFs)

Victoria has 21 MRFs, with 12 located in Metropolitan Melbourne and receiving feedstock from metropolitan and regional areas. All MRFs are privately owned and operated. Several operators own more than one MRF across the State.

The degree to which a MRF can separate and recover individual material streams depends on the technology used and the level of contamination of the feedstock. Materials not recovered are transported to landfill for disposal, incurring a cost to the operator.

Recovering more materials often needs an upgrade of technology. The business case to support these upgrades will often require larger economies of scale resulting in larger MRFs, particularly in Metropolitan Melbourne. This has resulted in direct competition for feedstocks between regionally located MRFs and larger MRFs, particularly local government kerbside commingled contracts. Several smaller regional MRFs have already closed in favour of transporting materials to larger facilities. For example, the kerbside collected commingled materials from Mildura are consolidated at Mildura and transported over 500 km for sorting in Metropolitan Melbourne.

The Regional Implementation Plans identified that if current recovery trends and patterns continue, the existing MRF network most likely has enough capacity to meet expected demand over the next 10 years. According to the Metropolitan Plan, we need improvements to enable a wider range of materials to be sorted. If we are to increase recovery beyond business as usual recovery rates, the MRF network will need to adapt to meet this challenge. Table 6.9 outlines some of the opportunities to increase the capacity of the MRF network to recover additional materials.

A current gap in the MRF network is the ability to sort and recover materials from the residual waste stream. The Metropolitan Plan identifies establishing facilities to sort residual waste as an opportunity to increase recovery and reduce future landfill needs.

MRFs that can handle residual waste are often called a 'dirty' or 'wet' MRF due to the putrescible component in residual waste streams. As with traditional MRFs, the types of materials recovered depends on the technology installed and often expands from the traditional glass, plastic, paper and metals to include recovery of the organics component.

TABLE 6.9
OPPORTUNITIES TO INCREASE MATERIALS RECOVERY AT MRFS

Opportunities	Considerations
Improve sorting capability to reduce contamination and/or respond to changes in material streams that reflect changes in consumer patterns	› Increasing the amount of materials recovered increases return on investment and reduces disposal costs › Reducing contamination improves the quality and marketability of recovered materials › Build in flexibility to respond to changes in consumer goods and packaging, for example, upgrading equipment to capture increasing quantities of soft plastics used for packaging
Build flexibility into operations to accept additional materials from other sources	› Adapting entry points to allow both kerbside collection vehicles and emptying skip bins increases the ability to receive materials from domestic and C&I sources › Build in flexibility to take advantage of one-off sources of feedstocks to boost regular feedstock sources
Adapt to take advantage of fluctuations in commodity prices	› Increase ability to handle additional materials when commodity values are high and the capacity to store when commodity values are low › All storage must meet planning and regulatory compliance, minimise impact on the surrounding communities, public health and the environment, and not reduce the value of the material
Establish residual MRFs to increase sorting	› Increase diversion of materials including plastics, metals, garden organics and wood and timber for reuse back into the community › Technology and management practices need to handle the putrescible nature of residual waste to assure the community that impacts on the surrounding amenity, environment and public health are managed and minimised › Can be at the front end of WtE facilities
Work with generators to reduce contamination of feedstock	› Reducing contamination at the source of generation improves the quality of the feedstocks and the ability of the MRF to sort › Lowering contamination reduces the amount of residual waste and costs of disposal

6.6 Reprocessing facilities

Reprocessors use industrial processes to change the physical structure and properties of discarded materials so they can be used again by the community. Reprocessors are diverse in nature and range from facilities that dismantle and breakdown products like tyres, e-waste and mattresses into their different components to provide feedstock for further reprocessing, to facilities that melt, break up and reform materials like organics, plastics, glass and rubber to either make feedstocks for new products or reuse materials. Reprocessors are critical to the system if we are to successfully and sustainably increase recovery of valuable materials.

6.6.1 State overview

In 2015–16, an estimated 8,489,000 tonnes of material were reprocessed in Victoria at more than 160 facilities as detailed in the infrastructure schedules in the Regional Implementation Plans. Many of these facilities process one or more of the main material streams. For example, an individual facility may accept both a combined food and garden feedstock from kerbside FOGO collections and a garden feedstock from other sources.

Table 2.1 outlines the capacity gaps across Victoria, identified in Regional Implementation Plans.

Table 6.10 lists the number of facilities by region that can reprocess individual material streams. Facilities that manage multiple streams are counted for each material stream.

TABLE 6.10
VICTORIAN REPROCESSORS AND ESTIMATED TONNES MANAGED (2015–16)

Feedstock	Tonnes (estimated)[a]	Total No. of facilities[b]	Facilities		Products (indicative only)
			Region	No.	
Food organics	103,000	3	Goulburn Valley	2	Compost products and soil conditioners
			Grampians Central West	1	Stockfeed, protein meals, pellet feeds, brewer's grains and customised rations
Garden organics	429,000	11	Barwon South West	1	Mulches
			Goulburn Valley	1	Wood chips, bark, mulch, pebbles, quarry rock, aggregate, soil mix, planter box, recycled timber and soft-fall surfacing
			Grampians Central West	4	Vermicompost, Vermicast, worm tea, compost worms and compost
			Loddon Mallee	1	Mulch
			Metropolitan	4	Mulches, barks and compost
Combined food and garden organics (FOGO)	Data not available*	6	Barwon South West	3	Compost products and worm juice
			Goulburn Valley	1	Compost products and soil conditioners
			Metropolitan	2	Compost product for broadacre agriculture, horticulture, biosolids management, manure blending, fertiliser blending, land rehabilitation
Wood/ timber	204,000	10	Barwon South West	2	› High-quality heating pellets, equine bedding/living and animal litter › Recycled timber
			Gippsland	3	Mulches
			Goulburn Valley	3	Eco logs
			Metropolitan	1	Potting mix and nursery supplies
			North East	1	Softwood timber, particleboard and melamine laminated products

Feedstock	Tonnes (estimated)[a]	Total No. of facilities[b]	Facilities		Products (indicative only)
			Region	No.	
Mixed/other organics	300,000	24	Barwon South West	6	Compost and soil conditioners
			Gippsland	4	Compost for pasture improvement, land rehabilitation or beautification projects Bark, mulch and soil conditioner
			Goulburn Valley	7	Compost products, soil conditioners, pellets and bulk mulches
			Loddon Mallee	3	Compost products and fertiliser replacements and mushroom growing supplies
			North East	4	Tallow, meat and bone meal and dried blood
Paper and cardboard	1,551,000	8	Gippsland	1	Feedstock for paper manufacture
			Metropolitan	6	Food and drink packaging, mulch, cellulose spray-applied thermal installation and acoustical treatment products
			North East	1	Custom-made cardboard packaging
Glass	173,000	2	Metropolitan	2	New glass with a recycled component and glass sand product
Plastics	149,000	24	Barwon South West	1	Resins to produce items such as pot plants, garden furniture, concrete reinforcing and bar stools
			Goulburn Valley	3	Underground cable covers, garden edging and resin pellets from thin film plastics, pipe, headwalls, fabrication, feed and water troughs, bay outlets, channel stops, float stops
			Grampians Central West	1	Bollards, decking, exercise equipment, fencing, furniture, profiles, signage and wheel stops
			Loddon Mallee	2	Recycled plastic products including outdoor furniture, bollards, fence posts and decking Expanded polystyrene products including packaging, waffle pods and wall cladding
			Metropolitan	17	Resins for polyester (PET) soft drink packaging/HDPE milk bottles, wheelie bins, irrigation pipes and toner Bollards, decking, exercise equipment, fencing, furniture, profiles, signage and wheel stops Polystyrene building and insulation products, Materials for building, finishes, flooring, furniture, kitchens and bathrooms, outdoors, lighting, windows and doors. Laminated and coated plastic bags Extruded sheets and rolls and polyester (PET) strapping
Tyres and rubber	Data not available	2	Metropolitan	2	Crumb rubber and rubber granules
Metals	1,425,000	7	Barwon South West	2	Processing/selling of ferrous and nonferrous recycled metals
			Metropolitan	5	› Raw material feedstock (ferrous and nonferrous recycled metal) › Reinforcing steels, hot rolled structural, merchant bar, pipe tube, wire and rail products

Feedstock	Tonnes (estimated)[a]	Total No. of facilities[b]	Facilities		Products (indicative only)
			Region	No.	
Aggregates masonry and soils	4,093,000	51	Barwon South West	5	Recycled concrete and asphalt, brick and garden blend,
			Gippsland	13	Waffle pods, recycled brick, tile and asphalt, recycled pre-mix and decorative concrete for stock troughs, cattle grids, feed pad troughs and rural fencing
			Goulburn Valley	3	Recycled aggregate
			Grampians Central West	4	Recycled aggregate
			Loddon Mallee	2	Pre-mix concrete
			Metropolitan	22	› Road base and aggregate materials, asphalt, paving, recycled pressed bricks, roof tiles, pitches, steps and sills › Crushed rock and concrete, cement stabilised blends, wet mix, gypsum, lime, bedding sands and soils › Recycled steel, copper, aluminium, plaster, plastic, plastic film, cable, paper, cardboard, soil, empty gas bottles and batteries
			North East	2	Recycled aggregate
Textiles	2,000	3	Barwon South West	2	Metals melted down, foam recycled into carpet underlay and timber processed into reusable woodchip
			Metropolitan	1	Mattress and base demanufacturing and all components separated for reuse in other products
E-waste	Data not available	7	Barwon South West	1	Collection and disassembly of e-waste, e.g. television and computer parts are recycled
			Grampians Central West	1	
			Metropolitan	5	
WtE (using a variety of feedstocks)	Data not available	9	Gippsland	2	Generating powering
			Goulburn Valley	1	Energy using an anaerobic digester
			Grampians Central West	2	Heat for hydronic heating system
			Metropolitan	2	› Heat used in the production of manufactured timber products › Electricity
			North East	2	Heat used in the production of manufactured timber products

*Estimates at date of publication are that up to 7,000 tonnes have been collected

a *Victorian Recycling Industry Annual Report 2015–16*

b Numbers represent the number of facilities that can manage individual material streams. Facilities that manage multiple streams are counted for each material stream.

Source: Regional Implementation Plans, unpublished data (2016).

6.7 Residual waste management

A range of infrastructure and technologies provide opportunities to recover additional materials or resources from residual waste. What can be recovered and what products can be made vary and most have some material remaining that must be disposed of to landfill, though it is vastly reduced in volume.

Most opportunities focus on two main areas:

1. Better sorting of the residual waste stream to extract recoverable materials before landfilling

   This includes pre-sorting at landfill sites to remove materials such as metals, wood and timber, and aggregates, masonry and soils. The sophistication of pre-sorting infrastructure will vary from site to site and new technologies continue to emerge.

   As discussed in Section 6.5.5, residual MRFs (also called 'dirty' or 'wet' MRFs) can sort putrescible residual waste while diverting materials including plastics, metals, garden organics and wood and timber. Once separated, the materials can be managed as individual streams.

2. Treating residual waste to produce energy and energy products, such as heat and biofuels

   As previously discussed in Chapter 5, WtE processes may play a role in reducing reliance on landfill. It is important to note that incineration, or the use of other thermal technologies without energy or material recovery, is not considered WtE. They remove the opportunity to recover value from residual waste and have been identified as a form of infrastructure that is inconsistent with achieving of the goals of the SWRRIP.

6.7.1 Opportunities to increase recovery from the residual waste stream

Aside from some pre-sorting at landfills, usually on a manual scale, there is currently minimal additional recovery from the residual waste stream We are likely to see an increase over the life of the SWRRIP, driven by the need to recover more materials and to reduce landfill airspace requirements.

The Metropolitan Implementation Plan identifies residual waste processing as an opportunity to reduce reliance on metropolitan Melbourne landfills. However, as identified in the Plan, investment in the required infrastructure would need to:

- secure suitably zoned land
- secure long term supply of feedstock
- develop a business case that is competitive with gate fees at landfills
- ensure long term markets for the products including energy products generated.

Because of these, any initial projects are likely to be small to medium in scale and linked to distributed energy networks where the energy produced is used onsite or locally.

6.8 Disposal infrastructure (landfills)

Historically, landfills have played a necessary role in the sanitary management of wastes. Reducing our reliance on landfills is one of the goals of the SWRRIP. However, until full recovery can be achieved, landfills will continue to be required to protect the environment, public health and our communities. They will only be used for managing potential adverse impacts from the waste and materials that cannot be viably recovered or may arise from events such as fire and floods.

6.8.1 Regulation of landfills

Modern landfill management is vastly different from the past. This reflects greater community expectations that any adverse impacts from managing waste are minimised and managed to protect community amenity, the environment and public health. As a result, they are strongly regulated and controlled through all aspects of their life from design, construction and operation and during rehabilitation when they no longer accept waste.

All landfill sites must adhere to requirements in the EP Act. This includes adhering to EPA's *Waste Management Policy (Siting, Design and Management of Landfills)* (the landfill WMP). The materials accepted by landfills must be in accordance with the relevant EPA licence conditions, or, in the case of licence-exempt sites, the broader regulations.

Under the EP Act, the EPA must refuse to consider an application for works approval for a new landfill (except for private (own waste) landfills – see table 6.11), if the landfill is not provided for in the proposed sequence for the filling of available landfill sites in the Schedule to the Regional Implementation Plan.

In accordance with the landfill WMP, an operator can apply for a landfill site licence exemption. Operators of sites exempt from licensing should use EPA's *Landfills Exempt from Licensing Guideline* (Publication number 1563, April 2014) to demonstrate compliance with the Landfill WMP. This guideline provides direction on siting, design, operation, rehabilitation and aftercare of small municipal landfills that are exempt from holding an EPA licence.

Landfill sites issued with a works approval or licence must comply with the *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills* (Landfill BPEM). The landfill BPEM sets out the objectives and outcomes for all licensed landfills which accept fill: putrescible, solid inert and prescribed industrial wastes.

Licensed landfill operators need an auditor to acknowledge that the design and construction of new cells and landfills complies with the landfill BPEM. Operators must allow sufficient time to design, construct and obtain approvals for new cells to ensure ongoing provision of adequate airspace; this can take up to 18 months. In the past, this process has taken longer than expected and has led to less-than-optimal temporary arrangements such as overfilling of existing cells and transporting some waste to another landfill.

The EPA monitors landfill operators to ensure compliance with the EP Act. Operators of landfill sites who fail to comply with legislation can face prosecution. Adherence to legislative requirements ensures Victoria's current and future facilities and waste services are well sited, well built and operated at the highest standards, ensuring the community amenity, environment and public health benefits expected by Victorians.

Wastes accepted at landfills are classified under regulations based on the level of risk they pose and are only allowed to be deposited in landfills that are designed, constructed and operated to manage these risks. Table 6.11 lists the general types of landfills, all of which are regulated by the EPA. EPA regulations and policies can be found on the EPA website at **www.epa.vic.gov.au**

TABLE 6.11
TYPES OF LANDFILLS IN VICTORIA

Type of landfill	General description
Solid inert	› Can accept solid inert waste, such as soils, composite building materials, etc., largely from the C&D sector, which does not readily decompose and therefore generates low levels of landfill gas, odour and leachate › May be licensed to accept some hazardous but inert materials that pose manageable risk, such as low-level contaminated soil (Category C prescribed industrial waste) and asbestos contained in accordance with regulations
Putrescible	› Accept a range of non-hazardous materials, including food and garden organics › Organic materials decompose, generating landfill gas, odour and landfill leachate which is managed by significant infrastructure › May be licensed to accept contaminated soils which are Category C (low-level) prescribed industrial waste and asbestos (in accordance with regulations)
Prescribed industrial waste	› Accepts a range of materials including putrescible materials and Category B prescribed industrial waste
Landfills exempt from licensing	› Sites which are occupied by a municipal council and serve less than 5,000 people › Accept a range of wastes including putrescible and solid inert as per the landfill WMP, the Environment Protection (Scheduled Premises and Exemptions) Regulations 2007 (Vic.) and the EP Act
Private (own waste)	› Privately owned sites that only receive wastes that consist of substances owned by the owner of the site › These sites are not approved to accept waste from external sources and are not sequenced in the Regional Implementation Plan infrastructure schedules › The SWRRIP does not consider these landfills as part of Victoria's waste and resource recovery system

6.8.2 State overview

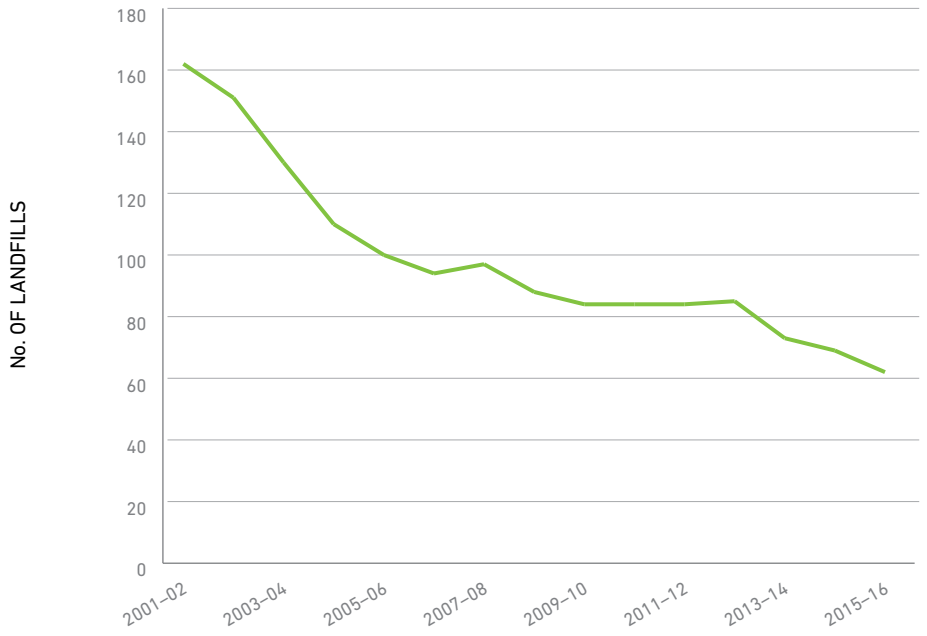
In 2015–16, Victoria's landfills managed around 4,184,000 tonnes of waste and materials. Around another 424,000 tonnes of prescribed industrial waste went to licensed landfills throughout Victoria. Much of this was Category C contaminated soil.[7]

There are 72 landfills operating in Victoria; 47 licensed landfills and 25 landfills exempt from licensing.[8] All landfills exempt from licensing are located in regional Victoria.

Figure 6.2 shows the steady decrease in the number of licensed landfills and landfills exempt from licensing in the past 15 years. This is due to:

- improved transport infrastructure, reducing cost of transport
- increased cost of operating landfills associated with increased regulatory requirements for environmental performance of landfills and levies, leading to waste being transferred to larger regional facilities with greater efficiencies and lower costs due to economies of scale
- local governments choosing to close landfills after assessing current and long term costs, benefits and risks associated with operating and rehabilitating landfills.

FIGURE 6.2
TRENDS IN THE NUMBER OF LANDFILLS (2001–02 TO 2015–16)



Source: *Victorian Local Government Annual Waste Survey Reports* 2001–02 to 2015–16

Note: No data was collected for 2003–04. The trend was extrapolated from existing data.

7 Sourced from landfill levy data 2015–16. Note that infrastructure to manage PIW is not considered in the SWRRIP except in relation to its impact on landfill airspace and is not discussed in detail. Information on managing PIW can be found on the EPA website at www.epa.vic.gov.au

8 Regional Groups, unpublished data (1 June 2017).

6.8.3 Operating landfills

Maps of all the operating landfills in Victoria can be found on the SV website at **www.sustainability.vic.gov.au**

Table 6.12 lists licensed landfills and landfills exempt from licensing by waste and resource recovery region at 1 June 2017.

There are another 10 private (own waste) landfills which receive waste exclusively from a single source, usually the owner/generator. These are managed separately by the EPA and are not included in the SWRRIP.

Most licensed operating landfills in regional Victoria are owned by local governments. These landfills tend to be smaller than those in the metropolitan region. The most notable exception is the privately owned, solid inert Maddingley Brown Coal Landfill in Bacchus Marsh in the Grampians Central West region that accepts industrial waste almost exclusively from Metropolitan Melbourne.

TABLE 6.12
NUMBER OF OPERATING LANDFILLS BY REGION (JUNE 2017)

	Licensed landfills			Landfills exempt from licensing	Total
	Local gov't owned	Non-local gov't owned	Total no. of licensed landfills		
Barwon South West	4	1	5	1	6
Gippsland	6	2	8	2	10
Goulburn Valley	4	1	5	0	5
Grampians Central West	2	2	4	12	16
Loddon Mallee	5	0	5	8	13
Metropolitan	4	14	18	0	18
North East	2	0	2	2	4
Total	**27**	**20**	**47**	**25**	**72**

Note: All landfills exempt from licensing except for one are owned by local government.

Source: Regional Groups, unpublished data (1 June 2017).

6.8.4 Waste materials accepted at landfills

Landfills are only allowed to accept materials in accordance with their licence and the EP Act. For example, if a landfill is licensed to accept solid inert waste, it cannot accept putrescible waste. Within the limits of their licence, it is at the discretion of the operator as to the wastes they will accept. Some may make operational decisions not to accept certain waste streams even though they are allowed to under their licence.

Table 6.13 outlines the categories and the number of landfills that can accept each type of waste. Landfills exempt from licensing can accept a range of materials including putrescible and inert waste as per the landfill WMP and EP Act.

The EPA sets the standards for the types of waste an existing landfill can accept. All prescribed industrial waste intended for landfill disposal must be classified into one of three categories, depending on the level of hazard. Category A is the highest hazard and Category C the lowest. Category A wastes must be treated and cannot be accepted at any landfill.

In Victoria, only one landfill is licensed to accept Category B prescribed wastes. Other landfills across the state are licensed to accept certain Category C (low-hazard) prescribed wastes, for example, low-level contaminated soil, packaged asbestos and odorous wastes such as those from seafood processing.

Asbestos

Asbestos is a hazardous material widely used historically in products such as building materials, carpet and underlays and window putty. While the use of asbestos containing materials is now banned, there remains a legacy issue relating to its safe removal, collection and disposal.

Asbestos cannot currently be recovered safely and must be disposed of to a landfill licensed to accept it. Commercial quantities must be managed in accordance with the *Environment Protection (Industrial Waste Resource) Regulations 2009*. Many of the landfills licensed to accept asbestos, also collect and dispose of solid inert waste. Table 6.13 identifies the number of landfills able to accept domestic and commercial quantities of asbestos. Details of their locations can be found in the relevant Regional Implementation Plans.

A preliminary analysis of the infrastructure needed to manage asbestos undertaken for SV[9] identified that:

- it is highly likely that significant amounts of asbestos waste will continue to be generated over the term of the SWRRIP
- over the life of the SWRRIP, there is likely to be a need for additional licensed landfill airspace for the safe disposal of asbestos
- the safe disposal of asbestos sourced directly from households (not through commercial providers) will rely on a support network of resource recovery centres and transfer stations that can collect and store it until it can be safely transported to an appropriate landfill
- commercial quantities, for operational issues are best disposed of directly to appropriately licensed landfills
- owners and operators of asbestos handling facilities face a set of barriers including difficulties in obtaining public liability insurance, the lack of a standard set of operating procedures and staff and public concerns about the potential risks from exposure to asbestos onsite.

Managing asbestos over the life of the SWRRIP will require maintaining (or enhancing) a network of appropriately licensed landfills that provide ready access for asbestos disposal. This could be built on the existing network of landfill infrastructure. The Government will continue to guide this process through statewide planning processes.

TABLE 6.13
TYPES OF WASTE ACCEPTED AT LANDFILLS ACROSS VICTORIA

Type of waste		No. of landfills able to accept this material[a]
Solid inert waste		72
Putrescible waste		57
Asbestos (domestic quantities only)		8
Prescribed industrial waste	Asbestos (commercial quantities only)	1
	Asbestos (commercial and domestic quantities)	20
	Category C (licence specific)[b]	19
	Category B (licence specific)[b]	1

a Under licence conditions as at 1 June 2017.

b Can only accept the specific Category B or C wastes listed in their current EPA licence.

9 Sustainability Victoria, *Analysis of Victorian infrastructure for waste asbestos*, prepared by Randell Environmental Consulting (unpublished), Melbourne, April 2017.

6.8.5 Future planning and scheduling

Planning for future landfills requirements must ensure that there is enough landfill airspace to protect the environment, public health and community from potential adverse impacts from the wastes and materials that cannot be viably recovered or may result from events such as fires and floods. However, planning also needs to balance this with the government's policy objective that "the development and use of landfills for the management of waste in Victoria be minimised" (Landfill WMP).

An important planning tool for landfills is the Infrastructure Schedule Part B (Landfill) required under the EP Act as a component of each Regional Implementation Plan. The purpose of this schedule as outlined in the Ministerial guideline (2014)[10] made under EP Act 50CA for making Regional Implementation Plans includes to:

- ensure each region has sufficient landfill capacity to ensure the safe and sanitary disposal of wastes that are not recovered, for at least the next 10 years
- minimise the development and use of landfills for managing waste in Victoria as per section 9(3) of the landfill WMP
- propose the sequence for filling available landfill sites for at least the next 10 years
- estimate the intended or likely closure date for landfills listed in the schedule
- ensure that future landfill capacity needs are planned so that appropriate buffers are known and defined, allowing for sound planning decisions on land development in the vicinity of any new landfills listed in the schedule.

To develop the schedule, the Regional Groups must determine if their region has sufficient airspace capacity to meet the expected needs for at least the next 10 years. To do this, the Groups undertook a consistent statewide process to meet their legislative requirements and in line with SV's supporting guideline, *Outline of Process: Supporting Guideline: Statewide Waste and Resource Recovery Infrastructure Scheduling*[11]. This comprehensive analysis identified the airspace required to manage the tonnes of residual waste and examined the adequacy of projected availability of airspace in and beyond the region to meet this need.

The key factors considered for each region as part of this assessment include:

- the tonnes of waste currently going to existing individual landfills from their own and other regions
- the projected tonnages of residual waste likely to need landfilling in the next 30 years
- information from owners and operators of individual existing landfill sites on airspace availability, land use planning status, compaction rates and future plans
- contingency requirements including options available in the event of natural disasters or the unexpected closure of facilities in their own or other regions
- accuracy and verification of information available and the impact of data gaps on the assessment.

Appendix 4 includes a more comprehensive list of the factors considered by each Regional Group when undertaking their landfill needs assessment. Further information on each regions assessment can be found in the relevant Regional Implementation Plan.

Overall, it was found that Victoria has sufficient landfill airspace for the next 10 years, subject in some instances to the approval or expansion of existing sites. Loddon Mallee identified that additional airspace was needed to service their region. Their scheduling process identified that this need could be met through planned expansions to existing landfills and they worked with other regions to ensure that these options were included on the appropriate schedules.

In addition, Regional Groups are responsible for developing contingency plans to ensure their region has sufficient landfill and resource recovery capacity to accommodate an emergency or unexpected event. Circumstances can change, for example – increased recovery can reduce the need for landfill or emergency events may affect capacity at one or more sites. In addition to an annual review of contingency plans, Regional Groups have committed to review the infrastructure schedules within five years to ensure that adequate capacity is available and to give industry time to respond should a new landfill be required in Victoria.

10 Department of Environment, Land, Water and Planning, *Guideline: Making, amending and integrating Statewide Waste and Resource Recovery Infrastructure Plan and Regional Waste and Resource Recovery Implementation Plans*, Melbourne, 2014.

11 Sustainability Victoria, *Outline of Process: Statewide Waste and Resource Recovery Infrastructure Scheduling*, Melbourne, 2015, viewed on 26 October 2017 <sustainability.vic.gov.au/our-priorities/statewide-waste-planning/2015-2020-priorities/regional-waste-and-resource-recovery-implementation-plans>.

6.8.6 Future trends

In the long term, we expect the number of smaller licensed landfills and landfills exempt from licensing to decrease in favour of a move towards the use of larger regional landfills.

As outlined in the Regional Implementation Plans, no additional landfill airspace is required to meet the expected needs for the next 10 years. To ensure that that there is a planned and timely approach to landfill, Regional Groups will be regularly reviewing landfill capacity (as previously described) and if at some point in the future a new landfill was determined to be required, it will need to:

- respond to a demonstrated need for additional airspace to service one or more regions
- operate to maximise diversion of materials that can be viably recovered
- be sited to comply with all legislation and regulations
- be larger to attract the economies of scale required to support increased management costs to meet community expectations and BPEM requirements.

As discussed, landfills are facing increased management costs to meet community expectations and best practice management requirements. Consequently, many local governments are reviewing the financial viability of their landfills, particularly small landfills in regional Victoria.

This is supported by EPA research in 2012–13 which looked at financial modelling of operations at individual sites under several potential future scenarios.[12] It also took into account the environmental risk profile of each site. The research showed that, as a rule, operating costs were likely to be higher if a landfill:

- has shallow cell depth
- accepts less than 25,000 tonnes per year
- only accepts waste from their local area.

Local governments operating landfills with these characteristics may assess the options that will best meet the service needs for their community while providing the best outcomes to the community, local government and state. In some situations, better outcomes may be achieved by transitioning sites to resource recovery and consolidation activities before transporting material streams for reprocessing or to larger landfills. While the decision to maintain a local landfill lies with the operating local government, such decisions need to be informed by appropriate research.

6.8.7 Closed landfills

The Regional Implementation Plans identified 497 landfills that have closed over the last 30–50 years in Victoria. These sites continue to pose environmental risks for a significant period after waste acceptance has ceased. Possible risks include:

- contamination of groundwater, stormwater or surface waters with leachate, a liquid formed by rainwater and decomposing waste
- migration of landfill gas, formed during the decomposition of waste, into the surrounding ground and atmosphere, causing odours
- inappropriate or incomplete capping, leading to infiltration of rainwater that generates large volumes of leachate
- insufficient assessment of risk due to a lack of appropriate ongoing aftercare management, maintenance, monitoring and reporting.

To reduce these risks, EPA requires the holder of the duty of care, usually the occupier of the site, to undertake ongoing aftercare until the site no longer poses a risk to the community, the environment or public health. The period for aftercare management (from when a site is closed) is a minimum of:

- 10 years for sites exempt from licensing
- 30 years for licensed sites.

Rehabilitation and aftercare management requirements for landfills exempt from licensing are listed in *Landfills Exempt from Licensing Guidelines* (Publication number 1563, April 2014).

EPA requires operating licensed landfills to be progressively rehabilitated in accordance with the landfill BPEM. During the post-closure phase of the landfill, the landfill WMP requires operators to undertake ongoing management of a landfill site including leachate and gas extraction operations. Once a landfill stops receiving waste and is in the aftercare phase, EPA issues a supporting pollution abatement notice (PAN) to develop rehabilitation and aftercare management plans. Once these plans have been submitted, EPA issues a post-closure PAN and the licence can be revoked.

The post-closure PAN sets out EPA requirements for monitoring, auditing and managing the landfill site post-closure and typically applies for at least 30 years. Post-closure PANs vary according to the risks the landfill poses to the local community and environment. Detailed information about post-closure PAN requirements can be found in the EPA's *Closed Landfill Guidelines* (Publication number 1490, December 2012).

As identified in Regional Implementation Plans, the EPA and Regional Groups will work with duty holders to identify further closed landfills and take a risk-based approach to ensure their rehabilitation to protect communities and the environment from adverse impacts.

12 Environment Protection Authority, *Rural Landfill Risk Assessment Report*, 2013 (Unpublished)

7. Appendices

7.1 Appendix 1: Economic and transport modelling methodology

The following outlines the methodologies used for the economic and transport analyses as discussed in section 2.6.

The study follows a two-way economic framework by combining a 'transport model' and an 'economic model'. In the transport model, the study used waste recovery and projected landfill data, land use (population and employment), facility information and open and close dates, to obtain outputs based on the quantities of waste and materials:

- sorted by region and by material
- recovered by region, by material and by year
- going to landfill by region, by material and by year.

In the economic model, an 'investment schedule' was developed using these transport model outputs, to determine the type of plants needed, the appropriate time and region to build the facility and the facility size. This approach sets out an infrastructure investment case. We then tested the responsiveness of the various material streams to changes in the cost of processing to obtain elasticities of recovery with respect to the net cost of processing (costs less benefits such as avoided landfill). These elasticities were used to inform possible interventions.

Transport

A Waste Transportation Model (WTM) was developed to estimate and map the flow of resources from each material stream across the State under different conditions or scenarios. The WTM estimates the total distance (kilometres) and hours travelled by material streams for Melbourne and regional Victoria, at a local government level. Additionally, the WTM is used to identify opportunities to increase resource recovery through improvements in transportation and operational procedures.

The WTM is an estimate of the movement of waste throughout Victoria, based on a set of reasonable and logical assumptions, which estimates where producers of waste are more likely to dispose of waste material 'all things being equal'.

It does not consider individual companies producing waste (it uses total employment of a particular type within a local government area), so it cannot determine the level of mixture, quality or cleanliness of each waste stream. It also does not consider commercial arrangements between producers and consumers of waste, nor how individual recovery facilities set their gate fees.

The WTM has been developed and implemented in Visual Basic for Applications in Microsoft Excel. Microsoft Excel was chosen because it allows for easy specification and storage of data and linking outputs to the economic analysis. It is also scalable, and allows for different zoning systems, waste streams, employment classifications, waste sources, calibration factors and testing parameters to be easily specified. The workbook structure also allows simple navigation from input to output tables.

The structure of the WTM is similar to traditional Freight Transportation Models. However, the WTM was modified due to differences in logistics chains between the two models. The structure of the WTM is listed below:

Generation

The WTM estimates the amount of waste by area, using population and employment data. Unlike traditional models, however, individual rates are not pre-calculated.

Distribution to landfill

Estimates the cost of transport and disposal for each material stream for each source of waste (C&I, C&D and municipal) and each local government area. Unlike a traditional Freight Transportation Model, which distributes to where the freight is required, the WTM assumes that the business will select the closest landfill to their current location. This may be in the same local government area, or an adjoining one if none in the current area.

Distribution to recycler

Considers that instead of the waste being transported and disposed of at landfill, it is transported and disposed of at a recycler, either direct to recycler or via sorting or aggregation facility. This step calculates the cost of transport and delivery to the recovery facility for each waste stream, source and local government area combination.

Disposal choice

The WTM must decide whether it is more economical for a business producing waste in a particular location to landfill it or to transport it for recovery.

If for a particular waste stream and location, the transport and disposal cost is significantly lower for the landfill option, then it is likely to be landfilled; conversely, if significantly more expensive to landfill, it is likely to be recycled.

Assumptions and constraints

- Estimated gate fees were used where actual gate fees were unavailable for individual sites
- Estimated contamination rates for each material stream were used where data was unavailable
- The assessment period is 2016 to 2046
- Two truck sizes were considered for transporting materials
- The WTM does not consider individual companies producing waste; it uses total employment of a particular type within a local government area
- Conclusions depend on the robustness of the data; the data used in the model is subject to variation
- At the time of development, employment information was only available at local government area level from ABS at ANZSIC Level 1 for the 2011 Census year. The model can be updated as newer census data is available.

TABLE 7.1
TRANSPORT MODELLING DATA INPUTS

Data input	Source
Waste recovery and landfill projections by region, year and material stream	SV's Waste Projection Model incorporating data from SV's Victorian Recycling Industries Annual Report; EPA's landfill levy data; Victoria in the Future population projections; and SV's 2009 Landfill Audit Composition Study
Landfill and resource recovery facility data: GIS coordinates, facility type and material processed, gate fees (where available)	SV, waste data (2017)
Regional Implementation Plans	The seven Regional Groups in 2016 and 2017
Land use, sector employment and population data	SV and Australia Bureau of Statistics (2011) using ANZSIC level 1
Local government areas	
Estimation of travel distances and times	Aurecon data
Truck sizes, loading and backloading data	Aurecon data
Recovery efficiencies, input/output conversion, percentages to local markets, interstate and for export	SV, 'Greenhouse Gases from the Victorian waste sector', prepared by Randell Environmental Consulting (unpublished) 2017

Economics

The economic component of this study looks at the economic benefits and costs of investing in waste infrastructure to help inform investment decisions on recovering different waste streams in Victoria.

It evaluates the economic viability of the projects proposed to improve recovery by:

- examining the likely benefits and associated costs of a proposed project using a cost–benefit analysis economic appraisal framework
- presenting the implications of a change in the net cost of processing (modelled using a notional gate fee).

The economic assessment methodology follows the economic evaluation guidelines developed by the Victorian Department of Treasury and Finance.[15] The main steps in the cost–benefit analysis are to:

- define objectives and scope
- determine the base case and develop options
- identify and quantify costs and benefits
- discount future costs and benefits
- calculate decision criteria
- assess risk and uncertainty by undertaking sensitivity tests
- identify a preferred option and potentially undertake a detailed analysis.

Four options or cases were appraised as part of the study:

1. **Business as usual case**: calculates the overall resource landfill diversion rate achievable under current projections.
2. **Infrastructure case**: calculates recovery of the different material streams using a possible (defined) investment schedule. This is a core case used to test sensitivities to parameters, such as overall costs and the rate of cost reductions achieved.
3. **Difference case**: explains how variations to the infrastructure investment case were used to test responsiveness of landfill diversion rates to changes in net cost of processing. The responsiveness is expressed as 'materials recovery elasticities' around the infrastructure investment case. These elasticities only hold close to the recovery levels of the infrastructure investment case – that is, without spending any additional capital. Technically they are 'short run' elasticities that assume fixed infrastructure capacity.
4. **Combined case**: a variation of the infrastructure case which considers WtE for recovery of food organics and residual materials. Anaerobic digestion is considered as a substitute for composting and gasification, and combustion is used for recovery of residual materials streams.

TABLE 7.2
ECONOMIC MODELLING DATA INPUTS

Data input	Source
Estimated capital costs for Waste to Energy facilities	Market research, SV (2017)
Estimated value for recovered materials,	Market research, SV (2017) and Aurecon (2016)
Sector employment data, Employment in waste management and recycling	Access Economics (2009)
Landfill and resource recovery facility data	Regional Implementation Plans (2016 and 2017)
Survey data	Victorian Recycling Industries Annual Report 2015–16
Data on carbon emissions	SV (2017) 'Greenhouse Gases from the Victorian waste sector', prepared by Randell Environmental Consulting (unpublished)
Economic indicators	Economic Aspects of the Zero Waste South Australia strategy, EconSearch Pty Ltd (February 2014)
Outputs from the WTM	Refer table 7.1

15 Department of Treasury and Finance, Economic evaluation for business cases technical guidelines, Melbourne, August 2013, viewed on 26 October 2017 <dtf.vic.gov.au/Investment-Planning-and-Evaluation/Investment-professionals-toolkit/Economic-evaluation-guidelines>.

Model assumptions and constraints

The following parameters were used in this economic assessment:

- Base year is 2016–17
- The assessment period is 2016–17 to 2045–46, with benefits projected across a 30-year period
- A base discount rate of 7 per cent was used, in line with Department of Treasury and Finance guidelines, as the investments are considered Category 2 for this study (traditional government service delivery, where benefits are easily translated into monetary terms)
- Sensitivity tests using discount rates at 4 and 10 per cent.
- Costs and benefits are calculated in real (not CPI-escalated) and pre-tax dollar terms
- The economic analysis excludes taxes and subsidies from the costs and benefits, because taxes and subsidies are transfers between economic agents, and they do not typically represent resources used in consumption or production activities.
- The economic model does not consider individual companies or businesses to estimate the level of waste generation in a local government area. It uses employment and population data to estimate waste generation at a local government level.
- Conclusions depend on the robustness of the data; the data used in the model is subject to variation.

7.2 Appendix 2: Land use planning and waste planning framework infrastructure categorisation

TABLE 7.3
LAND USE PLANNING AND WASTE PLANNING FRAMEWORK INFRASTRUCTURE CATEGORISATION

SWRRIP and Regional Implementation Plan infrastructure type	Victorian Planning Provisions	
	Definitions (Clause 74)	Clause 52.10
Reprocessing infrastructure Other reprocessors	Industry – Materials recycling Land used to collect, dismantle, treat, process, store, recycle or sell used or surplus materials	Advanced resource recovery technology facility
		C&I materials recycling
		C&D materials recycling
		Used metals treatment or processing
		Used paper and cardboard treatment or processing
		Used plastics treatment or processing
		Other resource recovery or recycling operations
Reprocessing infrastructure Organic reprocessing facility		Composting and other organics materials recycling
Reprocessing infrastructure WtE facility	› Renewable energy facility › Land used to generate energy using resources that can be rapidly replaced by an ongoing natural process. › Renewable energy resources include the sun, wind, the ocean, water flows, organic matter and the earth's heat. › It includes any building or other structure or thing used in or about the generation of energy by a renewable resource. › It does not include a renewable energy facility principally used to supply energy for an existing use of the land	Combustion, treatment or bio-reaction of waste to produce energy
Resource recovery infrastructure Resource recovery centres/transfer stations	Industry – Transfer station Land use to collect, consolidate, temporarily store, sort or recover refuse or use materials before transfer for disposal or use elsewhere	› Refuse and used material storage, sorting and recovery in a transfer station: › Accepting organic material › other
Resource recovery infrastructure Materials recovery facility		
Disposal infrastructure Landfill	Industry – Refuse disposal Land used to dispose of refuse, by landfill, incineration or other means	Sanitary and garbage disposal in landfill
Disposal infrastructure Incinerator		

Note:
Clause 74 of the VPP lists terms used in relation to the use of land. All waste and resource recovery activities are nested under the headline use of 'Industry'.
Clause 52.10 lists uses with amenity impacts, some of which are relevant to waste and resource recovery activities.

7.3 Appendix 3: Process for review, inclusion, expansion, downgrading and removal of hubs

Hub criteria

Table 7.2 provides the cascading criteria for waste and resource recovery hubs and underpins the classification of hubs in the SWRRIP and Regional Implementation Plans.

Hubs are dynamic and likely to change as they develop over time. The relevant Regional Group will work with local government, industry and communities to build a shared understanding of the strategic role and function of each hub and create a common vision that will help identify and determine their development over time. For hubs of state significance, this will involve SV.

TABLE 7.4
CASCADING CRITERIA FOR WASTE AND RESOURCE RECOVERY HUBS

Level	Criteria
State importance	› The hub manages or processes a significant proportion of one or more material streams for the state. › The type of materials managed or reprocessed at the hub are of economic value to the state's economy or pose a significant risk to economic, community, environment and public health outcomes if not recovered. › It is an existing hub with established spokes for one or more materials. It is an integral component of the supply and/or processing chain across multiple regions or the state. If the functionality of the hub was compromised, it would put pressure on the viability of upstream or downstream industries. › The hub has access to generators, markets, ports or transport infrastructure. › The hub is in a location compatible with waste management and resource recovery activities and has capacity for future waste management and resource recovery activities.
Regional importance	› The hub manages or processes a significant proportion of one or more material streams for the waste and resource recovery region or adjacent regions. › The type of materials managed or reprocessed at the site are of economic value to the region or adjacent regions or pose a significant risk to economic, community, environment and public health outcomes if not recovered. › It is an existing hub with established spokes for one or more materials. If the functionality of the site was compromised, it would put pressure on the viability of upstream and downstream industries within the region. › The hub is in a location compatible with waste management and resource recovery activities and has capacity for future waste management and resource recovery activities. › The hub enables aggregation or consolidation of material streams from within the region or adjacent regions before transporting to a regional hub for reprocessing or disposal. › The hub may facilitate some reprocessing within or near the region.
Local importance	› The hub manages or processes a significant proportion of one or more material streams for the local community. › The hub is an integral component of the local infrastructure. If the functionality was compromised, it would reduce the ability of the local community to manage its waste streams and recover resources. › The hub enables aggregation or consolidation of material streams at the local level before transporting to a regional or state hub for reprocessing or disposal. › The type of materials managed or reprocessed at the site might be of economic value to the local community or pose a significant risk to economic, community, environment and public health outcomes if not recovered.

Review of hubs of state importance

The process in Table 7.3 outlines reviewing and assessing hubs of state importance.

This review process, and any forward planning regarding hubs, should consider the following:

- What activities currently occur at the hub?
- What are the community expectations around the future of the hub?
- What are the implications of reducing or ceasing activities at the hub?
- How would this affect provision of cost-effective services to the local community and the state? How would this affect the material streams currently being managed or recovered at the hub? What is the cost to the local community and the state?
- Should the hub be expanded or transition to other waste and resource recovery activities more compatible with community expectations or even to completely different land uses?
- What are the implications of expanding the hub? What are the potential economic benefits? What are the possible impacts to the community, environment and public health?
- Does the site have the appropriate buffers to provide long term viability?
- Is it appropriate to preserve the site in planning schemes for the long term?
- What value does the hub currently provide and what is the predicted value in the future?

Suitable justification for including or downgrading a site of state significance may include, but is not limited to, consideration of the following information:

- site/s location
- business plans
- availability of feedstocks if required, including from other regions
- likely volumes of materials to be processed, end products and proposed uses for materials
- strategic plans and future planning scheme amendments for the development of an area or site
- an assessment of adjacent land uses as they relate to the site or hub
- site plans where applicable
- any reasons why a site or sites should be considered for inclusion or downgrading.

Local government, or operators of facilities, may consider that a hub needs review in terms of status and/or a change in the description. In this case local government or operators should discuss with the relevant Regional Group and indicate that the hub should be the subject of a review at the appropriate time.

TABLE 7.5
PROCESS FOR REVIEWING AND ASSESSING HUBS OF STATE IMPORTANCE

Process step		Detail
1	Assessment	The relevant Regional Group and local government will assess land uses and infrastructure associated with each hub of state importance during the SWRRIP five-year review.
2	Potential change in status identified and key stakeholder consultation	› If the function of a hub is no longer in line with its level according to the cascading selection criteria in Table 7.2, the Regional Group will consult other government agencies, SV and the relevant council, and industry operator/s (where relevant) to determine an appropriate course of action. › The Regional Group may identify that an emerging area has demonstrated significant importance to Victoria, in which case the Regional Group will consult with SV and other stakeholders to determine if a new hub of state significance should be included. › As part of its review, or in relation to priority actions and policy directions at the state level, SV may also identify potential new hubs of state significance, or propose that a hub is no longer of state significance; in either case SV will work with the relevant Regional Group to begin the consultation process with key stakeholders.
3	Public Consultation	Having determined that a change in status is appropriate to reflect the function of the hub in the waste and resource recovery system, the SWRRIP consultation requirements will take effect, involving engagement with relevant industry and stakeholders, local government and the community.
4	Amendment to SWRRIP	The changed state is represented in the gazetted SWRRIP, if approved by the Minister.
5	Amendment to relevant Regional Implementation Plan	The relevant Regional Implementation Plan is updated to reflect the changed state.

7.4 Appendix 4: Data sources, data considerations and modelling

Data sources

Table 7.4 details the main data sources used for the SWRRIP. Data sources are referenced throughout the SWRRIP where appropriate. There may be small disparities between the figures in the SWRRIP and other published data due to assumptions underpinning the data and changes in the methodologies for reporting the data. Where possible these have been noted and caution is advised when comparing data.

TABLE 7.6
MAIN DATA SOURCES FOR THE SWRRIP

Data source	Description
Victorian Local Government Annual Waste Services Report 2015–16 Retrieved from www.sustainability.vic.gov.au/Government/Victorian-Waste-data-portal/Victorian-Local-Government-Annual-Waste-Services-report	› Annual data on materials collected through local government kerbside collection systems and published by SV. All 79 local governments in Victoria participate. The report provides trending data on recyclables, organics, residual waste, hard waste and litter. › The SWRRIP uses report data from the financial year 2015–16. › The report is available at **www.sustainability.vic.gov.au** › Previously known as the Victorian Local Government Annual Survey.
Victorian Recycling Industry Annual Report 2015–16 (VRIAR) Retrieved from www.sustainability.vic.gov.au/Government/Victorian-Waste-data-portal/Victorian-Recycling-Industry-Annual-Report.	› Annual data collection measuring tonnages of materials diverted from landfill by major reprocessors in Victoria. Used to measure progress against Victorian waste reduction targets, and trends in recovery of waste materials. › The survey is voluntary and although the return rate is relatively constant, contributors can vary from year to year. › Export data used in the report is sourced from the Australian Bureau of Statistics (ABS) › The SWRRIP uses report data from the financial year 2015–16. › The report is available at **www.sustainability.vic.gov.au** › Previously known as the Victorian Recycling Industries Annual Survey (VRIAS).
EPAs landfill levy returns	› Unpublished (commercial-in-confidence) information provided by EPA.
Australian Bureau of Statistics (ABS) population data	› ABS Catalogue number 3101.0 Australian Demographic Statistics, Jun Qtr. 2014, published December 2014. Table 4, Estimated Residential Population, Persons, Victoria.
Victorian landfill audits	› SVs disposal-based waste survey, 2009. › A visual waste audit of eight metropolitan landfills, one regional landfill and one transfer station, covering 2,003 separate inbound loads.
Regional Waste and Resource Recovery Implementation Plans (Regional Implementation Plans)	› Data and information sourced from the Regional Implementation Plans prepared in accordance with section 50B of the EP Act.
The Victorian Waste and Resource Recovery Projection Model	› SV's modelling of trends in population growth, economic activity, waste generation and growth of resource recovery markets to project future waste generation and resource recovery trends. › Sources for the model are EPA landfill levy returns, VRIAR 2015–16, SV's disposal-based waste surveys for 2009 and ABS population data. More information about the design and assumptions underpinning the model can be found in this appendix.
Mapping data	› SV internal data.

Data considerations

Data accuracy

Accuracy of information and data depends on the source. SV has verified information and data where possible, but all data should be considered as indicative only and has been provided as a guide or estimate of true values, unless otherwise stated.

Most data in the SWRRIP is rounded, for ease of reading. This may result in minor discrepancies between totals and line items. Non-rounded data was used to generate graphs and charts, and for modelling. Any exceptions are referenced.

Data availability

The availability of data is not evenly spread across the state, or available for all material streams. There is fairly robust data around material streams collected via municipal kerbside collection systems but limited data around C&I and C&D streams. For example, there is more data for municipal organics – as it is collected, measured and reported by local governments – than for C&I organics (for which there is no formal data collection and reporting system). There is also some disparity between data available from Metropolitan Melbourne and regional Victoria.

Landfill data

Calculating landfill airspace is based on information from landfill owners, local governments and the EPA. It reflects the estimated amount of airspace void and the amount of works and planning approved airspace. This approach to estimating closure dates will be refined through the process of integrating the SWRRIP and the Regional Implementation Plans and this data should be considered as an estimate.

Actual closure dates are determined by the owners and operators of each landfill. When estimating available landfill airspace, we also factored in prescribed industrial waste (PIW) received by landfills as this reduces available airspace at landfills that accept PIW, as well as municipal waste or solid industrial waste (SIW).

Landfill tonnes are based on landfill levy data and are not adjusted for daily cover. In previous versions of the SWRRIP and some other historical reports, landfill tonnages assumed that 15 per cent of the tonnes received at a landfill were used by the landfill for daily cover and maintenance such as roads. This was based on historical assumptions and does not reflect current activities.

Tonnes landfilled attributed to an individual region are based on the tonnes landfilled in that region. They include the flows into landfills in the region but do not allow for residual waste flows leaving the region.

Landfill numbers only include operational landfills at the time of publication and not those awaiting approval. For this reason, numbers may vary from those in Regional Implementation Plans, as they include planned and some closed landfills.

Landfill needs assessment

The analysis underpinning the landfill component of the infrastructure schedule in each Regional Implementation Plan considered a range of factors including:

- projected tonnages of residual waste likely to need landfilling in the next 30 years taking into consideration:
  - regional population and catchment growth
  - business as usual recovery rates as worst-case scenario
  - potential impact of recovery initiatives that could divert material from landfills (which are most likely to go ahead or have started since the baseline data year)
  - knowledge of the region
  - information from the waste and resource recovery industry
  - future of other existing landfills (including consideration of capacity need to compensate for landfills planned for closure)
- information from the owners and operators of individual existing landfill sites including:
  - compaction rates (if not available then a default low compaction rate was used)
  - the amount of daily cover
  - site survey results, where available
  - future plans
  - airspace availability (e.g. quarry void space)
  - land use planning and EPA works approval status of the available airspace
- tonnes currently going to individual landfills including:
  - landfill levy and council sourced data
  - specific factors that may have influenced the data collection year (e.g. a major event such as a flood that caused more waste to be landfilled than in a typical year)
  - tonnages expected to be landfilled under contracts and duration of these contracts
  - flows to or from other regions or interstate (including feedback from the generating Regional Group in relation to long term prospects of these flows continuing)
- contingency requirements including:
  - natural disasters
  - unexpected closure of facilities including those that may be located in another region and provide a service (landfill or recovery) to the region
- the management, accuracy and verification of information provided by third parties and impact of data gaps on the assessment. If data was unavailable, a conservative approach was taken.

Material streams

Data collected to support the former Towards Zero Waste Strategy included tyres as 'other organic' in data collections. The SWRRIP considers tyres separately as they are managed and reprocessed differently to other organic materials. This should be noted when comparing with previously published data.

In previous publications, textiles data was considered a subsection of organics data. As most recovered textiles are synthetic, it is now considered in a category of its own but granular data is limited.

Data relating to reprocessing material streams

Reprocessing data is sourced from the Victorian Recycling Industries Annual Report and represents the tonnes of materials entering reprocessing facilities. It does not directly correlate to how much was reprocessed as there is no data on amounts stockpiled or landfilled by reprocessors. For this reason, quantities are referred to as 'recovered', rather than 'reprocessed'.

Most businesses willingly provide information about the types and quantities of materials they handle. However, some choose not to participate and therefore, while the data is comprehensive and a good representation of the Victorian reprocessing industry, it is not complete.

Additional data identifying the reprocessing facilities was sourced from the former waste management groups, old recycling databases, phone conversations and site visits to businesses that collect and reprocess solid industrial waste.

Modelling

SV developed the Victorian Waste and Resource Recovery Projection Model to support the development of the SWRRIP. It uses past trends in waste generation and resource recovery to track and project future solid waste flows until 2045–46.

The model is based on data for annual tonnes landfilled and recovered, waste stream composition, landfill capacity data and government population projections. The model projects the amount of materials recovered and the amount of waste going to landfill in future years, assuming that current trends continue. It then splits these amounts into municipal and industrial sector streams.

While the model uses the best available data, several limitations need to be considered when using the data:

- The data overestimates the proportion of the total tonnes of waste recovered from the C&D and C&I sectors because it uses past trends to project future trends, and recovery trends in these sectors were very high for several years before 2010–11. C&D waste generation grew from about 1.4 million tonnes in 2003–04 to 2.3 million in 2010–11, and C&I waste grew from about 2.3 million tonnes to 3.7 million tonnes over the same period.
- The data models solid industrial waste which it then splits into C&D and C&I sector streams, based on landfill waste audits in 2009.
- Generation projections are the sum of the projections for landfill and for recovery, and are therefore only indicative of generation.

As a result, users should consider the model as giving a good estimate of total amounts going to landfill and total amounts recovered, but only a limited indication of the sector breakdown.

The model assumes Victoria's population will increase to 9.5 million by 2046 and per capita waste generation will be 2.1 tonnes a year. The projections are updated from the previous SWRRIP; with greater accuracy based on more historic data points (as time progresses) and 2016 ABS data. SV will update the model regularly based on real data as it becomes available, and to reflect changes in population growth and waste generation trends. This will improve the accuracy of the model. It is, however, only intended to be indicative and not representative of real quantities of materials.

How the model works

The Victorian Waste and Resource Recovery Projection Model is a custom-built Excel spreadsheet prepared for SV by Blue Environment in early 2013. It is designed to track and project future solid waste flows until 2045–46. The outputs are:

- estimates of past, present and future waste flows by quantity, composition, source sector and management route, with accompanying charts
- estimates of the drawdown of putrescible and inert landfill airspace by waste and resource recovery group region.

The primary datasets that the model uses are annual tonnes of waste landfilled and recovered, data on the composition of these streams, landfill capacity data and government population data and projections.

Generation tonnage figures are compiled using actual data and near term projections from EPA's landfill tonnes projection model for MSW, C&I waste, C&D waste and PIW to landfill. The near term projections run to 2016–17. The model finds the best fit between the input waste figures and population data and projections. It then applies this best fit to population projections to estimate future waste quantities to 2045–46.

Three scenarios are modelled for the split of MSW and solid industrial waste into landfill and recycling:

1. Business as usual: The recovery rate remains at the level, in the last year, projected by the EPA landfill tonnes projection model (currently 2016–17)
2. Moderate additional diversion: By 2045–46, the recovered tonnes exceed business as usual by some quantity that can be set by the user (currently set at 0.75 million tonnes)
3. High additional diversion: By 2045–46, the recovered tonnes exceed business as usual by some quantity that can be set by the user (currently set at 1.5 million tonnes).

The model then splits these quantities by waste and resource recovery region and, for Metropolitan Melbourne, into subregions (east and west). It applies the projected quantities of waste to landfill to regional estimates of landfill capacity, taking into account knowledge of cross-regional transfers of residual waste. It projects the drawdown of existing landfill capacity, showing when it is likely to be depleted. It then derives regional estimates for all landfill capacity and, separately, for inert landfill capacity.

The model generates updated estimates when new data is inserted. As the datasets increase in size, the projections should become more accurate.

Readers should consider outputs as best estimates based on available data and should only consider the values as indicative. Error margins are not known. Inputs with low levels of certainty include landfill composition, the split of industrial landfill quantities into C&I and C&D, and potentially the landfill capacity data. The margin of error of the projections increases with time, from the present.

Modelling method and assumptions

The projection model compiles the quantity of MSW and Solid Industrial Waste sent to landfill and recycled since 2002–03; the first year when this split was possible. The quantity of PIW to landfill was compiled since 2006–07; the year when the PIW levy was significantly increased.

Near term projections are imported from EPA's landfill tonnes projection model. EPA uses this model to project landfill levy income (at the time of writing, running to 2016–17). The EPA model is more sophisticated than SV's projection model because it uses a broader range of short term data, including projections of gross state product, weather and market conditions. For interagency consistency, the outputs of that model are imported directly into SV's model.

SV's model adds the landfill and recycling components of waste to landfill and waste recycled to get the total generated. It then seeks the best linear statistical fit (using a 'least squares' approach) between population and MSW and solid industrial waste generated and PIW to landfill. The best fit covers the period from 2002 to 2003 (the first year that data became available) up until the last year of EPA model projections. SV's model projects waste quantities after that date by applying this best fit to government population projections. The underlying assumption is that waste generation is driven by population growth and the past; measured statistical relationships between these variables represent the relationships through to 2045–46.

The projected quantity of MSW and solid industrial waste is split into recycling and landfill components for the three scenarios (business as usual, moderate additional diversion and high additional diversion).

It is assumed that the additional diversion occurs by an equal annual increment between the year following EPA model projections and 2045–46.

The composition of the recycling and landfill streams is calculated by the user nominating the proportion of solid industrial waste to landfill attributable to C&I, and the percentage composition of municipal, C&I and C&D waste to landfill.

For past years, the model applies proportions recorded in landfill composition audits.

For future years, unless the user specifies otherwise, the proportion of solid industrial waste to landfill attributable to C&I and the proportional composition of municipal, C&I and C&D waste to landfill are assumed to be those recorded in the most recent audit. For past years, the model applies proportions recorded in SV surveys of the recycling industry.

For future years:

- unless the user specifies otherwise, the proportion of industrial recycling attributable to C&I, and the proportional composition of municipal, C&I and C&D waste in the recycling stream, in the business as usual scenario, are assumed to be those recorded in the most recent recycling survey
- for the moderate and high additional diversion scenarios, the additional diverted material is assumed to have the same composition as waste to landfill (this assumption ensures that scenario selection does not affect the quantities of each waste type projected to be generated).

This data is used to calculate annual displays of data or projections, which can be seen in the spreadsheet *Annual summary*.

The quantity of waste to landfill transferred between regions (or in or out of Victoria) is projected to 2045–46 in the worksheet *Reg lfill transf calcs*. It is assumed that the transfers grow (or shrink) over time at the same rate as the average for waste to landfill produced in the source region. This applies only for the period nominated for that transfer in the data inputs. Transfers of MSW, solid industrial waste, PIW and waste to inert landfills are modelled separately.

The quantities of waste to landfill produced in each region are derived by adding or subtracting waste transfers to reported quantities of waste landfilled. The quantities of MSW, solid industrial waste, PIW and inert waste to landfill are separately projected to 2045–46, with automatic readjustment when new landfill data is entered in the model. These calculations are given in the worksheet Reg lfill proj calcs. Projections assume that the proportionate change in per capita production of each waste type sent to landfill is the same in each region, while the total must add to the projected quantity for the state in each year. This is complex because different regions produce varying quantities of waste to landfill per capita, and have different projected population growth rates.

Expressed mathematically, the assumption implies that $(L_{x,k}/P_{x,k})/(L_{x,k-1}/P_{x,k-1})$ is a constant (C_k), where:

$L_{x,k}$ = waste to landfill in region X in year K

$P_{x,k}$ = population of X in year K

Hence, $L_{x,k} = C_k * L_{x,k-1} * P_{x,k}/P_{x,k-1}$.

Putting $L_{x,k-1} * P_{x,k}/P_{x,k-1} = S_{x,k,}$ we can say: $L_{x,k} = S_{x,k} * C_k$

Also, we have ∑Lk for all regions = total garbage for the year k = TLk.

Substituting, we get: TLk = Ck * ∑Sk, and therefore: Ck = TLk / ∑Sk.

Inserting this value for Ck into (1), we have for any region X in year K: Lx,k = Sx,k * TLk / ∑Sk.

The interregional transfers of waste projected for each year are added and subtracted to the projected quantities of waste produced in the region, yielding an estimate of the waste sent to landfill in each region and year. The total waste to landfill by region is derived by adding the subcomponents. Waste to inert landfills is presented separately. These calculations are in the worksheet *Calcs - Reg lfill projections*.

The projected quantities of waste to landfill are subtracted from the recorded regional airspace capacities, resulting in a region-by-region time series estimate of the drawdown of landfill airspace. It is assumed that no waste is transferred between regions, unless specified in the *data inputs* worksheet. If a landfill site fills during the modelling period, it is effectively assumed that the material goes to another landfill in the region.

Similarly, when the model determines that all regional airspace is depleted, a zero is displayed: waste is not reallocated to some other region. For Melbourne, however, a separate calculation is carried out which assumes that when landfill capacity in the subregion metropolitan east is depleted, the material is transferred to the subregion metropolitan west. The worksheet *Time series* has data and charts showing the estimated drawdown of landfill airspace.

7.5 Appendix 5: Waste and Resource Recovery Group regions: member local governments

Table 7.5 lists all local government areas in Victoria by waste and resource recovery region.

TABLE 7.7
LOCAL GOVERNMENT AREAS BY WASTE AND RESOURCE RECOVERY REGION

Waste and resource recovery region	Local government area
Barwon South West	Colac Otway Shire Council
	Greater Geelong City Council
	Borough of Queenscliffe
	Surf Coast Shire Council
	Corangamite Shire Council
	Glenelg Shire Council
	Moyne Shire Council
	Southern Grampians Shire Council
	Warrnambool City Council
Gippsland	Bass Coast Shire Council
	Baw Baw Shire Council
	East Gippsland Shire Council
	Latrobe City Council
	South Gippsland Shire Council
	Wellington Shire Council
Goulburn Valley	Campaspe Shire Council
	Greater Shepparton City Council
	Mitchell Shire Council
	Moira Shire Council
	Murrindindi Shire Council
	Strathbogie Shire Council
Grampians Central West	Hindmarsh Shire Council
	West Wimmera Shire Council
	Ararat Rural City Council
	Horsham Rural City Council
	Northern Grampians Shire Council
	Yarriambiack Shire Council
	Ballarat City Council
	Central Goldfields Shire Council
	Golden Plains Shire Council
	Hepburn Shire Council
	Moorabool Shire Council
	Pyrenees Shire Council
Loddon Mallee	Greater Bendigo City Council
	Macedon Ranges Shire Council
	Mount Alexander Shire Council
	Buloke Shire Council
	Gannawarra Shire Council
	Loddon Shire Council
	Swan Hill Rural City Council
	Mildura Rural City Council

Waste and resource recovery region	Local government area
Metropolitan	Banyule City Council
	Bayside City Council
	Boroondara City Council
	Brimbank City Council
	Cardinia Shire Council
	Casey City Council
	Darebin City Council
	Frankston City Council
	Glen Eira City Council
	Greater Dandenong City Council
	Hobsons Bay City Council
	Hume City Council
	Kingston City Council
	Knox City Council
	Manningham City Council
	Maribyrnong City Council
	Maroondah City Council
	Melbourne City Council
	Melton Shire Council
	Monash City Council
	Moonee Valley City Council
	Moreland City Council
	Mornington Peninsula Shire Council
	Nillumbik Shire Council
	Port Phillip City Council
	Stonnington City Council
	Whitehorse City Council
	Whittlesea City Council
	Wyndham City Council
	Yarra City Council
	Yarra Ranges Shire Council

Waste and resource recovery region	Local government area
North East	Alpine Shire Council
	Benalla Rural City Council
	Indigo Shire Council
	Mansfield Shire Council
	Towong Shire Council
	Wangaratta Rural City Council
	City of Wodonga
	Falls Creek Alpine Resort Management Board
	Mount Buller and Mount Stirling Alpine Resort Management Board
	Mount Hotham Alpine Resort Management Board

7.6 Acronyms and abbreviations

Acronym	Phrase or word
ABS	Australian Bureau of Statistics
BPEM	Best Practice Environmental Management
C&D	Construction and demolition
C&I	Commercial and industrial
EP Act	*Environment Protection Act 1970*
EPA	Environment Protection Authority
FTM	Freight Transportation Model
FOGO	Food organics and garden organics
GHG	Greenhouse gases
M&E	Monitoring and evaluation
MRF	Materials recovery facility
MSW	Municipal solid waste
PAN	Pollution abatement notice
P&E Act	*Planning and Environment Act 1987*
PET	Polyethylene terephthalate
PIW	Prescribed industrial waste
QA	Quality assurance
SV	Sustainability Victoria
SWRRIP	Statewide Waste and Resource Recovery Infrastructure Plan
VORRS	Victorian Organics Resource Recovery Strategy
VPA	Victorian Planning Authority
VPP	Victorian Planning Provisions
VRIAR	Victorian Recycling Industries Annual Report (formerly the Victorian Recycling Industries Annual Survey)
WMP	Waste Management Policies
WtE	Waste to energy
WTM	Waste Transportation Model

7.7 Glossary

Term	Explanation
Aerobic composting	The controlled biological decomposition of organic materials under aerobic (in the presence of oxygen) conditions, accomplished in open or enclosed windrows or piles.
Airspace	The remaining capacity of a landfill.
Anaerobic composting	The controlled biological decomposition of organic materials under anaerobic (in the absence of oxygen) conditions, accomplished in enclosed vessels producing combustible methane gas and compost.
Anaerobic digestion	Biological breakdown by microorganisms of organic matter, in the absence of oxygen, into biogas (a mixture of carbon dioxide and methane) and digestate (a nutrient-rich residue).
Avoidance	The first step in the wastes hierarchy. Indicates practices whereby waste generation is circumvented.
Beneficiation	An optical sorting process used to separate different colours of container glass to produce cullet for reprocessing and mixed fines.
BPEM (landfill)	Landfill sites issued with a works approval or licence must comply with the EPA's landfill BPEM (*Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills*). The landfill BPEM sets out the objectives and outcomes for all licensed landfills which accept fill: putrescible, solid inert and prescribed industrial wastes.
Biogas or syngas	A gas generated by breaking down organic matter in the absence of oxygen, such as occurs in landfills. Biogas is typically comprised of 60 per cent methane and 40 per cent carbon dioxide, and can be used as an energy source.
Biomass	Biological material that is not fossilised, including forest and mill residues, agricultural crops and waste, wood and wood waste, animal waste, livestock operation residues, aquatic plants, fast growing trees and plants.
Biosolids	Biosolids are considered to be organic solids derived from sewage treatment processes that are in a state that they can be managed to sustainably use their nutrient, soil conditioning, energy, or other value (achieve minimum EPA standards for classification as T3 and C2 biosolids). The solids that do not meet these criteria are defined as sewage sludge.
Buffer zone	A buffer zone is an area of land outside the operating area of a facility that is set aside to maintain an adequate distance between the facility and sensitive land uses (such as residential development) so those uses are not adversely affected by noise, odour or dust. The land may or may not be owned by the facility owner. Buffer zones, or separation distances, aim to minimise the offsite impacts of sensitive land uses arising from unintended, industry-generated odour and dust emissions.
Category C contaminated soil	See *Prescribed waste and prescribed industrial waste*.
Clean fill	Material that has no harmful effects on the environment. This material is a natural soil material and does not contain any chemicals or other materials such as concrete rubble. Also called fill material.
Closed landfill	Landfills which have ceased to receive waste. During the decommissioning phase, they may continue to receive clean fill and soils to undertake the appropriate capping and contouring. If it was a licensed landfill, it should have received a post-closure pollution abatement notice from the EPA. If exempt from licensing, there should be reassurance that the closure process has begun or is in place.
Collection system	System for collecting materials from the kerbside, including bin type and collection frequency.
Commercial and industrial (C&I) waste	Solid materials and waste generated from trade, commercial and industrial activities including the government sector. It includes waste from offices, manufacturing, factories, schools, universities, state and government operations and small to medium enterprises, e.g. food organics.

Term	Explanation
Commingled recyclables	Materials combined generally for the purposes of collection, mainly through municipal collection services. Includes plastic bottles, other plastics, paper, glass and metal containers. Commingled recyclable materials require sorting after collection before they can be reprocessed. Can also be called commingled materials.
Composting	The process whereby organic materials are microbiologically transformed under controlled aerobic conditions to create a pasteurised and stabilised organic product for application to land.
Construction and demolition (C&D) waste	Solid materials and waste generated from residential and commercial construction and demolition activities, e.g. bricks and concrete.
Cullet	Sorted glass feedstock resulting from the beneficiation process of mixed container glass. Generally, consists of sorted streams of amber, flint and green glass of particle size greater that 5–10 mm depending on the capacity of the beneficiation plant.
Current capacity of infrastructure	Estimation of the installed capacity of an existing facility or infrastructure type.
Daily cover	The layer of compressed soil or earth which is laid on top of a day's deposition of waste on an operational landfill site. The cover helps prevent interaction between waste and air, reducing odours and creating a firm base for vehicles to work on.
Delamination	The process of splitting a composite material into its component parts, e.g. laminated glass.
Department of Environment, Land, Water and Planning	Victorian Government department providing policy planning, preparation of legislative amendments, leadership coordination and oversight of the environment portfolio.
Digestate	A nutrient-rich residue remaining after the anaerobic digestion of a biodegradable feedstock.
Drop-off centre/site	A facility where households can unload selected materials and household items for recycling and reuse. Also called drop-off facilities.
Duty holder	Any person who has a duty or obligation under the EP Act. In the SWRRIP, the EPA definition applies. Note: under section 67B of the EP Act, EPA may require duty holders to provide financial assurance as a condition of a licence or works approval.
E-waste	E-waste comprises electronic equipment with a plug or battery that needs a current to operate and that has reached end of life. It includes televisions, computers, monitors and whitegoods such as fridges and washing machines.
Energy from waste (EfW)	See *Waste to energy*. In the SWRRIP, EfW and WtE are interchangeable.
Environment Protection Act 1970 (EP Act)	The EP Act establishes the regulatory framework for environmental protection and sets up the seven regional Waste and Resource Recovery Groups. It has a range of guiding principles including the wastes hierarchy, and underpins the regulatory framework for managing waste. It sets out the content and process required to develop the SWRRIP and Regional Implementation Plans, and specifies how Regional Groups must develop the infrastructure schedules for their regional plans.
Environment Protection Authority Victoria (EPA)	Established under the EP Act, the EPA's role is to be an effective environmental regulator and an influential authority on environmental impacts.
Environmental justice	The principles of environmental justice are based on the concepts of equity and participation. The principles require that environmental benefits and impacts should be distributed proportionately, and affected communities should be able to participate in decision-making.
Feedstock	Raw material used to manufacture products. Material varies depending on what is being produced.
Fill material	See *Clean fill*.
Fines (glass)	Unsorted sub 5–10 mm glass material left over from the glass beneficiation process. It can contain contamination including plastics and small pieces of metals. These fines can be further processed to produce a glass sand product which has several uses.

Term	Explanation
Food organics	Food materials discarded from households or industry, including food processing waste, out-of-date or off-specification food, meat, fruit and vegetable scraps. Excludes liquid wastes.
Garden organics	Organics derived from garden sources, e.g. grass clippings, tree prunings. Also known as green organics.
Gasification	Thermal technology that converts materials into combustible gases by partial oxidation under the application of heat, leaving an inert residue.
Generated material/waste	Materials or waste originating from a point source or source of origin.
Green organics	See *Garden organics*.
Greenhouse gases	Gases, including carbon dioxide and methane that trap heat in the earth's atmosphere, affecting weather and climate patterns.
Hard waste	The term applied to household garbage that is not usually accepted in kerbside garbage bins by local councils, e.g. old fridges and mattresses.
Hazardous waste	See *Prescribed waste and prescribed industrial waste*.
Hubs	A facility or group of facilities that manage or recover waste or material streams. For larger hubs, the concentration of facilities enables sufficient waste-derived feedstock to support viable reprocessing and best practice management options. The location of hubs will vary for individual material streams.
Illegal dumping	Illegal dumping is the deliberate and unauthorised dumping, tipping or burying of waste on land that is not licensed or fit to accept that waste.
Incinerator/incineration	In the SWRRIP, a site and/or process that facilitates disposal of waste streams through burning, without producing another useful end product or capturing value from the waste material.
In-vessel composting	Composting technology involving the use of a fully enclosed chamber or vessel in which the composting process is controlled by regulating the rate of mechanical aeration. Aeration assists in heat removal, temperature control and oxygenation of the mass. Aeration is provided to the chamber by a blower fan which can work in a positive (blowing) and/or negative (sucking) mode. Rate of aeration can be controlled with temperature, oxygen or carbon dioxide feedback signals.
Inert materials/waste	Materials that are neither chemically nor biologically reactive and will not decompose. Includes glass, sand and concrete.
Kerbside waste/collection	Materials and waste collected by local councils, including garbage, commingled recyclables and garden organics, but excluding hard waste.
Landfill	Discharge or deposit of solid wastes onto land that cannot be practically removed from the waste stream.
Landfill available airspace	See *Airspace*.
Landfill capping	The material used to cover the waste materials in a landfill cell once it is full. It consists of an impermeable geo-membrane and/or clay materials, with a further layer of soil sometimes placed over the capping. Capping allows greenhouse gases to be captured and creates a 'dry tomb' protecting groundwater.
Landfill levy	A levy applied at differential rates to municipal, industrial and prescribed wastes disposed of at licensed landfills in Victoria. Landfill levies are used solely for the purposes of environment protection and fostering environmentally sustainable use of resources and best practice in waste management. They fund the activities of Regional Groups, SV and the EPA, helping to establish waste management infrastructure, industry waste reduction programs, education programs, regulatory controls and enforcement regimes. Levies also provide an incentive to minimise the generation of waste, sending a signal to industry that the government supports efforts to develop alternatives to disposal to landfill.
Landfill tonnages	Tonnes landfilled derived from landfill levy data supplied by EPA. Does not include prescribed industrial waste.
Leachate	Contaminated water that has percolated through or drained from a landfill.

Term	Explanation
Litter	Any small, medium or large item placed inappropriately.
Managed materials/waste	Materials or waste managed in the region refers to materials or wastes that have passed through or been managed at a waste and resource recovery facility in the region including resource recovery centres/transfer stations, MRFs, reprocessors or landfills. They may have been generated in another region and or they ultimately be reprocessed or disposed of outside the region.
Materials or wastes generated in the region	See *Generated material/waste*.
Materials or wastes managed in the region	See *Managed materials/waste*.
Materials recovery facility (MRF)	A centre for the receipt, sorting and transfer of materials recovered from the waste stream before transporting to another facility for recovery and management. At a MRF, materials may undergo mechanical treatment for sorting by characteristics such as weight, size, magnetism and optical density and may include cleaning and compression. Materials may be received as mixed streams such as commingled recyclables from households and businesses or single streams such as metals.
Materials processed	Materials that have been sorted, consolidated or processed at resource recovery centres/transfer stations, drop-off centres and/or MRFs in the region.
Materials recovered	Materials recovered and materials diverted from landfill for reprocessing or use through facilities in the region irrespective of where the recovery or reprocessing takes place.
Materials reprocessed	Materials that have passed through reprocessing facilities in the region. Materials reprocessed in a particular facility refers to the materials that are directly reprocessed in the individual facility.
Mechanical biological treatment plant	These plants combine mechanical sorting (such as in a MRF) with biological treatment of organic materials to process residual organic materials. This could include technology such as anaerobic digestion to stabilise the material and generate heat and power. Material remaining after further treatment (often referred to as 'digestate') can be added to compost or used as fuel in a thermal WtE facility.
Municipal solid waste (MSW)	Solid materials and waste generated from municipal and residential activities, and including that collected by, or on behalf of, municipal councils. In the SWRRIP, MSW does not refer to waste delivered to municipal disposal sites by commercial operators or waste from municipal demolition projects.
Open windrow composting operation	A type of outdoor composting process where organic materials are piled into windrows and turned for aeration.
Optical sorting	Technologies used to sort glass by colour type, and plastics by polymer type.
Organic material	Plant or animal matter, e.g. grass clippings, tree prunings and food organics, originating from domestic or industrial sources.
Pollution abatement notice (PAN)	Pollution abatement notices are issued under section 31A of the EP Act. They aim to prevent further occurrence of pollution or the potential environmental risk through installation of risk controls and changes to onsite processes and practices.
Prescribed waste and prescribed industrial waste (PIW)	These wastes are defined in the *Environment Protection (Industrial Waste Resource) Regulations 2009*. The EPA closely regulates these wastes because of their potential adverse impacts on human health and the environment. Prescribed wastes carry special handling, storage, transport and often licensing requirements, and attract substantially higher disposal levies than non-prescribed solid wastes. Also known as hazardous waste.
Private (own waste) landfills	Landfills privately owned by an entity that generate and deposit waste exclusively from a single source (arising from their own onsite activities).
Process derived fuels	Also called process engineered fuel or refuse derived fuel, it is a fuel produced after basic sorting and/or mechanical biological treatment plant to increase the calorific value and remove recyclable materials and contaminants of MSW, C&I and C&D waste.
Processing facilities	Facilities which either receive materials directly from collection systems or from recovery facilities for further sorting and/or processing to provide material for use in generating new products.

Term	Explanation
Product stewardship	A concept of shared responsibility by all sectors involved in the manufacture, distribution, use and disposal of products, which seeks to ensure value is recovered from products at the end of life.
Putrescible waste	Waste that readily decomposes, including food and garden organics.
Pyrolysis	Thermal breakdown of waste in the absence of air, to produce char, pyrolysis oil and syngas, e.g. the conversion of wood into charcoal.
Recover/recovery/resource recovery	The process of recovering resources from waste for reuse or reprocessing. This includes collection, sorting and aggregation of materials.
Recyclable materials	Materials which can be recycled. Recyclable materials can be collected separately to provide feedstocks for viable recovery.
Recyclables	While this term strictly applies to all materials that can be recycled, in the SWRRIP the term is generally used to refer to the recyclable containers and paper/cardboard component of kerbside waste and it excludes food and garden organics.
Recyclate	Raw materials that can be recycled that are sent to and processed in a recovery facility.
Recycle/recycling	To convert waste into a reusable material. In common practice, the term is used to cover a wide range of activities, including collection, sorting, reprocessing and reuse.
Refuse derived fuels	See *Process derived fuels.*
Reprocess/reprocessing	To put a material that has been used through an industrial process to change it so it can be used again.
Reprocessor/reprocessing facility/ reprocessing infrastructure	Facility that uses an industrial process to change the physical structure and properties of materials so they can be used again. This can include facilities that dismantle products, such as tyres, e-waste and mattresses and WtE facilities that use materials to generate energy.
Resale centre/shop	A centre/shop that enables the sale and subsequent reuse of good quality, saleable products and materials that were disposed of by their previous owner.
Residual waste	Waste remaining after materials that can be viably recovered have been removed for reuse, recycling or energy generation.
Resource recovery centre	A facility established to receive and/or recover reusable and recyclable materials that would otherwise be destined for disposal. Can be combined with a transfer station and may include resale centres.
Resource recovery infrastructure	Facility that receives and manages materials to enable them to be reused or reprocessed. This includes drop-off points, resale centres, resource recovery centres, transfer stations and materials recovery facilities.
Reuse	Recovering value from a discarded resource without processing or remanufacture, e.g. garments sold though opportunity shops are, strictly speaking, a form of reuse, rather than recycling.
Scrap metal	Metals recovered from all sectors (households, building and business). Can be further categorised into ferrous and non-ferrous metals.
Sectors/industry sectors	Groupings of industries used to generalise patterns in waste generation and disposal, e.g. construction and demolition, food services including food retail and food manufacturing, small to medium enterprises.
Separation distance	See *Buffer zone.*
Shredder floc	Residue directly arising from large-scale shredding operations to recover metals. Shredded material includes, but is not limited to, end-of-life vehicles, white goods, machineries, drums and corrugated material.
Social licence to operate	The concept of a social licence to operate has evolved from broader concepts of corporate social responsibility and is based on the idea that a business not only needs appropriate government or regulatory approval but also a social licence. The social licence is the acceptance that is continually granted to industry and facility operators by the local community or other stakeholders to operate.

Term	Explanation
Solid industrial waste (SIW)	Solid waste and materials generated from commercial, industrial or trade activities, including waste from factories, offices, schools, universities, state and federal government operations and commercial construction and demolition work. Excludes municipal solid waste, wastes prescribed under the EP Act and quarantine wastes.
Solid waste	Non-hazardous, non-prescribed, solid waste ranging from municipal garbage to industrial waste.
Source separation	Separating materials into discrete material streams before collection by, or delivery to, reprocessing facilities.
Spokes	The sequence of activities that move materials from waste generators to and from hubs, e.g. collection, transport and sorting. The length of the spoke, and hence the location of the hub, for a particular material stream is influenced by the impact of transport on the margin of return for that particular material stream.
Stockpiling	Storing materials.
Sustainability Victoria (SV)	Statutory authority established in October 2005 under the *Sustainability Victoria Act 2005* with the key objective of facilitating and promoting environmental sustainability in the use of resources. SV works across the areas of energy, waste and water, with communities, industries and government, applying the best ideas and encouraging action to enable change in environmental practices.
Syngas	See *Biogas*.
Synthetic material fibre	Materials such synthetic textiles, glass fibre, mineral wool and ceramic fibre.
Transfer station	A facility for unloading and consolidating waste and a wide range of recyclable materials. Can be combined with a resource recovery centre and may include resale centres. Does not undertake reprocessing activities.
Treatment	A specific activity, process or handling of an item/material (often involved with reprocessing to remove contamination and the like).
Waste	Any discarded, rejected, unwanted, surplus or abandoned matter, including where intended for recycling, reprocessing, recovery, purification or sale. Anything that is no longer valued by its owner for use or sale and which is, or will be, discarded. In this document, the term 'solid waste' refers to non-hazardous, non-prescribed, solid waste materials ranging from municipal garbage to industrial waste.
Waste and resource recovery group (Regional Group)	Statutory authorities established under the EP Act responsible for preparing the Regional Waste and Resource Recovery Implementation Plan for their region.
Waste and Resource Recovery Planning Framework	The planning framework defined in the EP Act, which includes: › the SWRRIP › the seven Regional Implementation Plans › relevant ministerial guidelines (made under section 50CA) › the process for integrating the SWRRIP and Regional Implementation Plans.
Waste and resource recovery industry	Applies to those involved in managing waste, e.g. collectors, sorters, reprocessors and landfill operators.
Wastes hierarchy	A concept promoting waste avoidance ahead of recycling and disposal. Recognised as promoting management of waste in the order of preference: avoidance, reduce, reuse, recycle and disposal.
Waste minimisation	The concept of, and strategies for, waste generation to be kept to a minimum level to reduce the requirement for waste collection, handling and disposal to landfill. Also referred to as waste avoidance.
Waste to energy (WtE)	The production of usable forms of energy from individual or mixed material streams. Energy products include electricity, heat, biogas and process derived fuels. In the SWRRIP, EfW and WtE are interchangeable.

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