REGIONAL WASTE AND RESOURCE RECOVERY MANAGEMENT PLAN

Central Queensland

Prepared for:

Local Government Association of Queensland
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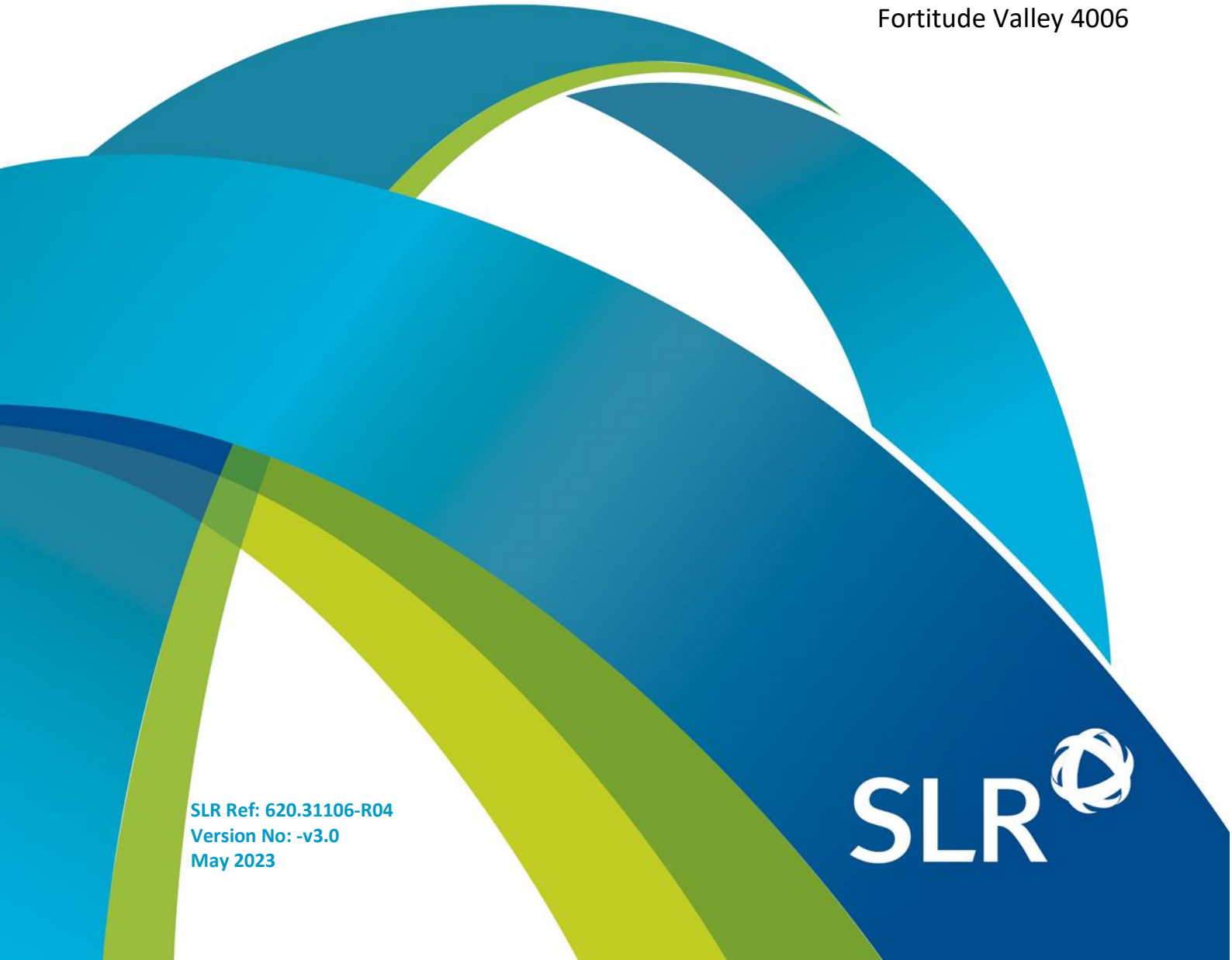

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Local Government Association of Queensland (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

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EXECUTIVE SUMMARY

The Central Queensland Regional Waste and Resource Recovery Management Plan

This Plan identifies a series of actions to be taken at a regional scale and for individual Councils to improve waste and resource recovery outcomes in the Central Queensland region. Participating Councils are Banana Shire Council, Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council, Rockhampton Regional Council, and Woorabinda Aboriginal Shire Council. Under the Central Queensland Regional Organisation of Councils (CQROC) Waste and Resource Recovery Working Group (WRRWG), a series of workshops and interviews were undertaken to define current challenges and opportunities, to identify, refine and select preferred options, and to identify a pathway for implementation.

The current population of the CQROC area is approximately 230,000[1] and predicted to grow an estimated 360,000 residents by June 2036. Population projections suggest growth in population will be most significant in Gladstone, Livingstone, and Rockhampton LGAs, marginal in Central Highlands, and population may decline in Banana Shire and Woorabinda Aboriginal Shire Council between 2016 and 2041.[2] Central Queensland is a major contributor to the state and National economy, generating $17 billion in Gross Regional Product in 2019, primarily from key industries of mining and agriculture. These key industries are widely dispersed throughout the region. Key mining operations are conducted in the central, western, and southern areas near Emerald, Blackwater, Biloela, and Moura. Agricultural activities are located across the region from Banana through to Rockhampton, with the Central Highlands supporting approximately 1.3 million head of cattle across its expansive LGA.[3]

CQROC recognises that Woorabinda Aboriginal Shire Council is a member of the Central Queensland region for the purpose of developing and implementing a Regional Waste Management Plan and that:

- Woorabinda's preliminary internal assessment of impacts and opportunities relating to Waste Management does not identify business case elements for potential initiatives to be considered as part of the Qld State Infrastructure Investment Plans and/or other Strategic Plans in the immediate future.
- To negate this limitation, Woorabinda Aboriginal Shire Council will develop its own local waste reduction and resource recovery Plan to inform further iteration of the CQROC Regional Waste Management Plan and in due course provide greater opportunities to align needs and opportunities for State Infrastructure Investment and/or other Strategic Plans for Waste Management into the future.

[1] Central Queensland Regional Organisation of Councils, 2022. Population (https://cqroc.org.au/population/)
[2] Queensland Government population projections, 2018 edition; Australian Bureau of Statistics, Population by age and sex, regions of Australia, 2016 (Cat no. 3235.0).
[3] DSDIP (2013). Central Queensland Regional Plan

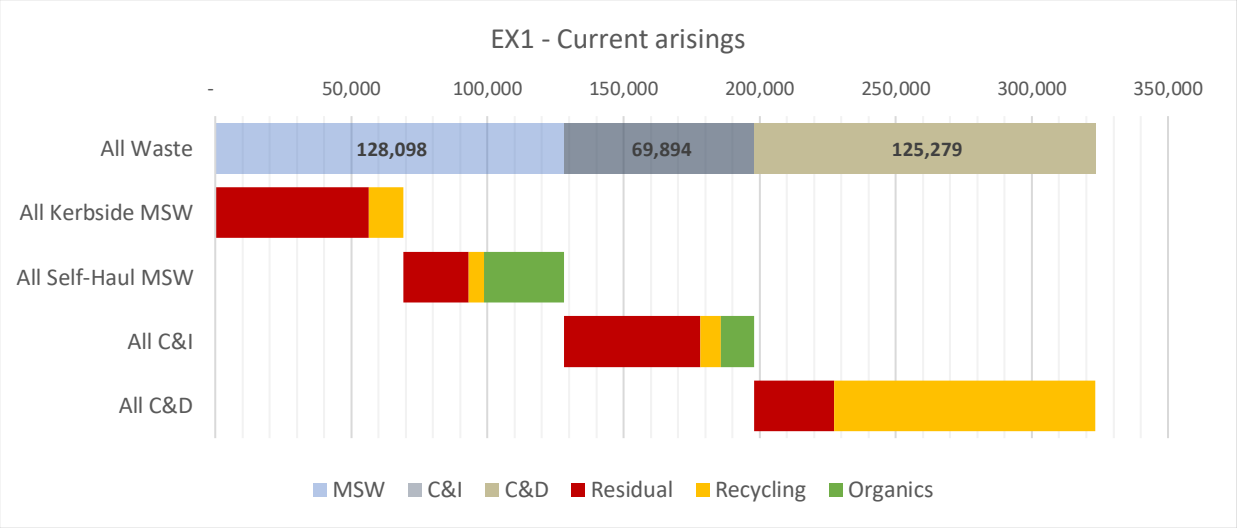
EXECUTIVE SUMMARY

Current state

Waste arisings and services

Councils in the Central Queensland region managed a total of 323,271 tonnes of waste in the 2020-21 financial year (FY20-21). This included (see **Figure EX1)**:

- 128,098 tonnes of household waste (MSW stream).
- 69,894 tonnes of commercial and industrial waste (C&I); and
- 125,279 tonnes of construction and demolition waste (C&D).



Regionally the amount of waste managed by individual councils in FY20-21 was:

- Banana Shire Council: 4%
- Central Highlands Regional Council: 14%
- Gladstone Regional Council: 20%
- Livingstone Shire Council: 12%
- Rockhampton Regional Council: 50%
- Woorabinda Aboriginal Shire Council: <1%

Without action, waste managed by councils in the region is forecast to grow to 400,000 tonnes per year in FY30-31, and 480,000 tonnes per year by FY50-51. There remains a need to improve the quality and quantity of data available, particularly for private sector waste and recycling operations in the region.

All councils offer at least a kerbside household residual waste bin collection service. Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council and Rockhampton Regional Council currently offer a 2-bin collection system. Banana Shire Council offers a kerbside, blue-lidded bin for paper and cardboard

EXECUTIVE SUMMARY

All Councils also provide some form of self-haul facility which receive householder, commercial and industrial, and construction wastes. Problematic wastes with limited currently available recovery options in the region include construction and demolition wastes (e.g., masonry, aggregates, and concrete), contaminated soils, e-waste, food and garden organics, timber, textiles, and tyres.

The Plan identifies several regional or cross-regional solutions for these but acknowledges that Queensland or Commonwealth Government leadership and interventions will be needed for some of the more problematic waste streams.

Key issues

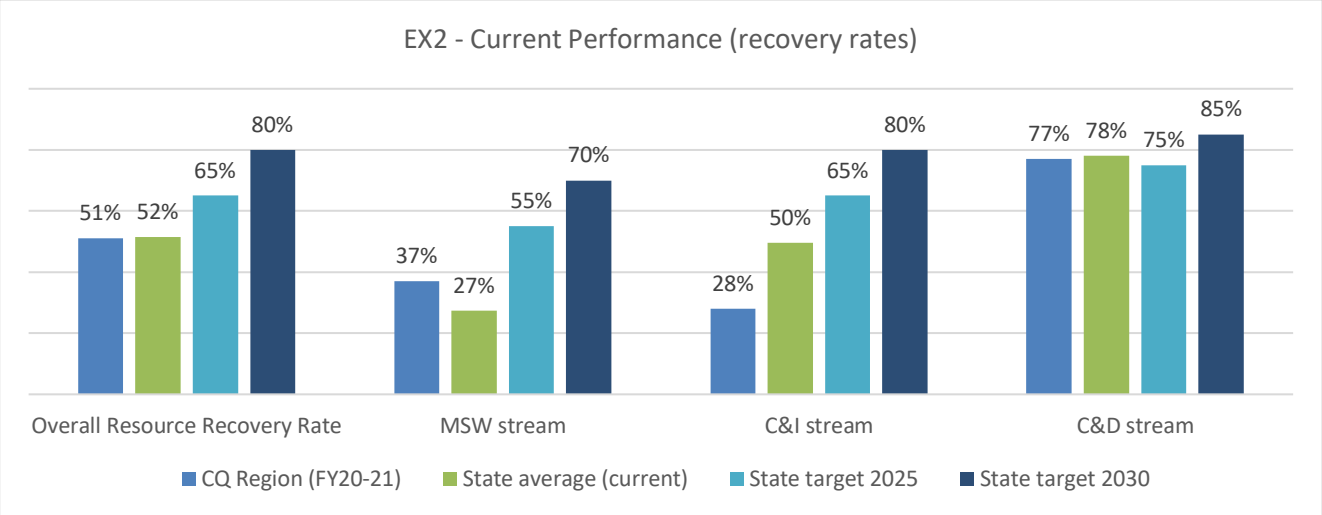
Several key issues identified were identified for the Plan to address:

- Lack of long-term approved and constructed landfill capacity.
- Geographical diversity in the region with a range of large geographical areas with dispersed populations and more densely populated urban areas, resulting in prohibitive transport costs.
- Councils in the region are required to diversify their service offering, but also receive significant amounts of non-household waste which they are expected to manage.
- Lack of scale for recycling or secondary processing.
- Lack of end-markets locally driving demand for recycled materials.
- Community understanding and behaviours impose a significant risk and impact to existing or proposed future operations.
- Current policy settings do not support greater recovery and recycling.
- There is an increasing cost to improving waste and resource recovery outcomes in the region.

Current performance against Strategy targets

The Central Queensland region has a current resource recovery rate of 51% across all streams, compared to a current state average of 52% and 2025 state target of 65%. The municipal solid waste (MSW) and construction and demolition (C&D) waste streams are consistent with the state average, whilst the commercial and industrial (C&I) stream is performing poorly. Across all streams, the 2025 and 2030 targets are challenging without intervention, as shown on **Figure EX2**.

EXECUTIVE SUMMARY



Plan outcomes

Education as a primary focus

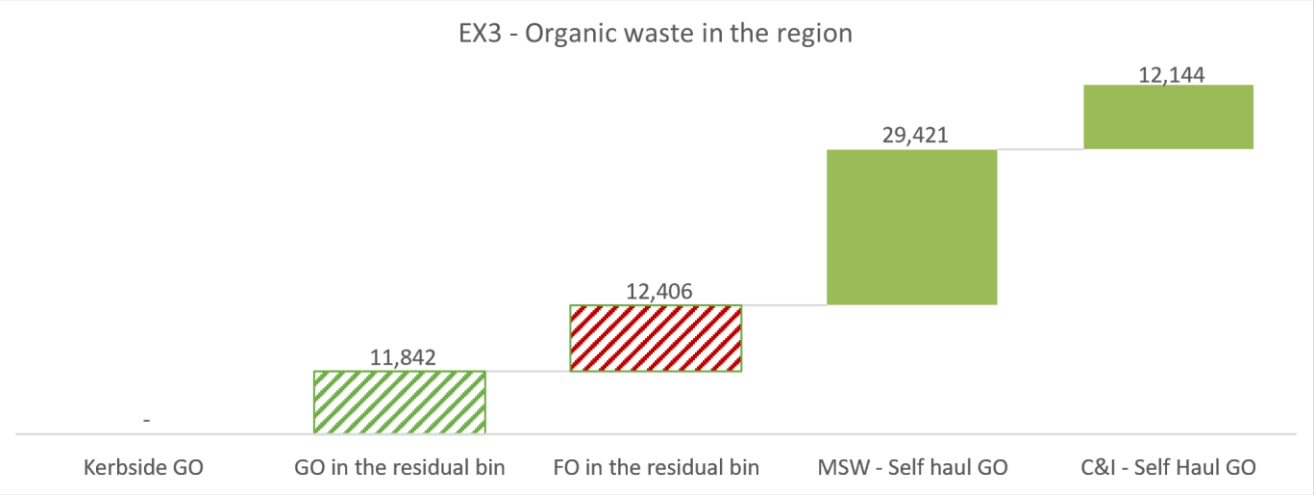
A regional waste and recycling education strategy has been identified by Councils to focus investment on education and behaviour change activities that promote better outcomes for the region. Education will focus on problem areas including reducing the kerbside recycling bin contamination rates, which diminishes the value of sorted material and can increase operational costs, as well as capturing more recyclable material currently sent to landfill. Other areas of focus will include food waste avoidance programs, and other behaviour change activities which educate residents on the benefits of getting recycling right.

The regional education strategy will be developed through collaboration by Councils in the region however will require investment and input from the Queensland Government to prepare and implement. Through further investment, this Strategy, and the resources deployed could also target education of waste producers in the C&I stream to drive better resource recovery outcomes. Woorabinda Aboriginal Shire Council will develop its own community specific education Plan to align with other education services in the area.

Improved organic waste management

The Central Queensland region already recovers and recycles 41,565 tonnes of green waste (in FY20-21) through material delivered to Council resource recovery facilities. A further 24,000 tonnes of food and garden organic waste (FOGO) is estimated to be sent to landfill across the region (as shown on **Figure EX3**). This represents an opportunity in the region to divert some of this material from landfill and into organic waste recycling through composting, whether at commercial facilities, at home, or via community facilities. In the region, current policy and economic settings suggest that Gladstone Regional Council and Rockhampton Regional Council have sufficient volume to introduce a separate organic waste kerbside collection and processing solution. For other councils in the region, lack of suitable processing and current policy settings may limit the potential establishment of kerbside organic waste services.

EXECUTIVE SUMMARY



For those parts of the region that cannot access a kerbside organic waste collection service, the Queensland Government will establish mechanisms for residents to participate in composting through community gardens or composting hubs, or by encouraging access to at-home compositing infrastructure such as compost bins or worm farms. These interventions will be implemented as soon as practically possible and dependent on availability of funding. Food waste avoidance education should also be rolled out across the region.

Economic analysis to support this Plan has identified that the introduction of a new kerbside organics service is expected to result in extra cost for Councils. The estimated cost for Gladstone Regional Council and Rockhampton Regional Council for a new organics collection service including processing is estimated is **$45 million** (present value) assuming a simple open-windrow technology can be deployed over a 30-year forecast period in each LGA. The estimated annualised cost increase compared to business as usual, allowing for increasing levy costs, would be an additional estimated **$25 per household** per year (present value), assuming the residual bin collection is reduced to fortnightly where a kerbside organics collection is available. This includes:

- One-off-transition costs to purchase consumables and distribute to households including new bins, kitchen caddies, and compostable liners estimated at **$1.5 million** for Gladstone Regional Council and **$2.2 million** for Rockhampton Regional Council.
- An additional potential one-off cost of $11-$21 per bin may also be incurred to change current residual bin lids from green to the standardised red.
- Additional establishment education and ongoing organics diversion education costs just for FOGO implementation are included in the estimate at **$0.14 million** for Gladstone and **$0.21 million** in Rockhampton per year commencing 2-years before a new service commences.

Whilst nothing in this Plan precludes other Councils from introducing a kerbside FOGO collection and processing solution, under current policy settings, the comparable cost per household would be higher due to 100% of landfill levy paid being returned to council in annual advance payments, in addition to the lack of scale and large distances required to transport waste for processing. Similar proportional costs may be incurred by other Councils progressing organic waste diversion.

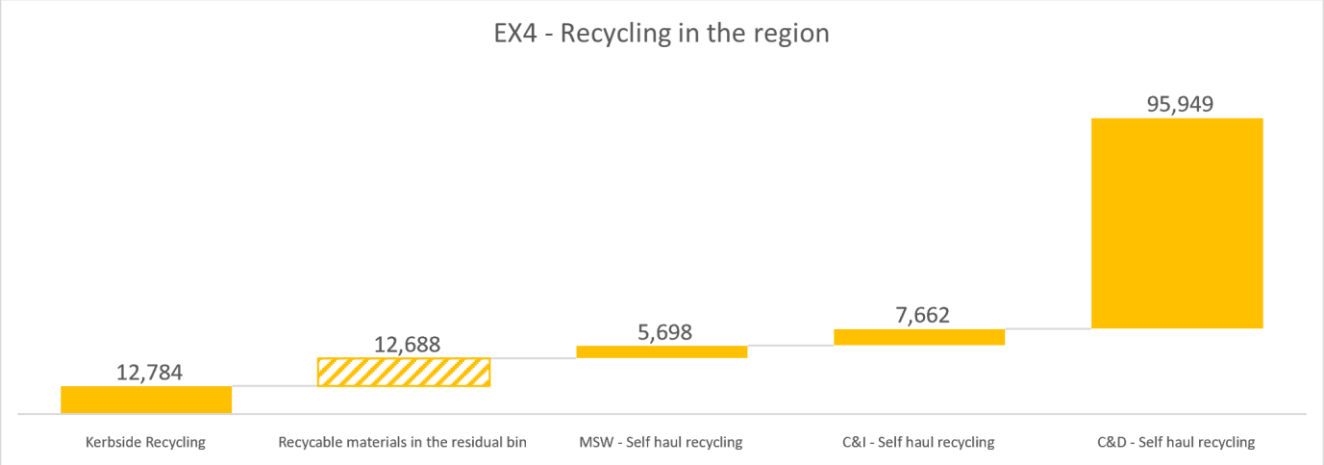
EXECUTIVE SUMMARY

Activities and actions are identified for Councils not introducing new kerbside services to support food waste avoidance, at-home, or community composting. These interventions are expected to be led by the Queensland Government.

It is estimated that the introduction of a FOGO collection service in both Gladstone and Rockhampton could capture an initial 13,000 tonnes of organic waste to be recycled. As a region this is forecast to result in a 4% increase in overall recovery rate for the region from a current 51% to 55% once the services commence. Between FY25-26 and FY30-31 this intervention is estimated to divert an estimated additional 65,000 tonnes of organic waste from landfill.

Improved material recovery and recycling

In FY20-21, 122,092 tonnes of material managed in the region was reported as recovered, of which the household kerbside collection of dry recyclables contributed 12,784 tonnes.



The bulk of reported recovered waste is from the C&D stream which has a recovery rate already of 77%. Contamination of the kerbside commingled bin in the region is around 20% but, in some cases, higher. It is estimated that approximately 12,688 tonnes of dry recyclable material is currently disposed of in the kerbside residual bin that could be captured.

Through focussed education campaigns as part of the regional education strategy it is expected that contamination will be reduced, and that there will be greater capture of recyclable material currently lost to landfill. Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council and Rockhampton Regional Council are currently collaborating on a new regional recycling processing solution. This may include the establishment of a new material recycling facility in the region.

There may be opportunities for the establishment of new recycling or reprocessing facilities in the region aligned with the Queensland Governments precinct approach, however this requires further refinement. Target reprocessers may access organic waste, C&D waste (masonry, aggregates, and concrete) and solar panel recycling to complement existing arrangements.

EXECUTIVE SUMMARY

To facilitate future precinct development and better diversion through resource recovery facilities, an allowance has also been made in the economic analysis for improvements to transfer facilities or existing landfill sites, additional operating costs, and transport to move recyclables from satellite sites to processing hubs. This may also include community recycling hubs or hazardous waste transfer facilities, and circular economy solutions such as fixing facilities.

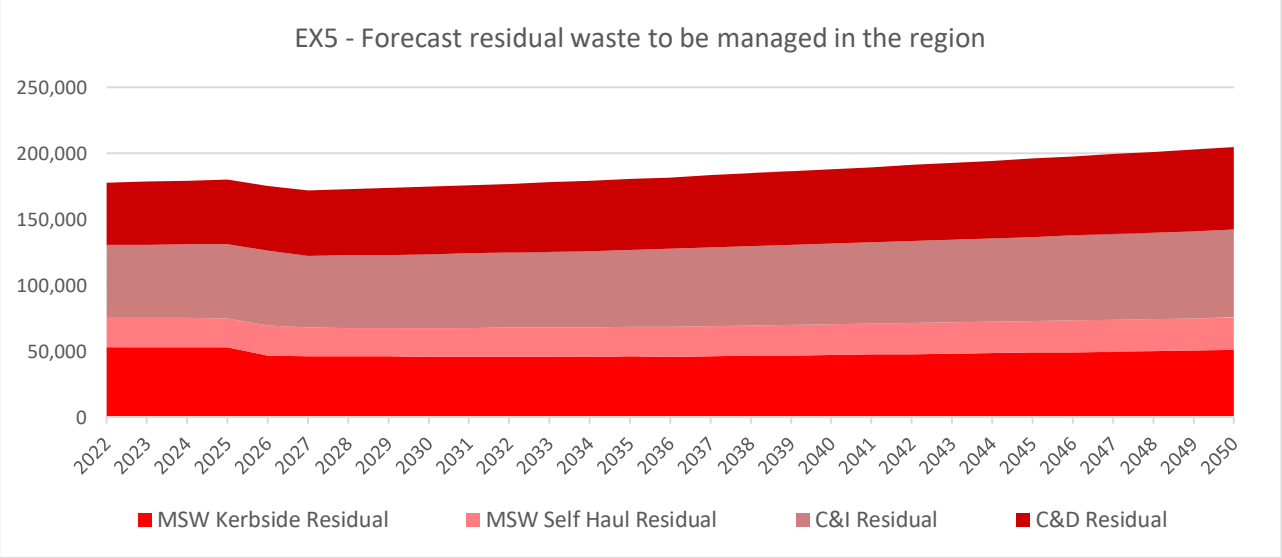
The estimated cost to implement the material recovery and recycling interventions is **$44 million** (present value) equivalent to an annualised cost of approximately $25 per household per year. This includes:

- Estimated capital expenditure of **$18 million** for a new regional scale MRF, if identified as the preferred solution, and ongoing operational costs for the MRF over the 30-year lifetime.
- Small-scale infrastructure improvement indicative budget of **$7.5 million** to allow for upgrades to existing facilities, or conversion of existing landfills to transfer facilities.
- The development and delivery of a regional education strategy that applies across all Councils to provide education priorities in collaboration with the Queensland Government, estimated to be **$0.68 million** per annum commencing immediately

It is assumed that additional education costs are funded by the Queensland Government. These changes are focussed on improving the quality and quantity of material captured for recycling through enhanced education across the region. A separate education Plan will be developed by Woorabinda Aboriginal Shire Council specific to community needs.

Residual waste management in the long-term

In FY20-21, 159,613 tonnes of residual waste was managed, of which 56,392 tonnes was generated directly by households. With the interventions identified in this Plan, residual waste is expected to be 180,615 tonnes by FY30-31 growing to 193,074 tonnes by FY40-41 and 212,240 tonnes by FY50-51. For the household derived MSW stream only, Councils are forecast to need to manage 69,482 tonnes of residual waste in FY30-31, 72,740 tonnes in FY40-41 and 78,282 tonnes by FY50-51 (see **Figure EX5**).



EXECUTIVE SUMMARY

Some Councils are running out of approved and constructed landfill capacity. The cost of residual waste management in general is expected to increase as new landfill capacity is required, or alternative solutions procured. However, the immediate cost of landfilling is also increasing rapidly for Gladstone Regional Council and Rockhampton Regional Council due to changes in annual advanced payments. In the long-term the region will need to identify and Plan a residual waste solution that considers continuation of landfill through development of new capacity, or via sending some residual waste to energy or to fuel from waste facilities that could be developed in the region. All solutions will still require ongoing landfill capacity.

Aligned with Queensland's Waste Management and Resource Recovery Strategy, utilisation of energy from waste is the likely path to achieve the states resource recovery targets of 90% recovered by 2050. There is uncertainty over the costs. This is because an energy from waste solution is not currently available or proposed in the Central Queensland region, or Queensland at present. If a solution was available, the estimated cost per household of diverting residual waste to EfW is likely to be significantly greater than continued landfilling. An action in the Plan is to monitor the opportunity to develop an EfW facility of suitable scale for the region.

Other problematic streams identified in the residual waste stream include biosolids, timber and contaminated soils. Long term solutions for these streams that avoid the need for landfill will require further cross-regional collaboration and strategic transformation of regional waste management.

Expected recycling and resource recovery outcome of the Plan

To achieve an estimated regional resource recovery rate of approximately 56% resource recovery, which amounts to an overall improvement of 5% for the entire region and a 19% improvement in recovery rate on the kerbside MSW stream, the Councils, principally Gladstone Regional Council and Rockhampton Regional Council, would need to introduce an organics diversion service targeting FOGO. This should be coupled with improvements to the existing yellow top bin recycling services for all Councils through a combination of improved transfer facilities and education. Beyond this, significant improvements to the C&I stream are required, but only after data for non-council managed wastes are collected and assessed. A forward estimate on the potential benefit to resource recovery rates if energy from waste was available in the future could be between 72% (for produced engineered fuel/refused derived fuel) to 78% (thermal combustion) depending on technology selection.

Implementation

Cost to deliver the Plan

The estimated cost for implementation (excluding residual waste management) is **$66 million** over this period as presented in **Table EX1**[4].

[4] Costs are estimated to a maximum of p50 accuracy where presented in this Plan

EXECUTIVE SUMMARY

Table EX1 Indicative Cost Estimate (costs in millions, p50 accuracy)

Item	2024	2025	2026	2027	2028	2029	2030	2031	Total to FY31
Regional Implementation									
Project Manager (RWG)	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	**1.44**
Administrative & Legal	0.10	-	-	-	-	-	-	-	**0.10**
Develop detailed implementation Plan	0.05	-	-	-	-	-	-	-	**0.05**
Review RWWP	-	-	-	-	0.10	-	-	-	**0.10**
Meetings (Council FTE requirement)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	**0.39**
Council contribution to actions	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	**0.22**
Sub Total – Plan Implementation	**0.43**	**0.25**	**0.25**	**0.25**	**0.35**	**0.25**	**0.25**	**0.25**	**2.30**
Regional Education Strategy									
Education Strategy (and updates)	0.05	-	0.02	-	0.02	-	0.02	0.00	**0.10**
FOGO implementation, GRC/RRC only	Captured within organic implementation costs below								**-**
Kerbside Education & Other	Captured within material recycling & recovery costs below								**-**
Sub-Total – Regional Education	**0.05**	**0.00**	**0.02**	**0.00**	**0.02**	**0.00**	**0.02**	**0.00**	**0.10**
Regional Organics Solution									
FOGO Implementation, GRC only									
Administration, business cases, PM	0.20	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.85
FOGO education costs (new service GRC)	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.08
One off investment (bins) (GRC)	-	-	1.43	-	-	-	-	-	1.43
Collection costs (new, GRC)	-	-	0.55	0.58	0.60	0.61	0.62	0.63	3.59
Processing costs (new, GRC)	-	-	0.64	0.65	0.67	0.69	0.70	0.72	4.08
Sub-Total – New FOGO Service, GRC	**0.34**	**0.34**	**2.83**	**1.44**	**1.48**	**1.51**	**1.53**	**1.56**	**11.03**
FOGO Implementation, RRC only									
Administration, business cases, PM	0.20	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.85
FOGO education costs (new service RRC)	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	2.08
One off investment (bins) (RRC)	-	-	2.20	-	-	-	-	-	2.20
Collection costs (new, RRC)	-	-	0.91	0.93	0.95	0.97	0.99	1.00	5.75
Processing costs (new, RRC)	-	-	0.93	0.95	0.98	1.00	1.03	1.05	5.94
Sub-Total – New FOGO Service, RRC	**0.46**	**0.46**	**4.38**	**2.22**	**2.26**	**2.31**	**2.35**	**2.39**	**16.82**
Organics Programs									
Community composting	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.80
Roll out of compost bin program	-	0.21	-	-	-	-	-	0.21	0.43
Material flow analysis - organics	0.01	0.02	-	-	-	-	0.02	-	0.05
Sub-Total – Organics Programs	**0.11**	**0.33**	**0.10**	**0.10**	**0.10**	**0.10**	**0.12**	**0.31**	**1.28**
TOTAL (Regional Organics Solution)	**0.91**	**1.13**	**7.30**	**3.76**	**3.84**	**3.91**	**4.01**	**4.26**	**29.13**

EXECUTIVE SUMMARY

Item	2024	2025	2026	2027	2028	2029	2030	2031	Total to FY31
Material recovery & recycling solution									
Education Implementation (kerbside + other)	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	5.44
Education Plan (Woorabinda)	-	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.17
Small scale infrastructure improvements	-	1.25	1.25	1.25	1.25	1.25	1.25		7.50
Community circular economy programs	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.40
Household Hazardous Waste CRCs	-	-	0.20	0.20	0.20	0.20	0.20	-	1.00
New regional scale MRF	0.50	17.50	-	-	-	-	-	-	18.00
Waste audit program	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.64
TOTAL (MRR Solution)	**1.31**	**12.11**	**9.78**	**2.28**	**2.28**	**2.28**	**2.28**	**0.83**	**33.15**
Residual Waste									
Develop regional residual waste solution & business case	-	0.05	0.30	0.30	0.30	0.02	0.02	0.01	1.00
Progress & implement R&D into problematic wastes & disaster wastes	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.80
TOTAL (Residual Solution)	**0.10**	**0.15**	**0.40**	**0.40**	**0.40**	**0.12**	**0.12**	**0.11**	**1.80**
OVERALL TOTAL – IMPLEMENTATION COST FOR RWRRMP TO FY30-31	**2.79**	**13.64**	**17.75**	**6.70**	**6.89**	**6.57**	**6.67**	**5.46**	**66.47**

All costs presented in Million $ based at 2023 rates, BSC-Banana Shire Council, CHRC-Central Highlands Regional Council, GRC-Gladstone Regional Council, LSC-Livingstone Shire Council, RRC-Rockhampton Regional Council, WASC-Woorabinda Aboriginal Shire Council

Access to supporting resources and funding

There is a need for support around the development of business cases and forecasting suitable for approval by the Queensland Government, particularly for infrastructure such as new or improved transfer facilities, new collections, or processing infrastructure. Access to regional facilitation / coordination support resources is essential for Councils implementation of the Plan, as would funding support to develop supporting documentation for funding applications. Implementation at the regional scale will also require funding to coordinate and liaise with the Queensland Government, and advocate for better waste outcomes in the region.

Funding for capital expenditure such as an organic waste processing facility (or enhancements to existing privately owned facilities), small scale infrastructure improvements, or potentially an energy from waste facility may also be facilitated by the Queensland Government, pending specific business case development.

EXECUTIVE SUMMARY

Regional collaboration and responsibilities

To support delivery of this Plan, the region has utilised a collaborative approach to strategy development and implementation through a working group operated under the Central Queensland Regional Organisation of Councils. This group will continue to collaborate on Plan implementation, and seek to undertake regional procurement where beneficial, as well as collaborate on the implementation of education and awareness campaigns. This is a critical action required to be commenced immediately following finalisation of the Plan. The Queensland Government will fund a project or program manager to deliver the Plan. Depending on procurement and ownership decisions around certain infrastructure, there may be a need to establish additional governance structures.

Responsibility for decision making for the implementation of interventions under this Plan will sit with individual councils facilitated by the WRRWG. The WRRWG will coordinate funding requests required to the Queensland Government for approval under the following proposed structure:

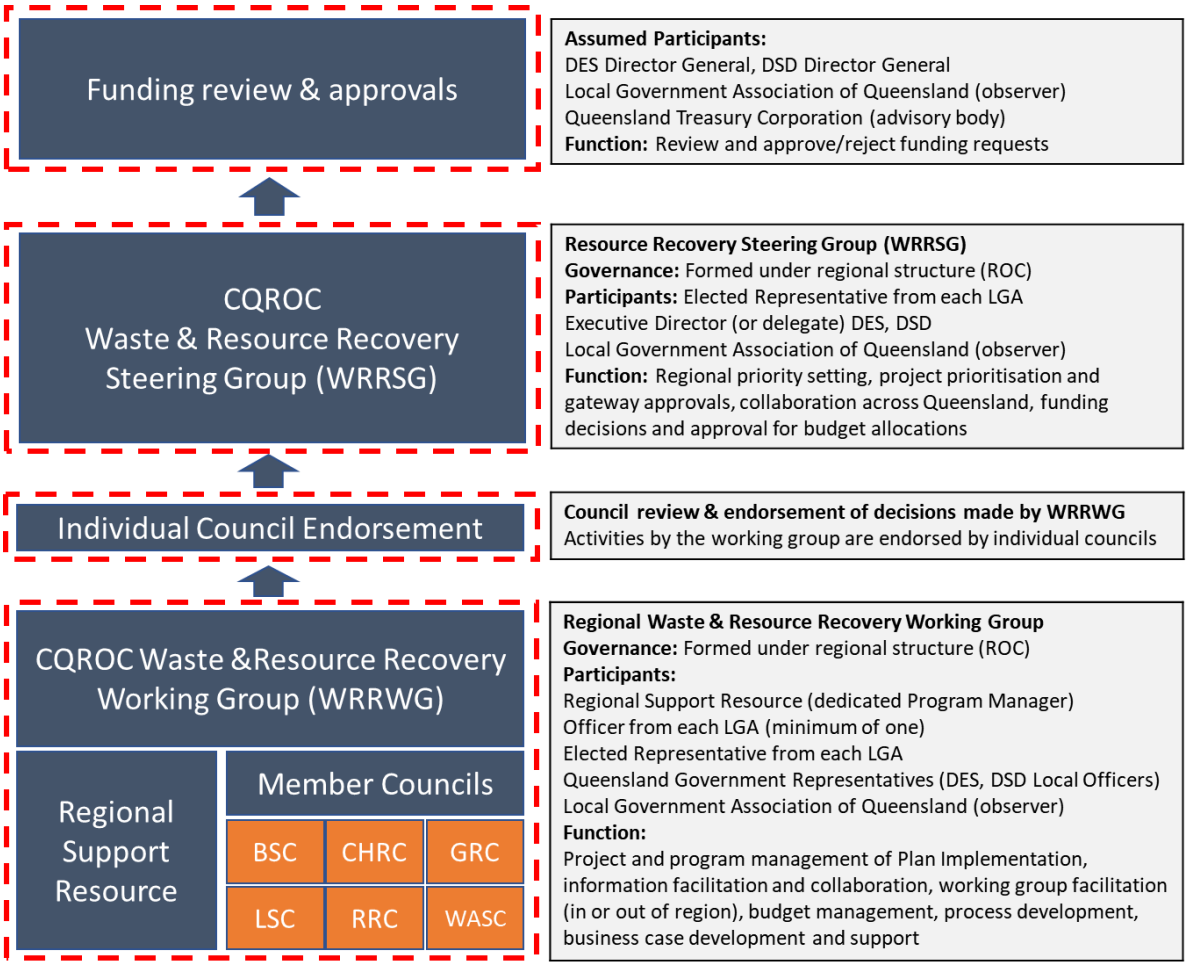


Figure EX6 – Regional governance structure

EXECUTIVE SUMMARY

Review and monitoring

Implementation of the Plan will be the responsibility of the regional steering group through the regional facilitation / coordination support assistance. Initial actions will be measured against progress, but longer-term review should be against metrics including delivery of specific services identified in the Plan and achieving levels of education, capture of types of waste (e.g., FOGO, GO, dry recyclables) and resultant change to recovery rates compared to forecast. The Plan will be scheduled for review and update every 5-years.

Implementation roadmap

An implementation roadmap has been developed identifying timing and activities to deliver this Plan, as show in **Table EX2**.

While the Regional Waste and Resource Recovery Management Plan provides the primary vehicle for accessing available funding from the Recycling and Jobs Fund, there may also be opportunities for initiatives to be funded that are outside the Plan. For example, a pilot at a local level to 'test' the suitability of a model or infrastructure for the region (or sub-region). It is recognised that the Plan needs to be a living document and that not all potential initiatives will have been identified in the Plan.

However, it is expected that the bulk of the funding will come through the projects identified in the Plan with a more streamlined pathway for funding approvals as it has already been identified in the Plan. In the first instance any projects identified that are outside the Plan would likely be discussed with the regional working and steering groups and the proposed regional support resource position that will be funded to support implementation of the Plan, to assess suitability for funding under the Plan or whether this would be considered under a separate funding process.

Councils, in participating in the development of this Plan and subsequent endorsement of or support for its finalisation and publication, can do so in the knowledge that this consideration does not obligate individual Councils to any funding commitment. Subsequent business cases developed as part of implementing the Plan and implementation decisions made by the region for implementing the Plan would normally include that detail.

EXECUTIVE SUMMARY

Table EX2 Implementation Roadmap

Action	Responsibility	Immediate	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2040	2050
		Next 2 years			Within next 5 years			Within next 10 years					To 2040	To 2050
General														
Formalise regional waste working group to implement Plan	WRRSG, All													
Program management	WRRSG, WRRWG													
Regional collaboration (e.g., WRRWG meetings, action management, etc.)	WRRSG, WRRWG, All													
Organic Waste Management														
Participate in Education and Behaviour Change Initiative (assumed continuation) as part of regional education strategy – incorporating a food waste avoidance component	WRRWG, All													
Review potential for behaviour change regulation (new services)	GRC, RRC													
Roll out of at-home composting solutions (where appropriate)	QGOV, ALL													
Develop detailed business case for organics collection service for council approval including market development	GRC, RRC													
Commence new organic waste collection service education	GRC, RRC													
Procurement of organic waste collection solution	GRC, RRC													
Procurement of organic waste processing solution	GRC, RRC													
Commence and operate kerbside organic waste collection service (pending individual council approval)	GRC, RRC													
Continuation of self-haul green waste receipt and processing	All													
Roll out of community composting solutions including guidance (where appropriate)	QGOV													
Develop regional solution for biosolids and timber	WRRWG													
Develop pathway to improve non-Council held data collection	QGOV, All													
Material Recycling & Recovery														
Develop Regional Education Strategy & Implement Participate in Education and Behaviour Change Initiative (assumed continuation)	WRRSG, WRRWG, All													
Develop Council specific Education Plan for Woorabinda Aboriginal Shire Council and implement	QGOV, WASC													
Review & agree pathway for improved enforcement activity for poor household behaviours in kerbside bin service provision, and implement	WRRSG, WRRWG, CHRC, GRC, LSC, RRC													
Collaborate on regional kerbside recycling processing solution	WRRSG, WRRWG CHRC, GRC, LSC, RRC													
Seek opportunities to collaborate on regional kerbside recycling collections approach when contracts allow	WRRSG, WRRWG, All													
Develop business case, designs for new or improved transfer facilities	All (as required)													
Construct and commission upgrades or new transfer facilities	All (as required)													
Collaborate and refine need for establishment of regional scale precinct and ancillary satellite sites in accordance with precinct guidelines	QGOV, WRRSG, WRRWG,													

EXECUTIVE SUMMARY

Action	Responsibility	Immediate	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2040	2050
		Next 2 years			Within next 5 years			Within next 10 years					To 2040	To 2050
Construct enabling infrastructure for precinct	QGOV													
Establish new resource recovery processing facilities within precinct	GGOV													
Work with Queensland Government agencies to improve uptake or recycled materials in procurement	QGOC, WRRWG													
Develop pathway to improve material flow data and knowledge across region for recyclable material	QGOV, WRRSG, All													
Collaborate to collect data on contamination within kerbside bins to improve education approach.	QGOV, WRRSG, WRRWG, All													
Residual Waste Management														
Councils to consider individual landfill capacity needs in short-medium and long-term	All													
Consider long-term options and approach to managing residual waste in the long-term, pending availability of facilities out of region	SG, WRRWG, All													
Design, construct & commission long-term residual waste solution (or enter into long-term supply agreements with privately owned facilities)	SG, WRRWG, All, QGOV													
Develop long-term approach to managing problem and emerging wastes	All													

Notes: BSC-Banana Shire Council, CHRC-Central Highlands Regional Council, GRC-Gladstone Regional Council, LSC-Livingstone Shire Council, RRC-Rockhampton Regional Council, WASC-Woorabinda Aboriginal Shire Council, QGOV-Queensland Government, All-All councils, WRRWG-Regional Waste and Resource Recovery Working group, WRRSG-Regional Resource Recovery Steering Group

CONTENTS

1 INTRODUCTION 1
1.1 Purpose 1
1.2 The region 2
1.3 Key issues to be addressed 4
1.4 Approach to Plan development 4
1.5 Document map 5
1.6 Assumptions and limitations in preparing this Plan 6
2 EXISTING INFORMATION 7
2.1 Policy & legislative drivers 7
2.1.1 National policy and legislation 7
2.1.2 Queensland policy and legislative environment 7
2.1.3 Queensland's Landfill Levy 10
2.1.4 Queensland's Resource Recovery 10-year Roadmap and Action Plan 12
2.1.5 Recycling Enterprise Precinct Development 13
2.1.6 Queensland's Organic Waste Strategy and Roadmap 14
2.2 Regional collaboration and documents 15
2.3 Existing services 16
2.4 Current performance 18
2.4.1 Overall waste managed 18
2.4.2 Breakdown of waste arisings in Central Queensland 19
2.4.3 Current resource recovery performance 20
2.5 Existing infrastructure 22
2.6 Forecast waste arisings 24
2.6.1 Regional waste growth projection 24
3 KEY ISSUES AND OPPORTUNITIES 25
3.1 Landfill capacity 25
3.2 Growth in waste generated 26
3.3 Transport costs are prohibitive 27
3.4 Impacts of landfill expansion 27
3.5 New services may be beneficial 28
3.6 Low population density 28
3.7 Scale for processing and remanufacturing 29

3.8 Community understanding and behaviours 31
3.9 Australian and Queensland objectives and targets for waste management 32
3.10 Potential economic and community benefits 32
4 ORGANIC WASTE 34
4.1 Organic material stream dynamics 34
4.2 Levers and interventions 35
4.2.1 Avoiding and reducing organic waste 35
4.2.2 Alternative pricing strategies / pay as you throw 36
4.2.3 Levies and bans 36
4.2.4 Introducing new organics collections services 37
4.2.5 Education to support a new kerbside organic collection 38
4.2.6 Post collections infrastructure 39
4.2.7 Establishing a market for recycled organics 40
4.3 Major options considered 41
4.3.1 Priority of focus on organics waste stream 43
4.3.2 Organics separation approach 43
4.3.3 New household organic waste collection services in Gladstone and Rockhampton 43
4.3.4 Processing technology 44
4.3.5 Infrastructure ownership and facility delivery 44
4.3.6 Improved understanding of whole of region waste stream composition 44
4.3.7 Market development 45
4.3.8 Approach to behaviour change and education 45
4.3.9 Regional collaboration on community initiatives to reduce organic wastes 45
4.3.10 Tackling problem organic wastes including biosolids 46
4.4 Expected outcomes 46
4.5 The cost of making the change 48
4.6 Supporting the change 49
4.6.1 Getting to the decision point for investments 49
4.6.2 Funding support for Capital Expenditure 49
4.6.3 Behaviour change and education support to support food waste avoidance 50
4.6.4 Clarity of regulation 50
4.6.5 Setting the parameters of community composting 50
4.7 Timeframes 50
4.8 What could affect implementation 52
5 MATERIAL RECYCLING AND RECOVERY 53
5.1 Waste stream dynamics 53
5.2 Levers and interventions 55

5.2.1 Refuse, reduce, avoid, and reuse through education 55
5.2.2 Policy and legislation 55
5.2.3 Regulation and enforcement 55
5.2.4 Collection systems 55
5.2.5 Processing infrastructure 56
5.2.6 Market development 57
5.3 Major options considered 58
5.3.1 Behaviour change and education are critical deliverables 60
5.3.2 Improved or new transfer facilities for community and business recycling 60
5.3.3 New contract for kerbside recycling processing 60
5.3.4 Improved knowledge of recyclable material in region 61
5.3.5 Establish an enterprise recycling precinct and attract investment in new industry 61
5.3.6 Regulation that supports resource recovery and landfill diversion 61
5.3.7 Promoting the 10Rs hierarchy 62
5.4 Expected outcomes 62
5.5 The cost of making the change 64
5.6 Supporting the change 65
5.7 Timeframes 67
5.8 What could affect implementation 68
6 MANAGING RESIDUAL WASTE IN CENTRAL QUEENSLAND 69
6.1 Residual waste stream dynamics 69
6.2 Levers and interventions 70
6.2.1 Avoidance and residual waste reduction 70
6.2.2 Landfill levy and bans 70
6.2.3 Infrastructure – landfill capacity and new landfill 71
6.2.4 Infrastructure – Energy recovery 71
6.3 Options considered 73
6.3.1 Short term residual capacity considerations 74
6.3.2 Deciding between long-term residual landfill or energy from waste 74
6.3.3 Bulking and transfer facilities to support regional collaboration 75
6.3.4 The cost of transport 75
6.3.5 Transport to support EfW 75
6.3.6 Managing disaster waste 75
6.3.7 Managing problem wastes 75
6.4 Expected outcomes 76
6.4.1 Residual waste management - landfill 76
6.4.2 Residual waste sent to energy from waste 77
6.5 The cost of making the transition 80

6.6 Supporting the change 81
6.7 Timeframes for delivery 82
7 IMPLEMENTING THE PLAN 83
7.1 Key actions & collaborations 83
7.2 Delivery mechanism 83
7.2.1 CQROC Waste and Resource Recovery Working Group 84
7.2.2 Regional Procurement Entity 85
7.2.3 Support for delivery 85
7.3 Implementation Plan 86
7.4 Roles and responsibilities 89
7.5 Cost estimate 92
7.6 Funding 92
7.6.1 Local Government funding & financing 92
7.6.2 Private sector funding & financing 92
7.6.3 Queensland Government funding - Annual Advanced Payment for Local Governments 92
7.6.4 Queensland Government funding – Infrastructure 93
7.6.5 Government funding – Subsidising & supporting new systems 93
7.6.6 Government funding – non-infrastructure 94
7.7 Managing change 94
7.8 Monitoring and review 94

DOCUMENT REFERENCES

TABLES

Table 1 Document map 5
Table 2 Summary of relevant State legislation and policy 9
Table 3 Announced changes to annual advanced payment proportions 10
Table 4 Regulated annual advance payments – FY22-23 to FY25-26 11
Table 5 Organic Waste Strategy and Roadmap targets relevant to this Plan 14
Table 6 Regional strategy documents 15
Table 7 Existing Services by Council 16
Table 8 Container refund points 17
Table 9 Distribution of waste managed by Central Queensland Councils (FY20-21) – all streams 18
Table 10 CQROC waste diversion target comparison 21
Table 11 Central Queensland LGA landfill capacity and closure dates 26
Table 12 Potential organics in kerbside waste per LGA 37
Table 13 Indicative Costs for Collection Consumables 38
Table 14 Indicative Costs for Education 38

Table 15 Organic waste processing options summary 39
Table 16 Major organic waste decisions 42
Table 17 Expected Outcomes – changes to organic waste performance 47
Table 18 Organics implementation timeframes 50
Table 19 Indicative Costs for an MRF 56
Table 20 Indicative Costs for Reprocessing 57
Table 21 Major recyclable waste decisions 59
Table 22 Expected Outcomes – material recycling and recovery 63
Table 23 Recycling Stream implementation timeframes 67
Table 24 EfW technologies and options 71
Table 25 Major residual waste decisions 74
Table 26 Residual Waste Stream implementation timeframes 82
Table 27 Implementation Schematic 87
Table 28 RACI definitions 89
Table 29 RACI Chart – Plan Implementation 90
Table 30 Monitoring parameters 94

FIGURES

Figure 1 Regional Location Plan 3
Figure 2 The 10 Rs of a Circular Economy 8
Figure 3 Impact of differential in annual advanced payment ($/tonne) 11
Figure 4 Change in annual advanced payments – Central Queensland Councils 12
Figure 5 Households and coverage of kerbside services provided 17
Figure 6 Regional waste summary by stream (FY20-21) 18
Figure 7 Summary of fates by stream and material for Central Queensland 19
Figure 8 Waste materials by fate for Central Queensland 20
Figure 9 Current performance compared to state and 2025/2030 targets 21
Figure 10 Current waste flow mapping by materials and destination for Central Queensland 22
Figure 11 Regional Infrastructure Stocks 23
Figure 12 30-year waste projections for Central Queensland by waste stream 24
Figure 13 Estimated breakdown of organic waste managed by Councils in region 35
Figure 14 Future State for Organics collections 47
Figure 15 Proportion of recyclable material forecast in each source (FY20-21) 54
Figure 16 Current forecast – residual waste within the region to 2050 70
Figure 17 Forecast whole of region residual waste arisings (landfill scenario) 76
Figure 18 Future State for Kerbside Residual Waste management with energy recovery (Combustion) 77
Figure 19 Forecast whole of region residual waste arisings compared to current state (EFW via combustion) 78
Figure 20 Future State for Kerbside Residual Waste management with energy recovery (Waste to PEF) 79
Figure 21 Forecast whole of region residual waste arisings compared to current state (Waste to PEF) 79
Figure 22 Regional Collaboration & Individual Council Actions 83
Figure 23 Governance and collaboration structure for implementation 84

Glossary

Acronym	Details
Annual advance payment	A payment made by the Queensland Government as part of a commitment made to avoid there being a direct impact of the waste disposal levy on households. Councils receive a percentage (depending on levy zone) of the amount paid in waste disposal levy on household waste as an advanced payment.
Capital Expenditure (CAPEX)	An expense incurred through the additional of capital infrastructure works
C&D	Construction and demolition - Waste generated by demolition and excavation companies, builders, contractors, and property developers. The waste from these activities can include excavated material, waste asphalt, bricks, concrete, plaster, timber, vegetation, asbestos, and contaminated soils.
C&I	Commercial and Industrial - Waste generated by manufacturers, shops and business of all sizes and varieties.
Circular economy	A model of production and consumption that avoids waste and depletion of finite resources through the reuse of materials and assets.
Composting	Repurposing of organic waste to produce compost or other soil improver products, which are then sold into landscaping and agricultural markets
DES	Department of Environment and Science - A department of the Queensland Government driving sustainability, wellbeing, and scientific excellence.
Diversion	Diversion in the context of this report refers to diversion of waste from landfill to an alternative recovery pathway
EFW	Energy from waste: Interchangeably termed 'waste to energy'. A collection of treatment processes and technologies used to generate a usable form of energy, for example, electricity, heat, and fuels, from waste materials. In Queensland, EfW technologies can be divided into two broad categories: biological, chemical, thermal.
Expanded polystyrene (EPS)	A lightweight cellular plastic material, widely used in building and construction, and packaging.
FOGO collection	Food Organics and Garden Organics – Refers to a kerbside collection service of combined food and garden waste, mostly from domestic or municipal sources in one collection bin
Infrastructure	Infrastructure in the context of this report refers to waste and resource recovery infrastructure unless otherwise noted
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
Leachate	A form of wastewater that has percolated through waste such as that in landfills
Mixed recyclables	Comingled recyclable materials including plastic, aluminium, glass, steel, and paper
MRF	Material recovery facility – A Plant that separates and prepares recyclable materials to sell to end users as raw materials for new products.
MSW	Municipal Solid Waste - Primarily the waste and recyclables generated by households and collected by Councils but may also include other Council generated wastes.
Operating expenditure (OPEX)	An expense a business incurs through its regular business operations.
Organics processing	The processing of organic materials into beneficial products such as soil conditioners and mulch

Acronym	Details
PEF	Process Engineered Fuel, also known as refuse derived fuel (RDF), is a solid fuel produced after processing of waste, for example in a dirty MRF, to increase the calorific value, homogenise the material, remove recyclable materials, remove inert materials, and remove hazardous contaminants
Processing facilities and infrastructure	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 the generation of new products.
PV	Photovoltaic- mechanism used in solar panels
Product stewardship	Recognition of the shared responsibility to reduce the environmental and human health and safety impacts of products and materials over their life from design to disposal.
QWDS	Queensland Waste Data System. The web-based data system used by the Queensland government to collect data from operators. Depending on reporting entity there are different reporting requirements. Data from QWDS has been utilised to inform this Plan.
Recyclate	Raw material transported to a waste recycling facility or a material recovery facility for processing into a new material or product
Reprocessing	Changing the physical structure and properties of a waste material that would otherwise have been sent to landfill to add value to the processed material and prepare it for reuse.
Resource recovery	The process of obtaining matter or energy from discarded materials
WRRWG	Waste and Resource Recovery Working Group
Secondary processing	Taking pre-sorted materials and changing their physical and/or chemical nature, adding value to the processed material so that it can become a feedstock for a manufacturing process or re-enter the economy
Single use plastic	Materials primarily made from petrochemicals to be disposed of directly after use. Commonly used for packaging and service ware, such as bottles. Wrappers, straws, and bags.
Sustainable procurement	Meeting the need for materials, goods, utilities, and services in a sustainable, environmentally friendly, responsible, and ethical way.

1 Introduction

Central Queensland Regional Organisation of Councils (CQROC) and the Queensland Government recognise the importance of regional implementation in the delivery of Queensland's *Waste Management and Resource Recovery Strategy*[5] (WMRR Strategy). The Local Government Association of Queensland (LGAQ) is supporting the development of the Central Queensland Regional Waste and Resource Recovery Management Plan (the Plan) on behalf of the Councils within the CQROC. This Plan details a clear path for the future of waste management, resource recovery and recycling in the region through providing strategies and actions to strengthen regional collaboration regarding the delivery and improvement of waste management and resource recovery services across the region.

The intention of the Plan is to provide long-term direction to 2050 of the needs of the region in terms of critical waste streams, infrastructure, and the identification of a particular suite of levers required to achieve regionally specific targets. Specific activities and actions in the short to medium-term are identified, where there is a relatively high degree of certainty in process and outcome. Longer-term activities and actions are expected to be implemented later in the program of works or require further refinement and development. It is anticipated that the Plan will require a degree of flexibility.

The Plan aims to achieve a balance between a clear implementation Plan for the best whole of system outcome for the region, while reflecting the needs and wishes of each individual Council and their rate payers.

CQROC recognises that Woorabinda Aboriginal Shire Council is a member of the Central Queensland region for the purpose of developing and implementing a Regional Waste Management Plan and that:

- Woorabinda's preliminary internal assessment of impacts and opportunities relating to Waste Management does not identify business case elements for potential initiatives to be considered as part of the Qld State Infrastructure Investment Plans and/or other Strategic Plans in the immediate future.
- To negate this limitation, Woorabinda Aboriginal Shire Council will develop its own local waste reduction and resource recovery Plan to inform further iteration of the CQROC Regional Waste Management Plan and in due course provide greater opportunities to align needs and opportunities for State Infrastructure Investment and/or other Strategic Plans for Waste Management into the future.

1.1 Purpose

The purpose of the Plan is to address any problems and opportunities with the current waste management in the region. The objectives of this Regional Waste and Resource Recovery Management Plan are to:

- Maximise the value of waste, including problematic waste streams
- Deliver the best pathway for the region that identifies opportunities for government co-funding arrangements, and industry investment or co-investment
- Provide Councils with the data and options analysis required to make informed decisions about policy, location of infrastructure and optimal value for money investment, and non-infrastructure options
- Support improved waste management, resource recovery and recycling practices to contribute towards agreed regional and Queensland Government targets
- Encourage and support opportunities to embed circular economy principles into business-as-usual practices, including through sustainable procurement principles

[5] Queensland Government, 2019. *Waste Management and Resource Recovery Strategy*

- Encourage and support job creation and economic and market development opportunities
- Improve environmental outcomes for the community
- Identify non-infrastructure and social and community benefits and
- Establish and maintain collaborative relationships with key stakeholders to drive long-term sustainable outcomes.

1.2 The region

This Plan is specifically for the Central Queensland region, comprising the Local Government Areas of Banana Shire Council, Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council, Rockhampton Regional Council and Woorabinda Aboriginal Shire Council. Where appropriate, the Plan may look outside of the region to neighbouring regions or individual Councils for benefit of Plan implementation. The region is show on **Figure 1**.

The current population of the CQROC area is approximately 230,000[6] and predicted to grow to around 360,000 by June 2036[6] which is an increase of 2% per year over 25 years. Population projections[7] suggest growth in population will be significant in Gladstone, Livingstone, and Rockhampton LGAs, marginal in Central Highlands, and population will decline in Banana Shire and Woorabinda Aboriginal Shire Council between 2016 and 2041.

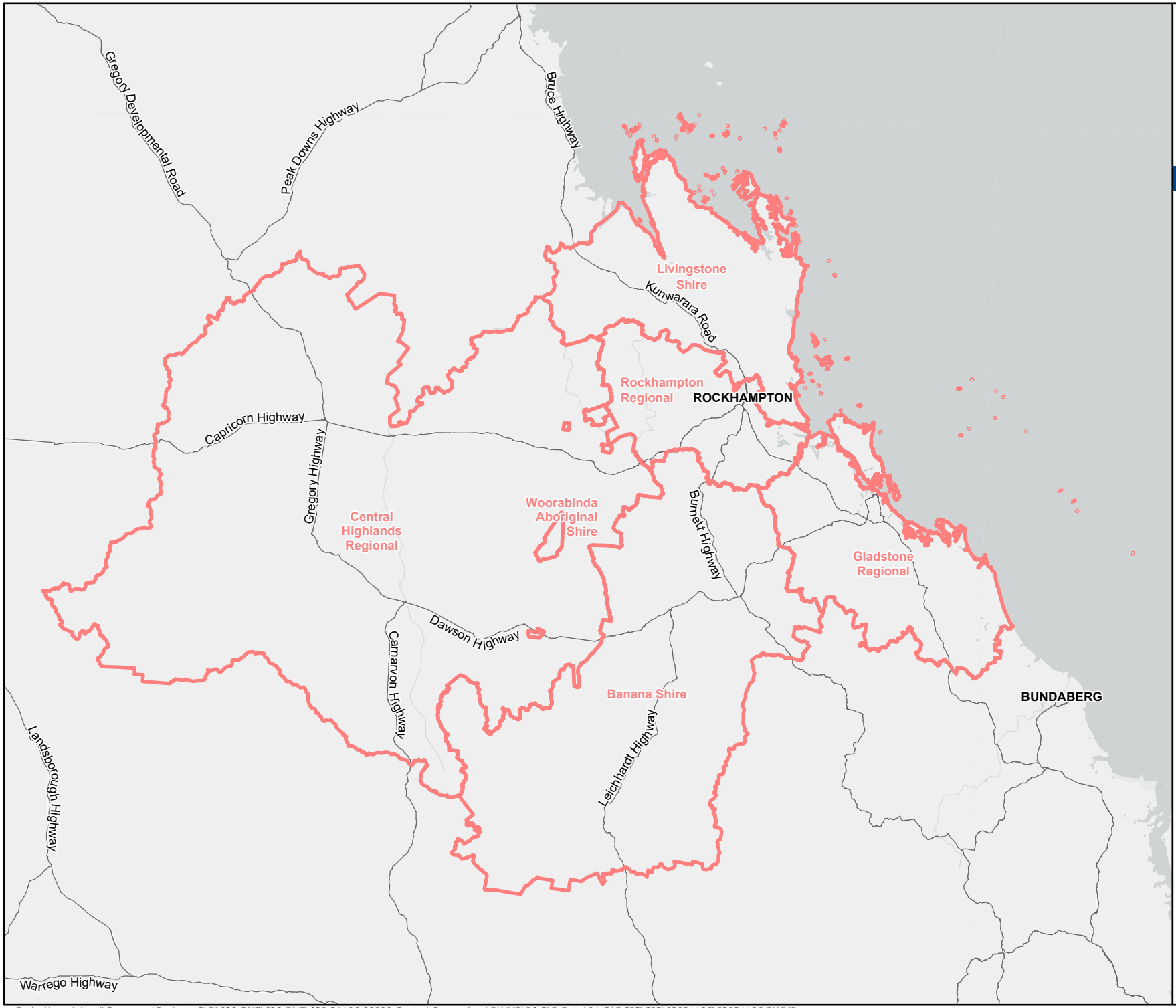
Central Queensland is a major contributor to the state and National economy, generating $17 billion in Gross Regional Product in 2019, primarily from the key industries of mining and agriculture. These key industries are widely dispersed throughout the region, with key mining operations conducted in the central, western, and southern areas near Emerald, Blackwater, Biloela, and Moura. Agricultural activities are located across the region from Banana through to Rockhampton, and the Central Highlands supports approximately 1.3 million head of cattle across its expansive LGA[8].

The region identifies key strengths[9] through cattle saleyards at Emerald and Gracemere, beef abattoirs at Biloela and Rockhampton, coal power stations at Rockhampton, Biloela and Gladstone, wind energy developments and ports located at Gladstone, Port Alma, and Emerald. These support key industries across the region including mining, construction, manufacturing, power and water, and agriculture, forestry, and fishing. Agriculture is dominated by cattle and calves contributing $1B to the economy.

Several key projects are identified by the Department of State Development within the Central Queensland Region, noting that the CQROC represents six Councils within a broader region as defined by the Queensland Government. These include:

- Hydrogen industry development and green chemicals manufacture
- Transport and supply chain logistics Planning
- Renewable energy generation
- Rockhampton Ring Road
- Major project supply chain development

[6] Central Queensland Regional Organisation of Councils, 2022. Population (https://cqroc.org.au/population/)
[7] Queensland Government population projections, 2018 edition; Australian Bureau of Statistics, Population by age and sex, regions of Australia, 2016 (Cat no. 3235.0).
[8] DSDIP (2013). Central Queensland Regional Plan
[9] Central Queensland Regional Organisation of Councils, 2022, CQROC Strategic Plan (https://cqroc.org.au/wp-content/uploads/2022/02/CQROC-Strategic-Plan.pdf)



CENTRAL QUEENSLAND RWRRMP

General Locations

FIGURE 1

Major Roads

Local Government Area Boundaries

Data Sources:
QLD DoR spatial catalogue, ESRI Basemap World Light Gray Canvas Base

0 50 100 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:2,900,000 at A4
Project Number:	620.31106
Date Drawn:	22-Nov-2022
Drawn by:	JG

SLR

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.31106.00000 Central Queensland RWMP\06 SLR Data\01 CADGIS\GIS\62031106\62031106 RWMP.aprx

1.3 Key issues to be addressed

Through an Investment Logic Mapping (ILM) process with CQROC Councils, elected officials and key Plan stakeholders including the Queensland Government, the following needs for the Plan to address (service needs) were identified:

- Landfills in the region, except for Gladstone, do not have long-term capacity and require further investment to enable appropriate management of residual waste
- It is forecast that the population of Central Queensland will grow over the next 20-years by approximately 2%, creating an increase in waste generated.
- Transport costs are generally prohibitive, particularly across smaller Councils with large geographical area to cover
- Landfill expansion or development of new landfill sites, particularly for putrescible waste, is challenging, but focus should be on growing existing sites if required
- Diversified input is required such as through the addition of a kerbside organics collection, but also through expectations for Councils to support C&I/C&D streams that enter their sites
- Areas with low population densities within the region do not have enough resources to recover materials, limiting the opportunities to achieve resource recovery – this extends to there being insufficient scale for processing of household recycling or secondary processing of raw materials derived from recycling.
- Community understanding and behaviours impose a significant risk and impact to existing or proposed future operations.
- The existing circumstances for waste generation and disposal in Central Queensland make meeting the objectives and targets in the Queensland Waste Management and Resource Recovery Strategy and National Waste Policy Action Plan impossible

An underlying constraint to all key issues is cost. These key issues are explored further in **Section 3**.

1.4 Approach to Plan development

This Plan has been developed through initial engagement between CQROC Councils, the Queensland Government, and other key stakeholders. Engagement to inform this Plan has included:

- An investment logic mapping workshop with the CQROC Waste and Resource Recovery Working Group including representatives from each member Council and the Queensland Government.
- An options assessment workshop considering the key options available to Councils as part of a regional collaboration or for individual Council action with the CQROC Waste and Resource Recovery Working Group including representatives from each member Council and the Queensland Government.
- An implementation options workshop with the CQROC Waste and Resource Recovery Working Group including representatives from each member Council and the Queensland Government to identify roles and responsibilities, governance structures, funding needs and timeframes.
- A series of follow up sessions with individual Councils to refine and improve on the understanding of workshop outcomes, capturing specific needs or to undertake editorial.
- Presentations to the CQROC Board and to individual member Councils.

- Additional follow up sessions with Council teams and Department of Environment and Science (DES) relating to information and data provided to inform waste flow forecasting.
- Engagement with key non-Council or Queensland Government stakeholders in the region including peak bodies, local industry and other specialist businesses managing materials or waste.

1.5 Document map

This Plan is the result of a significant research, consultation, and collaboration effort by the CQROC, and draws together historic and current work undertaken by the CQROC Waste and Resource Recovery Working Group, or by individual Councils within the region. Key information utilised is referenced in the document. The following provides a document map to where information is presented:

Table 1 Document map

Detail	Section	Sub-section	Description / Relevance to Plan
Purpose of the RWRRMP	1	1.1	The rationale and expected objectives of the Plan
Background information	1	1.2	Information on the Central Queensland Region
Policy setting	2	2.1, 2.2	The current policy setting in which this Plan is developed including approach to regional collaboration
Waste arisings, current baseline, and forecasting	2	2.4, 2.6	Analysis relating existing waste arisings in the region, current management, and processing infrastructure, and forecast arisings utilised to shape the Plan.
Key issues & opportunities	3	1.3, s3	Description of strategic rationale and detail of key issues identified by stakeholders to be addressed by the Plan
Organic waste stream	4	Whole section	This section considers the role the region will play in diverting organic waste from landfill, whether by large scale intervention or community based non-infrastructure solutions, including estimated cost of the transition and role each Council will play.
Material recycling & recovery	5	Whole section	This section considers how material recycling and recovery can be improved in the region, including reducing contamination, improving transfer and segregation facilities, and identifying collaborative actions for MRF and precinct development.
Residual waste stream	6	Whole section	Following implementation of the outcomes of s4 and s5 this section considers how the residual waste stream will be managed in the context of reducing airspace and increasing cost for landfill disposal.
Plan implementation	7	Whole section	This section presents how the Plan will be implemented, including key actions and agreements for collaboration, how the Plan will be delivered, and where funding may make the impact on households lower or more meaningful.

1.6 Assumptions and limitations in preparing this Plan

The following assumptions and limitations have been used to develop this Plan:

- Data provided by the Queensland Government from annual returns is assumed to be free from errors. The data cut off allows the utilisation of data up to FY20-21 to inform the study. In some cases, Councils have provided additional data to supplement or reflect their own analysis, which may be inconsistent with the Queensland Government supplied data.
- Cost estimates provided in the cost benefit analysis and presented in the Plan are accurate at a p50 level. These estimates are built using proxy costs in the region (where available), from out of region or from benchmark data. It is a general assumption that any costed solution will require further definition during implementation of the Plan and to satisfy the needs of Local, Queensland and Commonwealth Government decision makers.
- The waste sector is highly dynamic. Over the duration of the Plan development changes have been captured, however the Plan should be reviewed on a regular basis during implementation to ensure it meets the needs of the current policy position.
- This Plan represents the inputs and requirements of Councils developed through an interactive process. Whilst decisions reflected in the Plan are current at the point of issue, these decisions require continued council involvement, authorisation, and funding (whether from Councils or other funding sources) to progress towards the targets and outcomes.
- This Plan identifies the pathway and the evidence base for the region to deliver on the objectives of Queensland's Waste Management and Resource Recovery Strategy, including suggested actions and costs to implement.

2 Existing Information

2.1 Policy & legislative drivers

There are a range of economic, environmental, policy and legislative factors that drive the need for a regional-scale response. The key policy and legislative drivers applicable to this Plan are summarised in the following sections.

2.1.1 National policy and legislation

The **National Waste Policy**, which was updated in 2018, and the **National Waste Policy Action Plan**, identify priority wastes and prioritises the increased diversion of organic waste from landfill. Under the policy, and the introduction of the *Recycling and Waste Reduction Act* 2020, a framework for the banning of export of certain waste materials (glass, plastic, tyres and paper and cardboard). Reprocessers can now only export these materials under specific requirements[10], with a view to driving in Australia processing and remanufacturing. Support for the waste industry is provided by a partnership between the Commonwealth and Queensland Governments under the Recycling Modernisation Fund. In relevance to this Plan, export bans provide a barrier to existing Material Recovery Facility (MRF) operators and likely, over time will lead to increased gate fees for users of these facilities (e.g., Councils who provide kerbside collected commingled recycling), particularly whilst onshore processing and secondary markets utilising the recycled material are catching up.

Under the National Waste Policy, the Commonwealth Government has initiated the **Ministers Priority List**[11]. This is a list of priority wastes and actions updated annually, with an aim to driving action through product stewardship to manage problematic or emerging wastes. From this list product stewardship schemes for photovoltaic (PV) systems (i.e., solar panels), electrical and electronic products (e-wastes), plastic oil containers, child car seats, clothing and textiles, and problematic and unnecessary single use plastics have been established or are in the process of being established. A series of national product stewardship schemes are established for oil, TVs and computers, plastics and packaging, mattresses, mobile phones, tyres, large plastic bags, batteries, aluminium cladding under mandatory schemes, co-regulatory arrangements, or government accredited industry-led voluntary schemes. In regional Queensland access for residents, whether directly or via Council operated resource recovery or transfer facilities can be variable.

2.1.2 Queensland policy and legislative environment

The Queensland Government's ***Waste Management and Resource Recovery Strategy*** (WMRR Strategy), released in 2019 provides a framework and series of actions for the Queensland Government, Local Government, and industry to move toward a Zero Waste Society by 2050. The Queensland Government is required to have a waste management strategy under the *Waste and Recycling Act* 2008. The development of this Plan is an action under the Strategy, which sets specific resource recovery targets for 2025, 2030, 2040 and 2050. To support the implementation of the Strategy, the Queensland Government introduced a levy on the disposal of waste to landfill in July 2019. The implication of this on this Plan is presented in Section 2.1.3 . Under the strategy a series of action Plans and policies have been developed or are in progress.

[10] The regulation of export of paper and card will commence on 1 July 2024. Glass, plastic, and tyres are already regulated.
[11] Australian Government, 2022. Minister's Priority List, from https://www.dcceew.gov.au/environment/protection/waste/product-stewardship/ministers-priority-list

The Queensland WMRR Strategy points towards a transition towards a circular economy. Whilst the waste hierarchy and the traditional 3Rs of Reduce, Reuse and Recycle continue to dominate how waste is managed in the region, and will continue to do so, it is reasonable to expect over time the nature of waste will change as producers and consumers begin to adopt circular concepts. The 10Rs of the circular economy (see **Figure 2**) place a much greater emphasis on the use of design for consumers and producers to refuse, rethink and reduce waste. Consumption under the circular economy will support reuse, repair, refurbishment, remanufacturing, and repurposing to minimise the return of materials for recycle or recovery. This Plan attempts to find a balance between meeting existing needs and allowing for future changes.

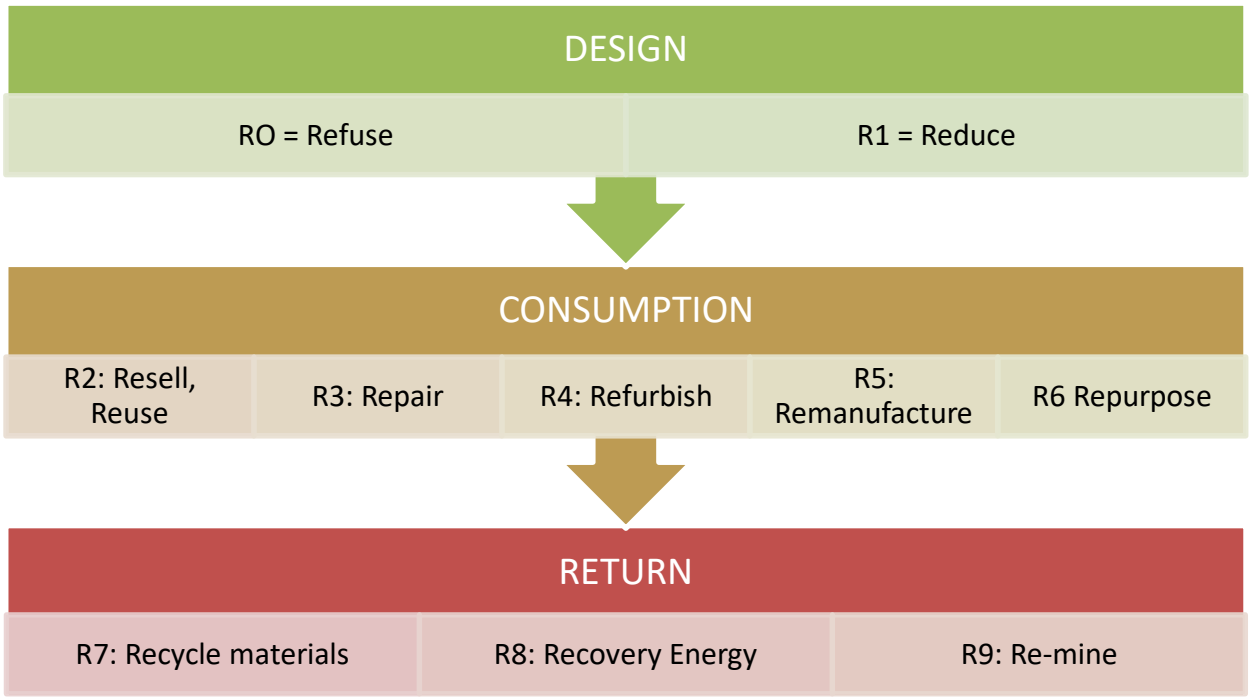


Figure 2 The 10 Rs of a Circular Economy[12]

[12] Vermeulen, W.J.V, Reike, D. and Witjes, S. 2019. Circular Economy 3.0 – Solving confusion around new conceptions of circularity by synthesising and reorganising the 3R's concept into a 10R hierarchy.

Table 2 Summary of relevant State legislation and policy

Document	Status	Relevance to regional Plan
Queensland Waste and Resource Recovery Infrastructure Report	Current	Statewide waste and resource recovery infrastructure report detailing stocks and flows, and locations and capacity of existing waste infrastructure. Used to inform baseline for this Plan
Queensland Resource Recovery Industries 10-Year Roadmap and Action Plan (2019)	Current	Action Plan under Waste Strategy Sets out a Plan to support industry growth and job creation in resource recovery, including framework for grant funding Interaction with precinct Planning provides for beneficial co-location of recycling and post-recycling
First Nation communities waste strategy and Action Plans	Current	Provides an innovative approach for Queensland's 17 Aboriginal and Torres Strait Island Councils in managing waste Is supported by regional Action Plans, in development, with three Councils included in RWRRMP being Palm Island, Woorabinda, Cherbourg
Queensland Energy from Waste Policy (2021)	Current	Non-statutory policy sets framework for role of EfW in Queensland and key performance and compliance indicators. Implications for EfW projects proposed under this Plan, requirements may impact analysis
Queensland Organics Strategy and Action Plan 2022-2032	Current	The Organics Strategy provides the framework and actions for improved management of organic materials across the supply and consumption chain. Regional Planning must be consistent with the Strategy aims and objectives and allow for the impact of the successful implementation in forward projections. The Action Plan provides specific actions for delivery across the avoidance, landfill diversion and recycling themes in the short, medium, and long term. The regional Plan will seek to contribute to these actions to support the Queensland Government in achieving the objectives of the strategy.
Queensland Plastic Pollution Reduction Plan	Current	Presents the strategy for how Queensland will be part of the solution to plastic pollution, including prioritised actions along every step in the supply chain. Implementation of the strategy has included the ban on sale or supply of single-use plastic items in 2021, with additional bans on other problematic plastics to commence soon. Solutions for improving the management of plastic wastes and moving towards a circular economy delivered under the regional Plan should align with the Plastic Pollution Reduction Plan.
Single-use plastic items ban	Current	Implemented on 10 March 2021, the legislation bans the sale or supply of straws, cutlery, unenclosed bowls and plates, stirrers and expanded polystyrene takeaway food containers and cups. This ban and future bans should be considered when forecasting future supply of waste containers such as compostable packaging.
Plastic bag ban	Current	The ban on the supply of single-use lightweight plastic shopping bags came into effect on 1 July 2018, forming part of broader measures to reduce single use plastic.
Containers for Change – container refund scheme	Current	The current container refund scheme facilitates a 10-cent refund for eligible drink containers at approved container refund points. The availability of recycled material collected through the scheme may be relevant to feedstock supply for certain types of secondary processing, for example, aluminium, plastics, and others. Recently announced consultation on the addition of wine and spirit bottles in late 2022.
Queensland E-Products Action Plan	In development	This Plan seeks to address waste avoidance, reduction, reuse, repair, and recycling for electrical and electronic products, collectively known as e-products.
Queensland Textile Waste Action Plan	In development	This Plan seeks to address problematic and hard to recycle textile wastes. It may present new pathways or avenues for support to improving recycling.
Landfill Disposal Bans	In development	The Queensland Government is currently undertaking analysis of the potential to implement bans on the disposal of certain types of waste to landfill.

2.1.3 Queensland's Landfill Levy

The Queensland Government introduced a landfill levy in July 2019 through amendments to the *Waste Reduction and Recycling Act* 2011. The levy is payable on all waste (including waste generated in another state or territory) disposed to a leviable waste disposal site within the levy zone or if it has been generated within the levy zone and disposed of to a landfill outside the levy zone in Queensland.[13] In the Central Queensland region, Banana Shire Council, Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council, and Rockhampton Regional Council were all included within the levy zone. The waste levy does not apply to waste generated in the Woorabinda Aboriginal Shire Local Government Area.

In late 2021 changes to the approach were announced. From 1 July 2022, the levy zone was divided into two areas:[14]

- the metro zone—comprising 12 south-east Queensland local government areas
- the regional zone—made up of the remaining 27 local government areas in the current levy zone.

From commencement in July 2019, 105% of the levy collected on household waste (the MSW stream) disposed of to landfill was returned to levied Councils via annual advanced payments to meet the Queensland Government commitment of no direct impact on households.[13] The changes announced in late 2021 have an implication on Councils within the Central Queensland Region, in particular for Gladstone Regional Council and Rockhampton Regional Council as outlined in **Table 3** below.

Table 3 Announced changes to annual advanced payment proportions

Council	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
Banana Shire Council	105%	100%	100%	100%	100%	100%	100%	100%	100%
Central Highlands Regional Council	105%	100%	100%	100%	100%	100%	100%	100%	100%
Gladstone Regional Council	105%	95%	85%	70%	60%	50%	40%	30%	20%
Livingstone Shire Council	105%	100%	100%	100%	100%	100%	100%	100%	100%
Rockhampton Regional Council	105%	95%	85%	70%	60%	50%	40%	30%	20%
Woorabinda Aboriginal Shire Council	-	-	-	-	-	-	-	-	-

Source: Queensland Government[14] – note Woorabinda Aboriginal Shire Council is not in the landfill levy zone

From 1 July 2023 Banana Shire Council, Central Highlands Regional Council and Livingstone Shire Council will receive 100% of the annual advanced payment, with the proportion reducing from 105%. The annual advanced payments for Gladstone Regional Council and Rockhampton Regional Council are different to other Councils in the region, with a progressive reduction in the proportion of annual advanced payment received commencing from FY23-24.

Four years' worth of payments were made to Queensland Councils in the levy zone at the start of the FY22-23 as shown in **Table 4**.

[13] About Queensland's waste levy | Environment, land and water | Queensland Government (www.qld.gov.au)
[14] Waste levy changes from 1 July 2022 | Environment, land and water | Queensland Government (www.qld.gov.au)

Table 4 Regulated annual advance payments – FY22-23 to FY25-26

Council	2022-23	2023-24	2024-25	2025-26	Four-year total
Banana Shire Council	$ 451,639	$ 486,764	$ 502,811	$ 524,208	$ 1,965,422
Central Highlands Regional Council	$ 987,134	$ 958,864	$ 990,475	$ 1,032,623	$ 3,969,096
Gladstone Regional Council	$ 1,952,397	$ 1,775,488	$ 1,640,966	$ 1,408,889	$ 6,777,740
Livingstone Shire Council	$ 1,140,178	$ 1,115,720	$ 1,152,502	$ 1,201,545	$ 4,609,945
Rockhampton Regional Council	$ 2,537,568	$ 2,308,415	$ 2,133,514	$ 1,831,778	$ 8,811,275
Woorabinda Aboriginal Shire Council	-	-	-	-	-

Source: as per Waste Reduction and Recycling Regulation, Schedule 4A. Woorabinda Aboriginal Shire Council is not in the waste levy zone

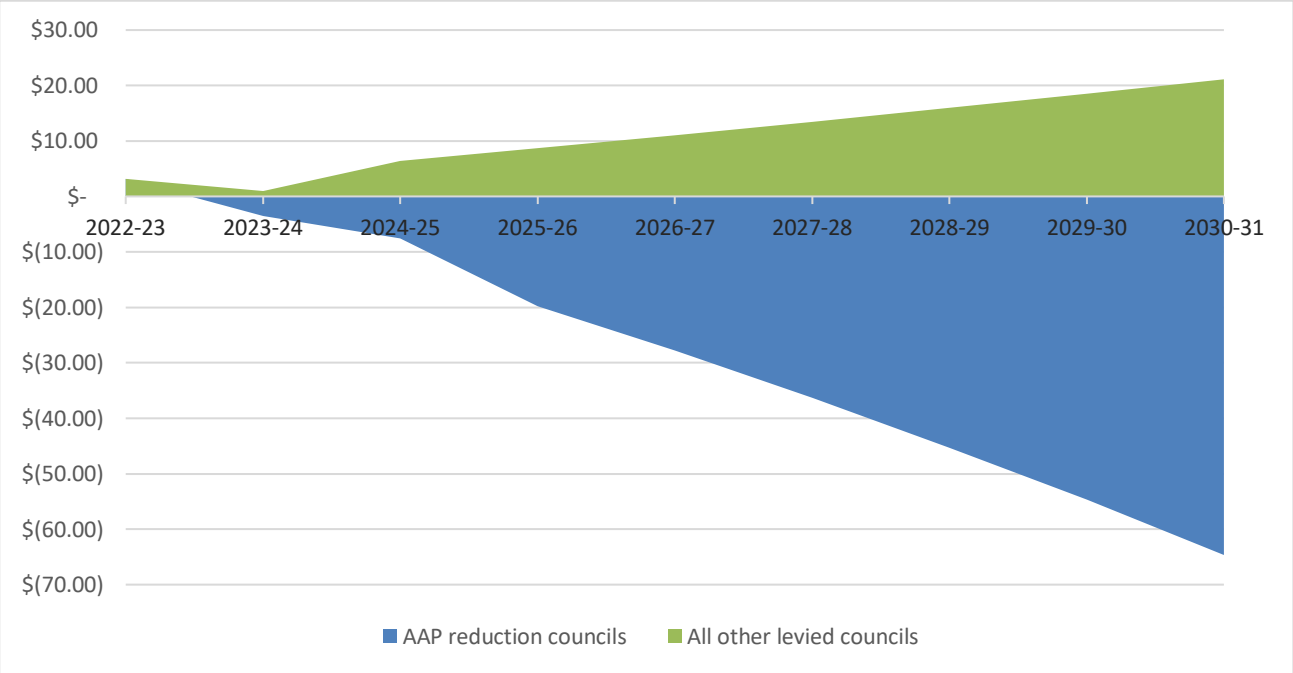
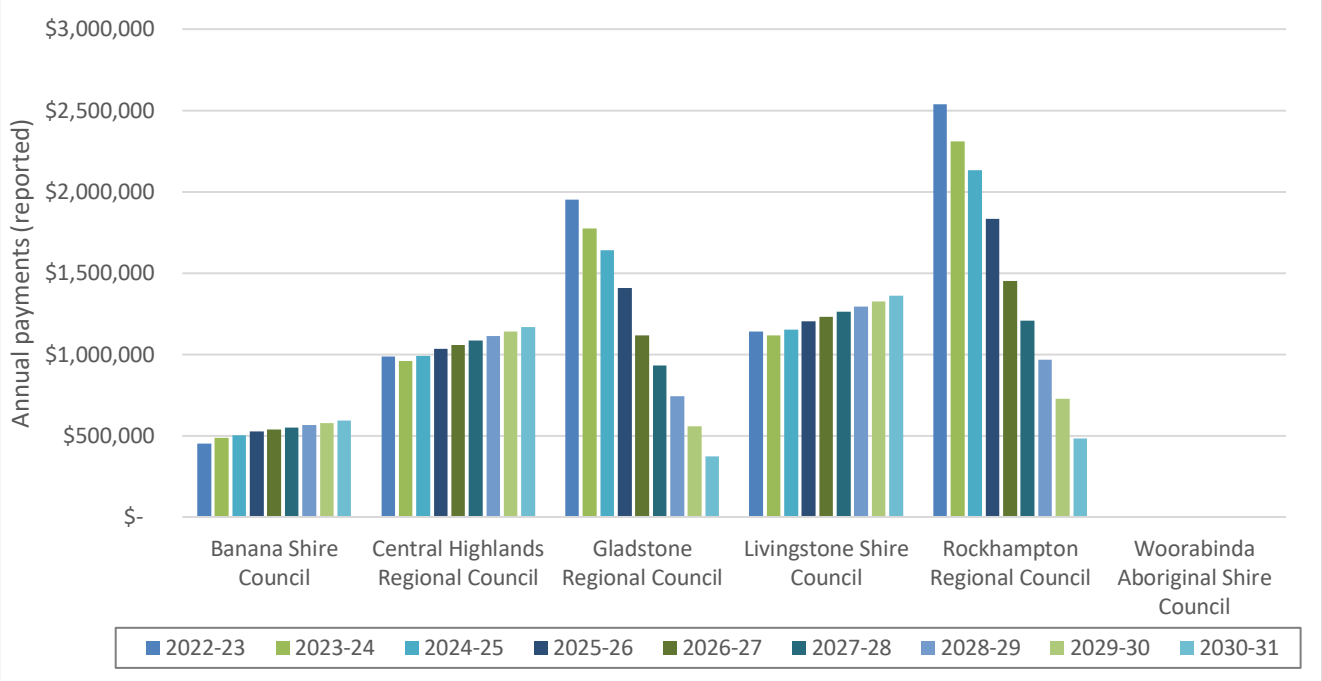


Figure 3 Impact of differential in annual advanced payment ($/tonne)

Beyond FY25-26 the regulated amounts of annual advanced payment have not been published however can be forecast based on percentage changes proposed. Over this four-year period there may be changes to the amount of household waste that goes to landfill within some Councils. Based on current arisings, the regulated annual advanced payments have been extrapolated out based on the proposed changes to the annual advanced payments. Waste arisings are expected to be different to the base year, so there may be some variation across all councils.

Over the period FY22-23 to FY30-31, the estimated cost of the landfill levy without any intervention is estimated to be $18.8 million for Gladstone Regional Council and $27.5 million for Rockhampton Regional Council. Over the same period, Gladstone Regional Council will receive $10.7 million and Rockhampton Regional Council $13.9 million in estimated annual advance payments, leaving a shortfall of $8.1 million and $13.6 million respectively compared to the original levy settings, as shown in **Figure 4**. Over this period, households would have to be charged between $43 and $46 per year more than their current service charge to cover this cost.



Note: Gladstone and Rockhampton extrapolated based upon FY22-23 at 105% estimated based on current data. Other Councils assumed to receive 100% over duration with annual advanced payment increasing by generalised long-term CPI rate of 2.5%

Figure 4 Change in annual advanced payments – Central Queensland Councils

For Councils within the region there is benefit to both being paid the annual advanced payments 4-years in advance and having clarity over the changes in proportion of these payments to FY30-31. For the smaller leviable Councils in the region this provides certainty of being able to minimise the impact of the levy on households and an incentive to improve resource recovery outcomes over this period, however, to meet the regulation of the annual advance payments this would need to contribute to a reduction in levy liability for households. For Gladstone and Rockhampton, it gives a clear timeframe for when the cost to Council, and ultimately ratepayers for continuing to dispose of waste to landfill at current disposal rates, may require action.

2.1.4 Queensland's Resource Recovery 10-year Roadmap and Action Plan

The Queensland Resource Recovery 10-year Roadmap and Action Plan was released in 2019 shortly after the WMRR Strategy. As a key action Plan under the Strategy, the Roadmap and Action Plan intends to support industry growth and job creation in resource recovery industries over the 10-year Plan period. The Roadmap and Action Plan targets the acceleration of project pipelines, market and supply chain development, updates specifically, where required, to the Planning framework and supporting the advancement of new and emerging technologies.

Under the Roadmap and Action Plan funding has been provided to support the establishment of businesses and local government through the establishment of:

- The Resource Recovery Development Program (RRIDP) provided funding support to an additional $193.8 million of capital investment creating more than 360 jobs across Queensland and diverting 1.3 million tonnes of waste per annum from landfill. Noting that this fund is now closed.

- The Queensland Recycling Modernisation Fund (QRMF) – co funded $20 million from the Commonwealth Government and $20 million from the Queensland Government for investment to support sorting, processing, recycling, or manufacturing of waste and divert wastepaper and cardboard, plastic, tyres, or glass from landfill. This fund is now closed.
- The Regional and Remote Recycling Modernisation Fund (RRRMF) - provides grants of up to $500,000 for local governments, and their industry partners, to improve the viability of sorting, processing, recycling, or remanufacturing of waste in regional and remote Queensland. Funding is available for infrastructure projects that divert waste plastics, mixed and unsorted paper and cardboard, unprocessed glass, or whole used tyres from landfill in regional and remote areas of Queensland. This fund is now closed to new applications.
- Industry Partnership Program – this $350M program will invest in several priority industry sectors including resource recovery including financial and non-financial incentives or assistance packages. This program may be accessed to support implementation of this Plan. However, the timing and details are not yet known.

2.1.5 Recycling Enterprise Precinct Development

Under Queensland's Resource Recovery 10-year Roadmap and Action Plan a key action was the development of recycling precincts. In identifying opportunities and challenges the Department of State Development, Local Government, Infrastructure and Planning (DSDLGIP) has with stakeholders in Central Queensland identified that:

- Wastes requiring most attention included organics, batteries, tyres, solar panels, and cardboard requiring action within the region, although a much longer list of wastes were identified including concrete, agricultural waste and plastics, green waste, steel, car bodies, bioplastics, textiles and mattresses, e-waste, solar panels, chemical, hazardous and medical waste, oils and liquid waste, and contaminated recyclables with specific reference to mixed construction and demolition waste.
- Several ideas were raised in how a precinct may look. It was identified that there was strong support for ensuring good aggregation of waste within a precinct, and that there would be good transport access and connectivity. It was flagged that precincts should combine processing and secondary manufacturing processes, and not be limited to either. Land use Planning was identified as a key enabler for industry investment.
- There are several potential locations for the establishment of a precinct within the Central Queensland region, including a hub and spoke approach with a centralised precinct with secondary preparation sites across the region. Locations identified include Biloela, Gracemere, Stanwell, Parkhurst, the Gladstone State Development Area, former mine-sites around Moura. Ultimately any precinct opportunity, including location needs to come from a business case.

Two guiding documents have been released by the Queensland Government complementary to this Plan:

- Recycling Enterprise Precincts: A "How To" Guideline[15] – this document provides practical information to assist proponents seeking to establish a precinct including key actions, activities and matters to consider.
- Recycling Enterprise Precinct Location Strategy[16] – this document presents guidance on potential locations for the establishment of a network of Recycling Enterprise Precincts across Queensland to maximise locational opportunities for industry development and recovered materials-based activities.

[15] E3 Advisory, 2022. Recycling Enterprise Precincts, A "How To" Guideline
[16] E3 Advisory, 2022. Recycling Enterprise Precinct Location Strategy

The development of a precinct within the region, including location, would need to be identified via the development of a detailed business case.

2.1.6 Queensland's Organic Waste Strategy and Roadmap

Queensland's Organic Waste Strategy and Roadmap provides a series of actions and outcomes that are directly relevant to this Plan.

Table 5 Organic Waste Strategy and Roadmap targets relevant to this Plan

Ref	Title	Detail & relevance
A1	Halve the amount of food waste generated	Utilising existing programs provide materials to Queensland Councils with dedicated education officers to assist deliver messaging. Targeting a 10% reduction in household food waste in the residual waste bin by 2025.
A2	Understand food waste behaviours in Queensland	Design effective interventions for state-wide and targeted messaging.
A3	Commence education for future generations	Develop materials and deliver food waste education materials as part of sustainability curriculum to reach 80% of Queensland schools by 2030.
A11	Lead by example at Government events	Driving food waste avoidance through action at State and Local Government events.
D1	Review fit for purpose solutions	Local governments are required to conduct a business case to identify the best fit-for-purpose option to improve household organic waste management in their local government area, including consideration of Food organics, Vegetable Organics, Garden Organics or combined Food and Garden Organics systems; or to implement small scale solutions to process organics such as through community composting hubs or encouraging home-based approaches for organics processing (e.g., composting at home, bokashi bins, worm farms etc.,) Specific actions relevant to this Plan including funding for additional Council trials, this Plan is required to recommend improved organics management options by 30 June 2023, and 75% of Councils within the levy zone have business cases for their solutions completed by 30 June 2023.
D2	Implement new household collection options which are consistent from the start	Based on D1 Local Governments are to implement solutions to improve household organic waste management in their LGA. The Queensland Government will provide support to better manage this material in a fit-for-purpose manner, including support for education and behaviour change, for consistency (bin lid colour harmonisation etc.,), to understand and enforce contamination levels, and incorporate sufficient data collection and auditing processes to monitor uptake and contamination levels. Performance measures include improved organics management services in place by 2026 in major regional Council areas with 80% of households participating in services within 3 years of a service commencing, plus demonstration of an increase in the volume of organics captured and reprocessed over time.
D3	Make the inputs clear	Develop, implement, and align household education and behaviour change tools in partnership with local government and industry to minimise contamination across all household kerbside bins, to maximise organic material being captured in organics bins and minimise contamination. Key metrics are that 65% of households in Queensland will have organics capture services by 2025, and 80% by 2030, with a 90% capture rate for Food and Garden Organics comprising 50% capture of Food Organics, 90% of garden organics and less than 1% contamination rate.
D6	Set a clear end goal	Queensland Government looking at the potential feasibility and options associated with undertaking landfill disposal bans for organic wastes, with a feasibility assessment to be completed by the end of 2022, with a view to progressive bans starting in South-East Queensland by around 2025. No information has been provided on this.

2.2 Regional collaboration and documents

At a regional level the CQROC Waste and Resource Recovery Working Group plays an important role in developing this Plan. This includes collaborating at a sub-regional level with member Councils such as on procurement associated with a new kerbside recycling reprocessing solution. Several Council specific documents are also available and utilised to inform this Plan.

Table 6 Regional strategy documents

Document	Status	Relevance to regional Plan
Key documents for member Councils		
Banana Shire Council, 2015. Waste Reduction and Recycling Plan 2015-2018	Released 2015	Aims to fulfill Council's obligations under the *Waste Reduction and Recycling Act 2011.* Details the implementation of waste management operations in the Shire. • Current/proposed waste infrastructure • Current/projected population and waste flows • Waste reduction and recycling targets • Strategic actions for waste reduction and recycling • Management, monitoring, and improvement methods
Central Highlands, 2022. Resource Recovery (Waste Management) Strategy 2022-2032 (in draft)	In Draft, currently being finalised	Aims to guide the way waste is managed in the region and help Council provide a cost-effective, fit-for-purpose waste management system. Key investigation points: • Investigate future expansion of Council's kerbside collection service • Review existing resource recovery centres (inc. landfills and bulk bin stations) to determine if they are fit for purpose, and • Establish a new regional resource recovery centre at Emerald. Consultation was undertaken in mid-2022 and Council is currently reviewing the responses prior to finalisation and endorsement by Council.
Livingstone Shire Council, 2020. A Strategy for the Management of Resource Recovery and Waste in Livingstone Shire to 2030	Current	Outlines the strategies to support the transition of the community to a circular economy and to position them on a path to zero waste in future. • Outlines key policy drivers • Current waste collection and disposal services, including resource recovery facilities • Changes in shared responsibilities between Council and community • Identifies the major challenges and opportunities • Discusses themes, priorities, and actions over the next 10 years
Gladstone Regional Council Waste Management and Resource Recovery Strategy 2019 (prepared by GHD, 2019)	Released 2019	• Summary of the key drivers • The Council's current position as it relates to waste generation and management • challenges and opportunities for improvement • detailed list of proposed activities by priority, to support the identified improvement opportunities. • The priorities identified in this strategy will be implemented over a 10-year period

Document	Status	Relevance to regional Plan
Rockhampton Regional Council, 2022. Waste Strategy 2020-2030	Current	Outlines the strategies Rockhampton Regional Council will employ to support the transition of the community towards a circular economy with the long-term goal of achieving net zero waste by 2050. • Evaluation of the existing capacity and performance • Outlines what a zero-waste community would look like in 2050 in terms of the waste they forecast the community will generate • Progress monitoring measures • Details the strategics actions to be implemented over the next 10 years • Fulfills Council's obligations under the Waste Reduction and Recycling Act 2011
Woorabinda Aboriginal Shire Council, Waste Plan	In development	A specific waste Plan has been developed for Woorabinda Aboriginal Shire Council.

2.3 Existing services

Waste services provided by Central Queensland Councils vary. All Councils provide a weekly residual or red lidded bin collection available to most households, noting that some properties are too remote to make it economic to provide any service. Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council and Rockhampton Regional Council offer a fortnightly commingled recycling bin collection provided to most households. Self-haul to transfer station options are available across all Councils except Woorabinda Aboriginal Shire Council.

Table 7 Existing Services by Council

Council	Residual Waste	Recycling	Garden Organics	Bulky Waste
Banana Shire Council	Weekly, 240L	Fortnightly, 240L	Self-haul only	No kerbside service, transfer station drop-off
Central Highlands Regional Council	Weekly, 240L	Fortnightly, 240L	Self-haul only	No kerbside service, transfer station drop-off
Gladstone Regional Council	Weekly, 240L	Fortnightly, 240L	Self-haul only	No kerbside service, transfer station drop-off
Livingstone Shire Council	Weekly, 240L	Fortnightly, 240L	Self-haul only	No kerbside service, transfer station drop-off
Rockhampton Regional Council	Weekly, 240L	Fortnightly, 240L	Self-haul only	No kerbside service, transfer station drop-off
Woorabinda Aboriginal Shire Council	Weekly, 240L	None	None	Self-haul only

Note: Councils do not provide a uniform service to all households, with variance due to remoteness common.

The total number of services offered compared to households in the region is shown in **Figure 5**.

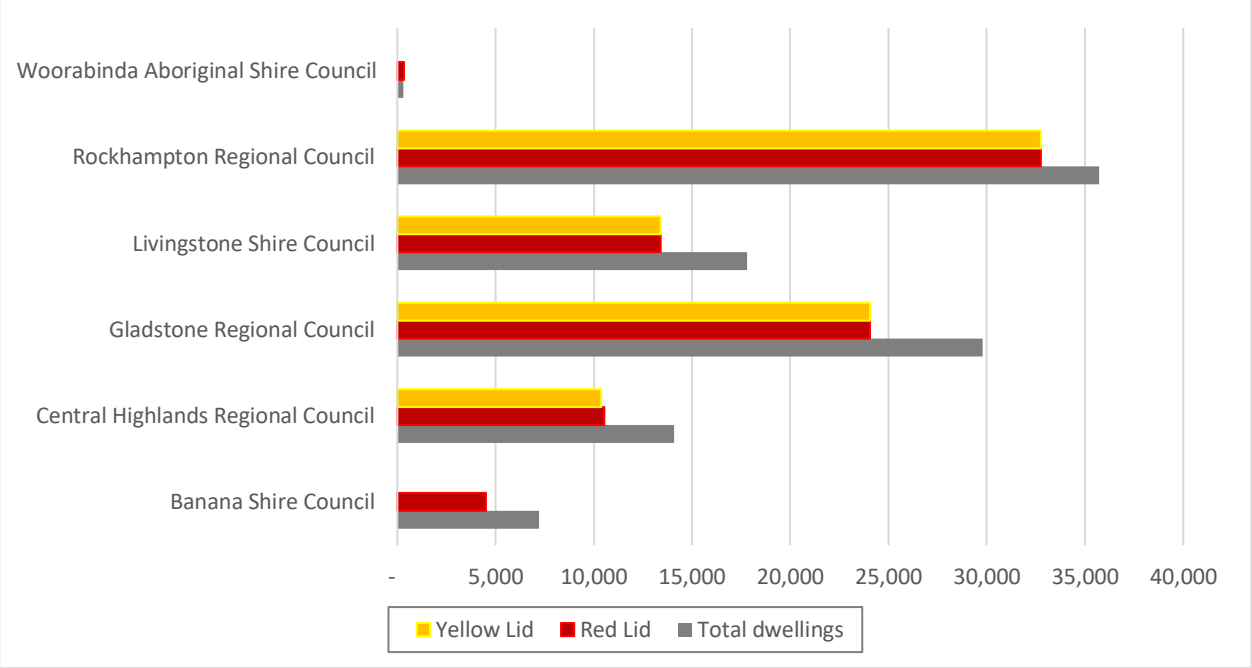


Figure 5 Households and coverage of kerbside services provided

In addition to eligible materials captured through kerbside recycling, each LGA (except Woorabinda Aboriginal Shire Council) has at least two container refund points to allow residents to participate in the state's container refund scheme, Containers for Change (see **Table 8**).

Table 8 Container refund points

Local Government Area	Number of Container Refund Points	Commentary
Banana Shire Council	2	Taroom, Moura, Biloela
Central Highlands Regional Council	6	Capella, Tieri, Emerald (2), Blackwater, Duaringa
Gladstone Regional Council	5	Gladstone (4), Agnes Water
Livingstone Shire Council	2	Emu Park, Yeppoon
Rockhampton Regional Council	5	Rockhampton (4), Mount Morgan
Woorabinda Aboriginal Shire Council	0	-

2.4 Current performance

2.4.1 Overall waste managed

Councils in the Central Queensland region managed a total of 323,271 tonnes in FY20-21. This includes kerbside MSW and self-hauled MSW, C&I and C&D waste streams as reported in the Queensland Waste Data Survey (QWDS). A breakdown of the regional waste by stream, and service type, residual, recycling, and organics, is shown in **Figure 6**.

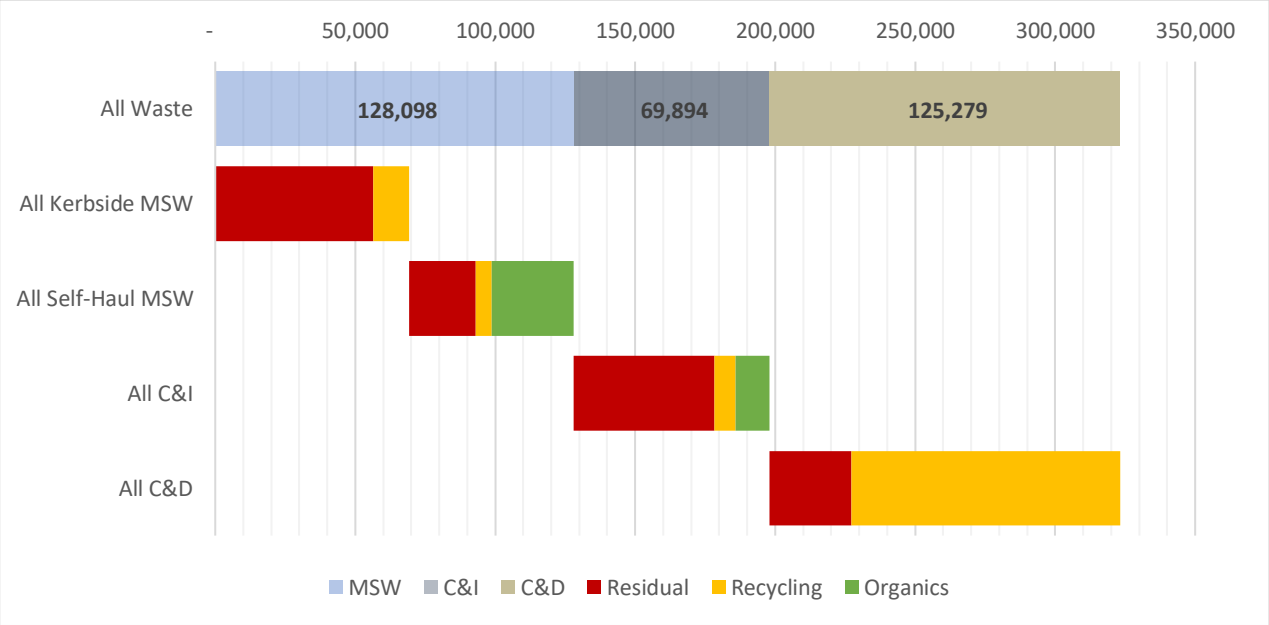


Figure 6 Regional waste summary by stream (FY20-21)

A further 2,122 tonnes of other Council waste was recorded, including litter, street sweepings and public place waste. During the same period, no disaster waste was recorded, noting this can be variable depending on the nature of disasters. Biosolids totalled 2,963 tonnes during the period however it is noted that the DES held data does not necessarily collect all this information, particularly where biosolids is utilised under the End of Waste framework and so is likely an underestimate, capturing only what goes to landfill.

Table 9 provides a breakdown of the contribution of each Council to the total regional waste quantities managed in region based on FY20-21 data. It is noted that this includes waste from all streams.

Table 9 Distribution of waste managed by Central Queensland Councils (FY20-21) – all streams

Council	Percentage of Regional Waste by Tonnes
Banana Shire Council	4%
Central Highlands Regional Council	14%
Gladstone Regional Council	20%
Livingstone Shire Council	12%
Rockhampton Regional Council	50%
Woorabinda Aboriginal Shire Council	<1%

2.4.2 Breakdown of waste arisings in Central Queensland

Figure 7 is a waste flow diagram showing the fates by waste stream and the material types. The materials represent what has been reported through QWDS and with a reference composition applied to kerbside waste and self-haul waste.

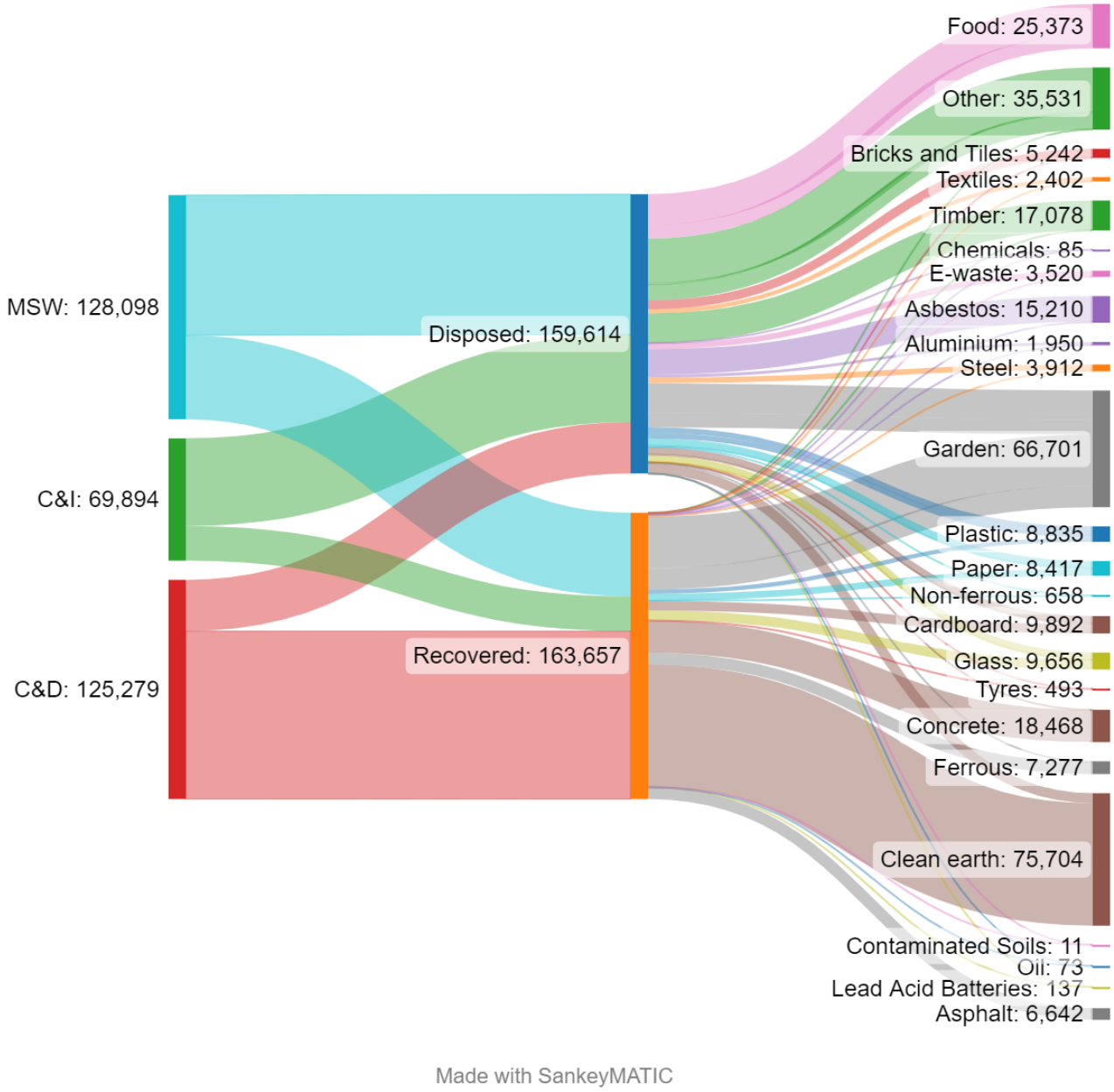


Figure 7 Summary of fates by stream and material for Central Queensland

A breakdown of all waste materials managed by Councils across the region is provided in **Figure 7** and shows the relative quantities (measured as tonnes) that are recovered or disposed.[17]

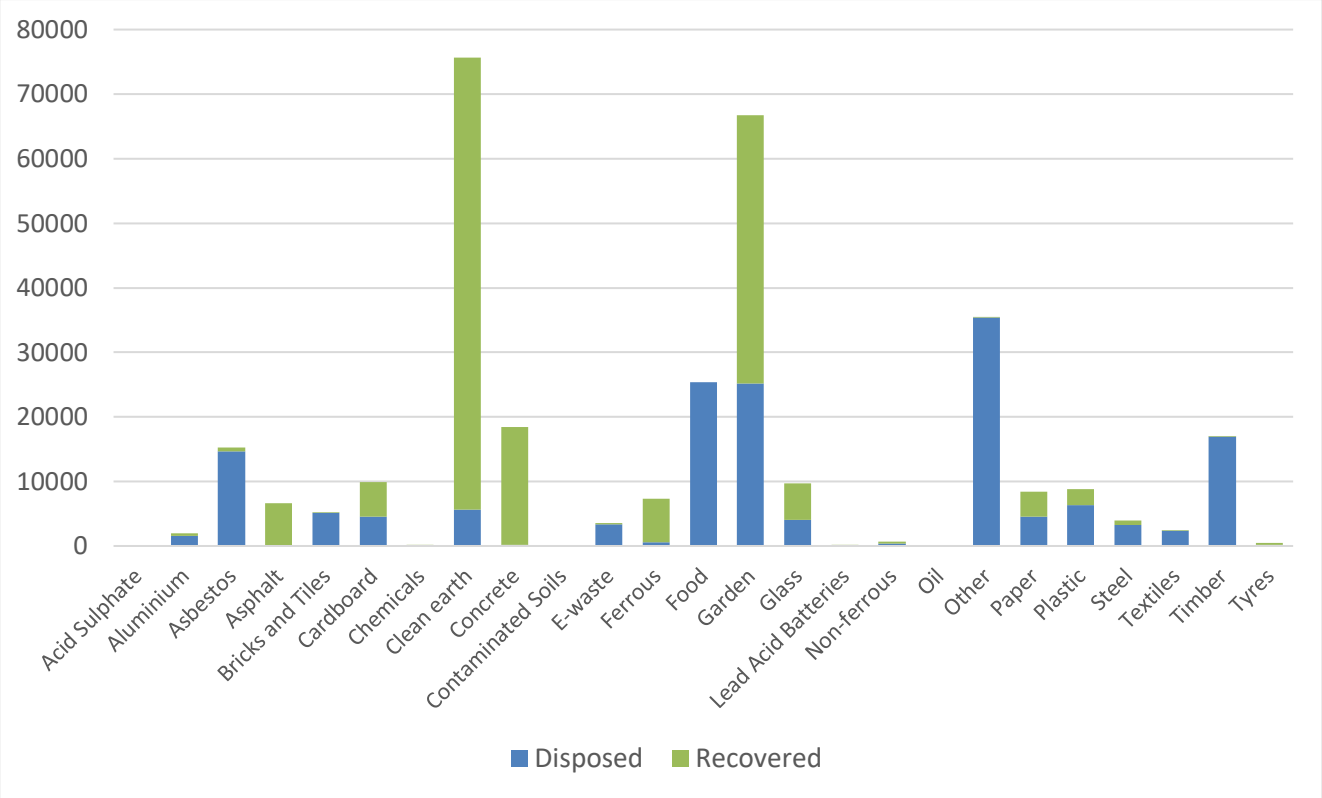


Figure 8 Waste materials by fate for Central Queensland

The resource recovery potential of different materials can be observed in **Figure 8**. Key opportunities appear to present with available food and garden organics, bricks and tiles, e-waste, and timber noting that this represents data for waste managed by individual Councils across the region. Likewise, measurement and presentation in tonnes may render lighter weight but significant volume wastes such as plastics seemingly less important. Other wastes such as biosolids have alternative management pathways (e.g., under the end of waste framework)

2.4.3 Current resource recovery performance

Table 10 and **Figure 9** detail the Central Queensland regions' performance in comparison to the Queensland average and targets, with the region outperforming the State average in combined waste and C&D waste.

[17] The tonnages depicted in Figure 7, Figure 8 and Figure 10 represent what has been reported as disposed or recovered and does not include materials that are currently stockpiled or otherwise stored for future use. As such are less than the total reported waste collected across the region

Table 10 CQROC waste diversion target comparison

Waste Type	Diversion from landfill targets			
	CQ (FY20/21)	State (FY21-22)[18]	State target 2025	State target 2030
Combined waste (all categories)	51%	52%	65%	80%
MSW	37%	27%	55%	70%
C&I	28%	50%	65%	80%
C&D	77%	78%	75%	85%

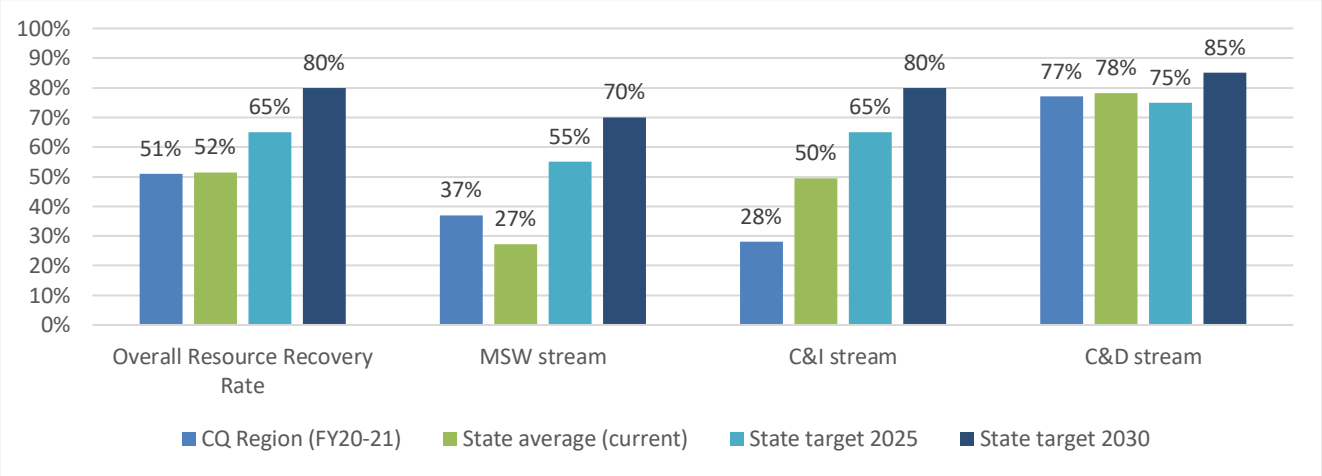


Figure 9 Current performance compared to state and 2025/2030 targets

[18] State of Queensland, Department of Environment and Science, 2022. Recycling and Waste in Queensland Report - Headline Wastes from https://www.qld.gov.au/environment/management/waste/recovery/data-reports/recycling-waste

2.5 Existing infrastructure

To accommodate all other potential destinations, waste can be broken down by materials. **Figure 10** shows the range of separate material streams reported, or where compositional data is known, and their destination.

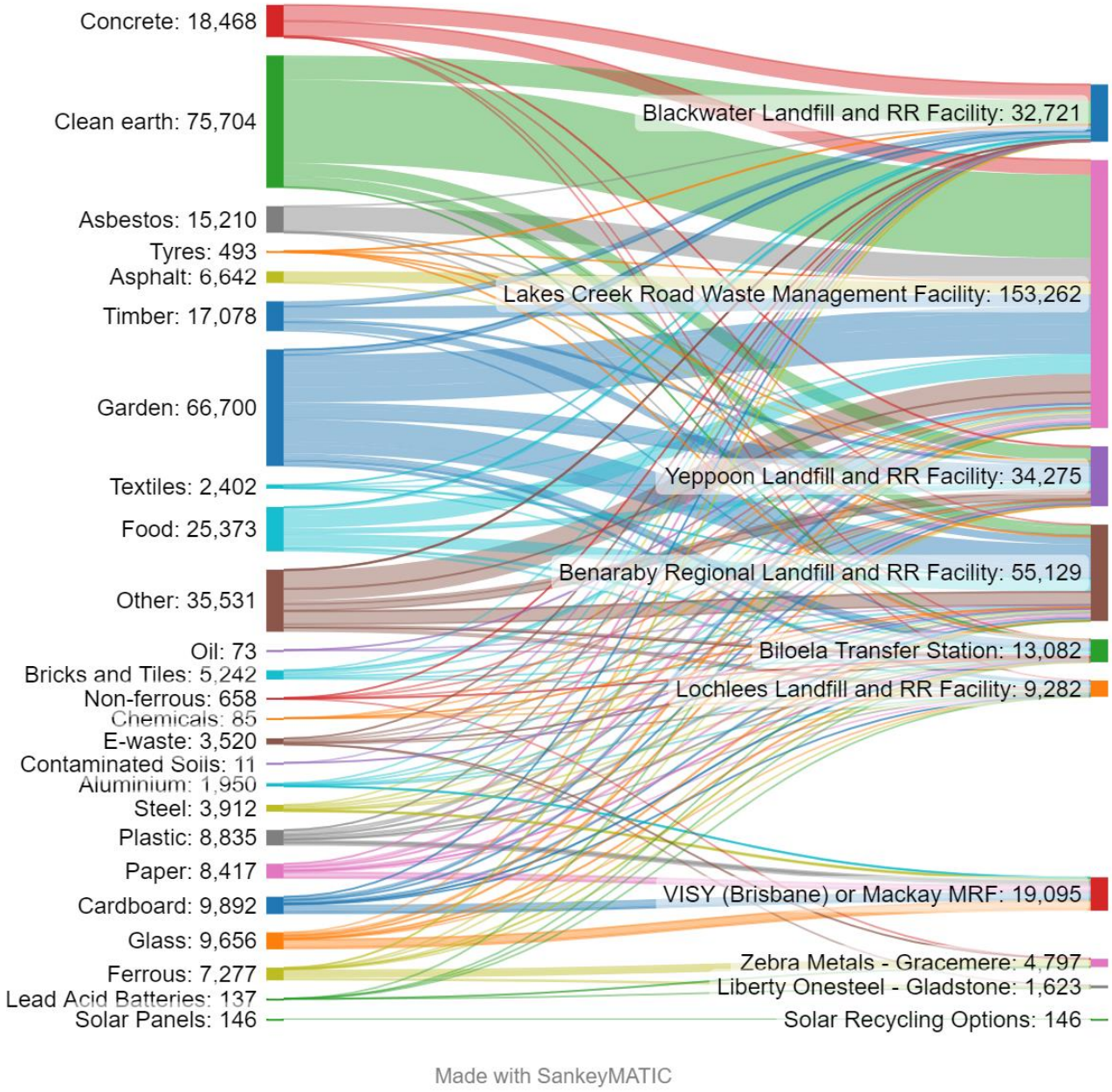
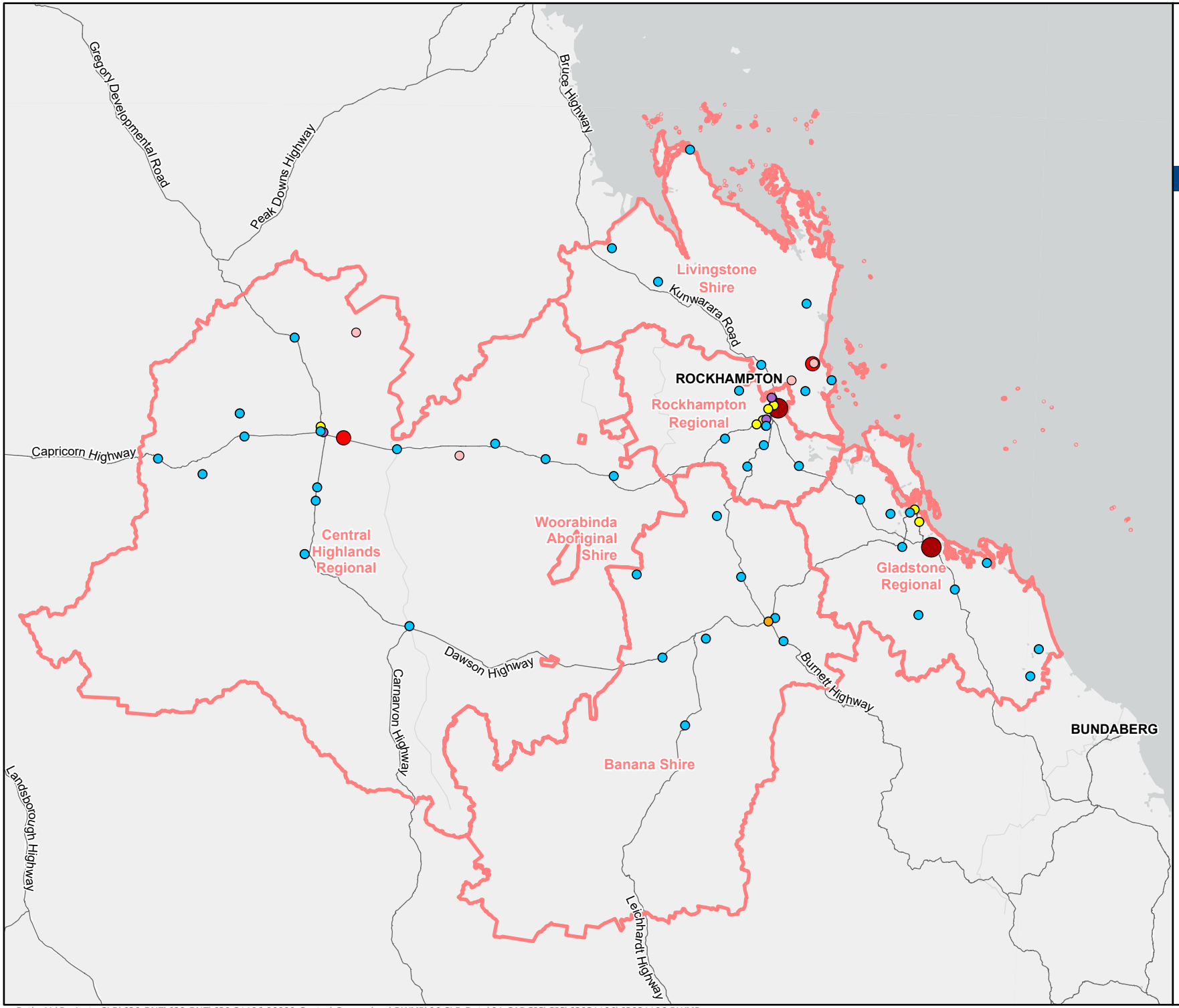


Figure 10 Current waste flow mapping by materials and destination for Central Queensland



CENTRAL QUEENSLAND RWRRMP

Infrastructure Locations

FIGURE 11

- Major Roads
- Central Queensland Region Plan

Landfill

- Small
- Medium
- Large

Other Categories

- E-Waste - Solar Panel Recycling
- Organic Recycling
- Recycling
- Transfer Station

Data Sources:
QLD DoR spatial catalogue, ESRI Basemap World Light Gray Canvas Base

0 50 100 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:2,700,000 at A4
Project Number:	620.31106
Date Drawn:	16-May-2023
Drawn by:	JG

SLR

Path: H:\Projects-SLR\620-BNE\620-BNE\620.31106.00000 Central Queensland RWMP\06 SLR Data\01 CADGIS\GIS\62031106\62031106 RWMP.aprx

2.6 Forecast waste arisings

2.6.1 Regional waste growth projection

Figure 12 provides a 30-year summary of the projected waste tonnes by waste stream. Total waste generated within the region is forecast to increase to approximately 400,000 tonnes in FY30-31, 430,000 tonnes in FY40-41 and 480,000 tonnes in FY50-51. It is noted that the growth projections do not consider the implementation of levers and interventions from the Plan.

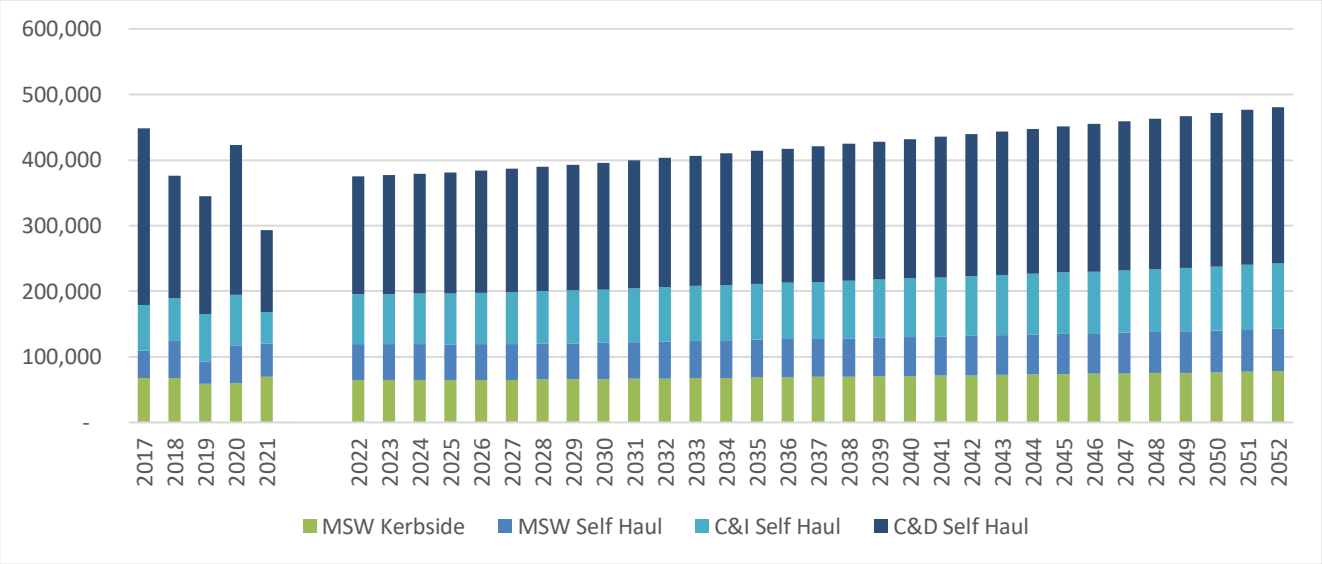


Figure 12 30-year waste projections for Central Queensland by waste stream

3 Key issues and Opportunities

Several region-specific issues and opportunities were identified in consultation associated with the development of this Plan, as described in this section.

3.1 Landfill capacity

Landfills in the region (except Gladstone) are approaching capacity/do not have long-term capacity and require further investment to enable appropriate management of residual waste

Landfills are an essential component of Australia's waste management system.[19] The Central Queensland region contains 13 active landfills, of which 10 are publicly owned putrescible landfills of different sizes and three are privately owned inert-only landfills. There are large-sized landfills in Rockhampton and Gladstone which provide most of the region's capacity. There are also medium-sized landfills in Banana, Central Highlands, and Livingstone Shire, and several small or very small landfills scattered throughout the LGAs, including one in Woorabinda Aboriginal Shire.[20] To achieve expansion, Gladstone Regional Councils' Benaraby Landfill will still require approvals.

Landfill capacity is primarily defined in terms of remaining airspace – the volume of void which is available to fill with waste[19]. The landfill capacity assessment undertaken in the Queensland Waste and Resource Recovery Infrastructure Report[19] identified that there was approximately 4.8 million tonnes of approved putrescible landfill capacity in the Central Queensland region in FY17-18. However, unique to regional areas is the impact of dispersed landfills, scale of waste generated and cost of operations. Currently, many very small/remote landfills that service some localities are slated for closure, putting increasing pressure on small to medium sized landfills in these LGAs.

Table 11 outlines the approved capacity of each Council managed landfill in the region and expected closure date. This provides insight into the viability smaller scale landfills, noting that Banana Shire Council's landfill capacity is expected to be exhausted by 2024. Banana's very small/remote Taroom landfill has closed, putting short-term pressure on the remaining Cracow and Trap Gully landfills– also set to run out of capacity by 2024 at current waste generation rates.[21] Central Highlands, as the largest LGA (by land area) in the region has also identified that there is an urgent need to expand and establish a central regional landfill that can integrate with other resource recovery operations before the existing residual waste disposal capacity fails to meet demand. [22] Central Highlands Regional Council has proposed the Blackwater Landfill for the expansion, given the Lochlees site has limited ability for expansion due to environmental restrictions.[22]

[19] Arcadis for Department of Environment and Science (2019). Queensland Waste and Resource Recovery Infrastructure Report. Accessed at https://www.qld.gov.au/__data/assets/pdf_file/0034/199249/qld-waste-resource-recovery-infrastructure-report.pdf
[20] Hyder for Department of the Environment, Water, Heritage, and the Arts (2009). Australian landfill capacities into the future. Accessed at https://www.dcceew.gov.au/sites/default/files/documents/landfill-capacities.pdf
[21] Banana Shire Council. (2022). Draft Waste Reduction and Recycling Plan. https://www.banana.qld.gov.au/downloads/file/7213/waste-and-recycling-management-Plan-2022-2025-draft
[22] Central Highlands Regional Council. (2022). Draft Resource Recovery (Waste Management) Strategy. https://haveyoursay.chrc.qld.gov.au/waste-strategy

Table 11 Central Queensland LGA landfill capacity and closure dates

LGA	Landfill	Annual disposal (FY20-21 tonnes)	Current approved capacity (tonnes)	Expected closure on current inputs
Banana Shire*	Trap Gully Landfill	15,710	100,000	2024
Central Highlands Region	Blackwater Landfill	-	86,206	2039
Central Highlands Region	Lochlees Landfill	38,597	295,962	2039
Gladstone Region	Benaraby Regional Landfill	59,443	1,118,623**	2056
Livingstone Shire	Yeppoon Landfill	19,775	806,546	2060
Rockhampton Region	Lakes Creek Road Landfill	59,155	1,332,011***	2043
Woorabinda Aboriginal Shire	Woorabinda Landfill	507	18,528	2051

* It is understood Banana Shire Council is currently progressing a new resource recovery facility including Landfill

** Airspace and expected closure based on information for Rockhampton Regional Council as of February 2023

*** Gladstone Regional Council will require approvals to expand the Benaraby facility in the long-term to achieve full capacity

3.2 Growth in waste generated

The population in the Central Queensland region is expected to grow modestly by 2% by 2041,[23] with most of this growth concentrated in Livingstone, Rockhampton, and Gladstone. Major projects, such as new mining opportunities in the Surat Basin (North Surat – Taroom),[24] renewables projects within the Queensland government's Fitzroy Renewable Energy Zone[25] and Gladstone Port's Corporation's Port Central Precinct Plan and 50-Year vision[26] will also increase population and local activity, creating additional waste volumes during construction and operations. Typically, as population and business increases, so do waste arisings, although trends in Queensland suggest the amount of waste generated per capita is generally following a downward trend. As the population grows and consumption increases, there is an ongoing need for effective, fit-for-purpose waste avoidance and resource recovery pathways and solutions to avoid the need for expanding landfills.

Disaster waste management Planning is also critical in tropical and sub-tropical regions. With the predicted increasing frequency of severe weather events, Councils have sufficient contingency to allow for occasional high quantities of residual waste generated in a natural disaster, or in an emergency such as unexpected closure of other residual waste processing facilities. Investment in resource recovery infrastructure and initiatives that minimise the quantity of waste being disposed will reduce the pressure on remaining landfills to accommodate waste from disasters and emergencies, however, Planning should ensure this allowance is maintained into the future.

[23] CQROC, 2022. CQROC Strategic Plan. https://cqroc.org.au/wp-content/uploads/2022/02/CQROC-Strategic-Plan.pdf
[24] North Surat Coal Pty Ltd
[25] Department of Energy and Public Works. Queensland Renewable Energy Zones. https://www.epw.qld.gov.au/about/initiatives/renewable-energy-zones
[26] Port Central Precinct Outlook 50 year strategic vision (Gladstone Ports Corporation)

3.3 Transport costs are prohibitive

Australia has a strong dependence on landfills as a form of waste management however, the number of landfills has been declining as residual waste is consolidated in larger, regional sites. Some Councils do not have the ability to expand landfills once they reach capacity and as landfills close, they are generally replaced by sites that are further away, resulting in increased costs and environmental externalities because of greater transport distances.

It is likely that in the medium-term, smaller Councils within the Central Queensland region may choose to transport waste to a large regional facility, such as the Benaraby Regional Landfill operated by Gladstone Regional Council, or the proposed Blackwater Regional landfill in Central Highlands, depending on proximity. However, the cost of transporting waste materials for disposal, recycling or recovery in another region may be prohibitive for Councils. Investing in resource recovery initiatives and regionalised processing infrastructure, is essential to prolong the life of regional landfills and reduce future transport costs.

3.4 Impacts of landfill expansion

Finding appropriate sites for a new landfill, particularly a putrescible landfill, is a significant challenge and it is important to maximise the use of existing sites where appropriate.[19] However, the development and expansion of landfills is constrained by environmental requirements in relation to lining, leachate management and groundwater monitoring.[19] Landfill sites contribute 20% of the global anthropogenic methane emissions and are a significant contributor to climate change.[19] Leachate, which can contain high levels of ammonia, if poorly managed, can migrate to groundwater or even to surface water through the flaws in the lining, contaminating aquifers which require extensive time for rehabilitation. Construction and management of landfills have ecological effects that may also lead to landscape changes, loss of habitats and displacement of fauna. Landfills also have a long-term legacy and even if well managed, post-closure capping and rehabilitation, and ongoing monitoring may pose a long-term cost to Councils well beyond the useful life of the asset. This is for a minimum of 30 years.

Modern landfill sites are typically well designed. One option to limit the need to build new landfill is state of the art ‘piggyback’ engineered landfills, such as Rockhampton’s Lakes Creek Road facility. Once fully constructed, this landfill will consist of some 8 adjoining cells and the profile of the “piggyback” landfill area will match the height of the previous landfill. While construction is scheduled to occur over the next 20 years, at current fill rates this site has a projected life expectancy to 2043.[27]

However, if resource recovery performance improves, such as through better behaviour or development of new resource recovery facilities, the life of all landfills in the region could be extended to differing extents and the capacity of any future regional landfill may be less than would otherwise be needed. The diversion of organic waste from the residual stream may also reduce landfill related emissions in the long term.

[27] Rockhampton Regional Council, 2020. Waste Strategy 2020-2030.

3.5 New services may be beneficial

Investment in improved resource recovery in Central Queensland is required to reduce the volumes of waste disposed of and extend the life of landfills in the region. For example, the largest portion of the residual municipal waste bin in Rockhampton is organic material, which accounted for 52% of this disposal stream in 2021.[28] In Gladstone, it is expected that 40% to 60% of red lid bin waste is food organics and garden organics (FOGO) waste.[29] Enhanced organics diversion may be achieved by introducing an organic waste collection via a third bin at the kerbside for garden organics, or garden organics and food organics. Rockhampton Regional Council recently completed a trial for FOGO collection with mid-trial results indicating a generally positive response from the community and effective diversion of waste with minimal contamination, achieving trial diversion rates of 47-55% for the food component and 90-99% for garden waste component.[30] It is understood that this service will continue to be provided to trial participants whilst a regional or council led approach is considered further.

Councils are not directly responsible for non-municipal waste; however, Council landfills across the region receive significant quantities of C&I and C&D waste. Key opportunities to improve recovery of these waste streams are associated with additional regional infrastructure to support tyre reprocessing, construction and demolition material recycling, timber reprocessing, and paper/cardboard collection and processing. Gate fees received for C&I and C&D wastes often provide a significant revenue contribution to Council waste operational budgets.

3.6 Low population density

Like other regional and rural parts of Queensland, sparsely populated communities struggle with a lack of scale of waste generated and long distances to processing infrastructure and end markets. A lack of scale means that developing local sorting, processing, or resource recovery infrastructure is not viable given the upfront capital costs and ongoing operation costs.[31] However, transporting waste to Materials Recovery Facilities (MRF) or other recycling facilities in other locations is also a significant cost and typically not viable at distances over 100 km. This prevents Councils in some parts of the region from providing kerbside co-mingled recycling collection services as it is not commercially viable to transport small amounts of sorted waste to major population centres for processing.

Therefore, the most commercially viable option for these Councils is to collect waste for delivery to the closest landfills. It is understood that in Central Queensland, even collection of MSW at the rate currently provided is a challenge due to the long distances required to service all residential lots. For example, in Banana, it takes one rubbish truck three hours to travel from Biloela to Taroom creating major inefficiencies for waste collection. These barriers are exacerbated by limited Council budgets and labour capacity and therefore Councils are often unable to provide co-mingled recycling bin services.

The major industries in the region present an opportunity for improved resource recovery and circular economies associated with heavy equipment waste such as tyres and commercial agricultural organics. However, without sufficient scale contributed by MSW, the vast distances to reach processing facilities and associated transportation costs mean that Councils have limited viable options to appropriately collect and manage waste streams.

[28] Rockhampton Regional Council, 2021. Kerbside Waste Stream Assessment.
[29] GHD, 2019. Waste Management and Resource Recovery Strategy Technical Report 2019.
[30] Rockhampton Regional Council, 2023. Kerbside Organics Trial 2021-2023, Project Evaluation Report
[31] National Waste Policy Regional and Remote Australia Working Group. Solutions for waste management in regional and remote Australia

3.7 Scale for processing and remanufacturing

The lack of scale for individual Councils in Central Queensland is a barrier in providing efficient and sustainable waste collection services. As a result, there are low levels of recovered materials able to be processed. Without sufficient scale of recovered materials, individual Councils have little to no ability to locally process materials at a competitive and commercial scale. Processing recovered waste creates value from materials such as generating compost, processing plastics and glass into secondary raw materials, or generating energy from waste. It excludes any processes that provide no value from waste, such as incineration alone. Processing delays the need to use virgin materials in manufacturing processes that would eventually become waste, as quality recovered, or reprocessed materials can be used as a substitute[32]. The primary barriers to resource recovery for regional and remote areas are poor economies of scale, distances and road conditions between regional centres and limited waste collection services.[31] These barriers are prevalent for Central Queensland Councils, which is impacting the region's ability to recover resources at a commercial scale.

Despite considerable barriers, Central Queensland has made significant resource recovery progress in 2022 with newly established $2 million Kriaris Recyclables Processing facility that processes glass containers from Rockhampton's Containers for Change program into glass sand for infrastructure projects. Although only just operational, the Solar Recovery Corporation's solar panel recycling facility has also opened in Biloela will recover at least 99 per cent of material from each end-of-life solar panel and junction box. Other solar recycling businesses are also active in the region. The recovered materials are used as feedstock to local manufacturing streams. However, these facilities are only viable due to local and State Government support and considerable effort and concessions to attract private investment. Furthermore, scale is critical to such facilities and Solar Recycling Corporation is sourcing end-of-life solar panels from within Queensland, NSW, and the Northern Territory (NT). However, sourcing recovered materials for processing from external localities is not always a viable solution for industry, owing to high transport costs. While progress has been made, all other sorted recycled materials, such as recovered plastic and cardboard/paper, are exported to for reprocessing out of region, adding to the overall cost of recovery.

Cost and scale are the key barriers to waste collection and recovery in the region. Limited resource recovery options impact the ability of the community and business to divert waste to be recovered, with disposal the easiest and cheapest option. Under these circumstances, sending waste to landfill is the cheapest option and under current economic and policy conditions will remain as the most viable solution unless a sustainable commercial alternative is developed. Fuel costs however have increased significantly recently, and this needs to be considered in long-term Planning.

Councils can be considered as price takers for waste management services and are therefore vulnerable to policy changes and external influences such as inflation pressures and flattening commodity prices.[33] These impacts have become increasingly prevalent in the wake of China launching its National Sword program, which imposed strict contamination limits on imported recyclable materials, as well as global disruptions caused by the COVID-19 pandemic, resulting in increasing costs at MRF and sorting facilities. The increasing cost of resource recovery coupled with dispersed communities that have limited scale of waste generation presents a significant challenge for developing local commercially viable recovery and reprocessing facilities.

[32] Queensland Government, 2019. Queensland Resource Recovery Industries 10-Year Roadmap and Action Plan, https://www.statedevelopment.qld.gov.au/__data/assets/pdf_file/0014/17204/resource-recovery-roadmap.pdf

[33] Local Government Association of South Australia, 2020. Cost-benefit analysis of establishing Materials Recovery Facilities in regional areas with low waste volumes. https://www.lga.sa.gov.au/member-services/financial-sustainability/grants/research-and-publications/researchlibrary/2019/cost-benefit-analysis-of-establishing-materials-recovery-facilities-in-regional-areas-with-low-waste-volumes-2019.72

Prior to its closure, all sorted and recovered materials from the Rockhampton MRF were transported out of the region for reprocessing. This indicates that it is more cost effective to transport current relatively low volumes of recyclable materials, than to reprocess locally.[27] Given the limited collection and recycling capabilities of some LGAs and access to MRF facilities, the volume of plastics in the region that could be recovered may be underestimated. Research suggests that low-technology MRF facilities in regional areas that are scaled to accommodate waste throughput of multiple smaller LGAs areas could be more economically viable due to the lower upfront capital and ongoing operating costs[33] and may lead to improved diversion of waste to landfill.

The small scale of individual LGAs in the region is not only impacting individual Council's ability to establish resource recovery facilities, but also affecting the ability to reprocess materials that could be used locally. Currently, garden waste is mulched at landfills, however in some cases this mulch product is difficult to deploy as a resource. More complex processes such as composting require economies of scale and an element of capital expenditure to be a viable solution. While there may be an opportunity to combine household organic waste with agricultural waste from the region, it is understood that most agricultural waste is left on farm for beneficial use.

While it is unlikely that each regional Council alone could achieve the required scale, there is opportunity for intra-regional collaboration to achieve commercial viability. This could involve the establishment of waste hubs in regional activity centres for collection, sorting, and processing of waste. Transportation costs must be considered (particularly for more rural contributors), however, hub and spoke style models have several benefits in regional and rural areas, including reducing costs associated with equipment, personnel, processing, and marketing. A hub and spoke method could enable the consolidation of materials, potentially producing enough volume to make it more feasible to process and market recovered waste.

End markets for secondary raw materials to be remanufactured are limited, however, National and state policies are prioritising the use of recycled materials in government projects. Generally, end markets are proximate to reprocessing facilities to enable efficient and commercially viable outcomes. In Queensland, existing end markets for the remanufacturing of secondary raw materials include recycled concrete aggregates, recycling of plastic waste into new products, glass reprocessing for use in roads (in Rockhampton), paper and cardboard to SEQ papermills and processing of tyre wastes.[32]

Generally, private organisations are responsible for the remanufacturing of secondary raw materials and therefore investment attraction is critical to developing sustainable circular economies. Suitable scale of secondary raw materials and downstream demand is critical to investment attraction for remanufacturing operations. With local end markets for remanufactured materials concentrated in SEQ, the challenge remains for regional areas to achieve commercially viable local remanufacturing. Furthermore, Central Queensland does not have sufficient scale of recovered and processed materials to facilitate local remanufacturing. Even if Central Queensland was able to remanufacture its processed secondary raw materials locally, it is likely that remanufactured products would need to be transported to SEQ end markets which would increase prices and limit value for money outcomes. Therefore, investment in the development of end markets (such as manufacturing industries) in Central Queensland is required to support local remanufacturing opportunities.

While regional areas currently struggle to compete with metropolitan areas, there is increasing support from governments at all levels to shift business to the regions to drive job growth and economic activity. In June 2022, the Queensland Government committed an additional $10 million to continue the *Manufacturing Hub Grants Program* for a further two years. Since its inception in 2017, the program has supported 104 advanced manufacturing projects across the state with 38 per cent delivered in regional Queensland.[34] Regional areas are attractive locations for large operations due to there being more space and fewer operational limitations such as transport and noise restrictions. Positioning Central Queensland as the pre-eminent region for such activities would assist in creating more scale and end markets for recovered resources. There is a significant opportunity for the region as it establishes itself as a major hub for modern industry given the strategic location of the Port of Gladstone and ongoing investment in mining and renewables operations. Attracting industry and increasing regional development will also assist in creating additional scale and end markets for recycled material making local remanufacturing more viable.

3.8 Community understanding and behaviours

There is a clear need and ambition to improve the resource recovery rate across Central Queensland to reduce environmental impact, optimise the life of the landfills, manage cost pressures, and support the ongoing development of a local circular economy. While there are barriers to resource recovery throughout the region due to scale and Council limitations, much of the community do not understand the cost of managing their waste, or challenges faced by Councils and the value of resource recovery. There is a need for investment in long term community and industry education to improve resource recovery and add value to recyclables.

Approximately 15% of materials in Rockhampton's general waste bins are misplaced recyclable materials, while commingled recycling bins had up to 22% of materials not suitable for recycling.[28] The general community is not aware of the environmental problems caused by waste generation, or the cost associated with sorting and processing, and find it difficult to connect individual actions to address those problems. Most people do not know where their waste goes, whether it is recyclable or if it can be recovered. Many people in the community are not sure what happens to their waste, or whether their actions make a difference. The lack of understanding across the region has led to high contamination rates in kerbside bins and low resource recovery rates, as potential recyclable items are disposed rather than recovered.[27] This exacerbates existing challenges regarding scale for reprocessing and remanufacturing in regional locations.

Illegal dumping is also a concern in Central Queensland, where low population density and distance from waste infrastructure led to illegal disposal and dumping of large waste volumes in remote areas. Littered and illegally dumped wastes are a substantial source of environmental contamination. Waste in the environment can cause animal entanglement, injury and death, and the economic costs of litter and illegal dumping are nearly always borne by local Councils. For example, litter and illegal dumping in Gladstone is costing Council approximately $200,000 a year to address.[35] Prevention of littering and dumping reduces or avoids these costs, demonstrating the importance of investment in litter and dumping prevention and efforts to modify behaviour.

[34] Queensland Government, 2022 Made in Queensland. https://www.rdmw.qld.gov.au/manufacturing/manufacturing-assistance-programs/made-in-queensland

[35] Queensland Government: Department of Environment and Science, 2021. Keeping Queensland Clean: the litter and illegal dumping Plan. Accessed at https://www.qld.gov.au/__data/assets/pdf_file/0024/176262/keeping-qld-clean-lid-Plan.pdf

3.9 Australian and Queensland objectives and targets for waste management

The existing circumstances for waste generation and disposal in Central Queensland make meeting the objectives and targets in the Queensland Waste Management and Resource Recovery Strategy and National Waste Policy Action Plan impossible. Recognising that a shift to a circular economy requires a National approach, the *National Waste Policy*[36] was updated in 2018 by the Federal, State and Territory governments. In 2019, the *National Waste Policy Action Plan*[37] was delivered, outlining several strategic priorities as a framework and guide to implement the *National Waste Policy.* **Table 6** outlines the objectives and targets of these Plans, and the Central Queensland region's alignment and current capacity in meeting the objectives and targets for waste and resource recovery.

To reach the 2030 target, upgrades to infrastructure, policy and initiatives are required at both an individual Council and regional level. Currently, the region has no MRF due to the Rockhampton facility fire in November 2020 and there are significant barriers for other LGAs to collect and transport waste. It is noted that several Councils within the region are working collaboratively to procure a new MRF contract. Eligible Containers recovered from the Containers for Change program in Rockhampton are handled at the Kriaris Recyclables Processing Plant, while solar panels from along the east coast will potentially be processed at a private facility in Biloela once commissioned, although other solar panel recycling entities exist and operate in the region. Organics processing in the region is also limited to mulching at Council landfills or a small number of private operators.

For Rockhampton Regional Council, most of this mulch is used by a commercial composter in Gracemere (NuGrow) to manufacture organic products. However, building new infrastructure within each LGA is capital intensive and not feasible for some Councils considering the low volumes of waste collected outside of Rockhampton and Gladstone. In addition, Councils have competing funding commitments within their budgets, and prioritising funds for resource recovery infrastructure, when landfill is a cheaper alternative, is often deferred for more immediate priorities. However, without a fundamental shift in policy or investment in infrastructure, State and Federal targets will not be met.

Considering the existing landfill viability in the region, small and very small landfills in more regional and remote areas are not viable long-term solutions. Investment in better waste management infrastructure is critical to meeting the future demand and needs of the region and realising the potential benefits of the resource recovery sector. Private sector participation is vital in resource recovery, and CQROC may achieve its targets by supporting and facilitating investment and enabling an environment where subsidy or joint investment may occur. This may require the transfer or leasing of existing resource recovery assets and facilities owned by Councils within the region.

3.10 Potential economic and community benefits

The Central Queensland economy in underpinned by its strong mining and agricultural industries, with diverse natural environments across the region and many areas well suited to renewables development. The Central Queensland Regional Plan outlines an economic vision for the region to foster growth industries, by supporting a dynamic economy, creating jobs, and attracting investment. It identified two high level regional outcomes:

[36] Australian Government, 2018. National Waste Policy. Accessed at https://www.dcceew.gov.au/sites/default/files/documents/national-waste-policy-2018.pdf
[37] Australian Government, 2019. National Waste Policy Action Plan 2019. Accessed at https://www.dcceew.gov.au/sites/default/files/documents/national-waste-policy-action-Plan-2019.pdf

- For agriculture and resources industries within the Central Queensland region to continue to grow with certainty and investor confidence
- The growth potential of towns within the Central Queensland region is enabled through the establishment of Priority Living Areas. Compatible resource activities within these areas which are in the communities' interests can be supported by local governments.

A focus on achieving these priority outcomes through further industry growth presents considerable opportunities for the development of downstream waste industries in the region. Economic value and jobs for Central Queensland residents can be created through the development of resource recovery industries, however, capacity for jobs requires scale of recovered waste. As identified in previous sections, this is a barrier at an individual Council level in Central Queensland. There also needs to be a clear benefit for industry to take advantage of resource recovery opportunities.

A key pathway to achieving the potential benefits of resource recovery industries in Central Queensland will be increased collaboration and knowledge sharing between Councils. Increased collaboration across policy Planning, procurement and delivery of infrastructure will be necessary to respond to the State and National push towards a circular economy while ensuring solutions are right-sized and cognisant of regional economic drivers and community needs. This increased focus on collaborative Planning can also provide opportunities to articulate and Plan for challenges facing the region now and into the future. Furthermore, supporting new processes within the resource recovery and recycling industries using innovative technology also has the potential to create new domestic and export markets and increase employment opportunities. New technologies and processes will provide challenges to existing operations but also opportunities to create a high-value, skilled workforce. However, initial support for small Councils such as Banana Shire Council and Woorabinda Aboriginal Shire Council to manage transport costs will be critical to the long-term success and viability of a regional solutions.

4 Organic waste

Organic waste is identified in both National and State guidance documents as a low hanging fruit when it comes to diverting more waste from landfill. There is significant support via the National Food Waste Policy to divert more food waste from landfill, supported by the establishment of research and roll out of Love Food Hate Waste as one possible of a range of campaign options for behavioural change program by the Queensland Government, alongside a series of actions in Queensland's Organic Waste Strategy and Action Plan. A key consideration of the options assessment for this Plan was the prospect of introducing regional or individual Council scale organics collections. This section considers:

- The existing dynamics of the organic waste stream in Central Queensland
- Potential levers and interventions
- Major options considered
- The expected outcomes of the preferred options
- What is required to support the change; and
- What may change during the implementation of the Plan

4.1 Organic material stream dynamics

In the Central Queensland region, no Council currently provides a kerbside organic waste collection service, however all Councils (except Woorabinda Aboriginal Shire Council) provide garden organic waste self-haul facilities for both residents and commercial providers, amounting to 41,565 tonnes of organic waste managed in FY20-21. This comprised 29,421 tonnes of self-hauled household garden organics, with the remaining 12,144 tonnes being self-hauled from commercial sources. The existing recovery rate for organics within the household stream is estimated to be 63% already. Green waste is typically processed into a mulch which is then utilised by Council, provided to residents as a free resource. Evidence from Councils suggests that reuse can be hindered by contamination and lack of pasteurisation, resulting in a poorer quality mulch product, or there are limited end-markets for the processed green waste outside of Council uses.

A significant proportion of household food and garden organic was is also disposed of to landfill via the residual bin. **Figure 13** presents the estimated breakdown of organic waste based on audit information for organic waste managed at Council sites in FY20-21.

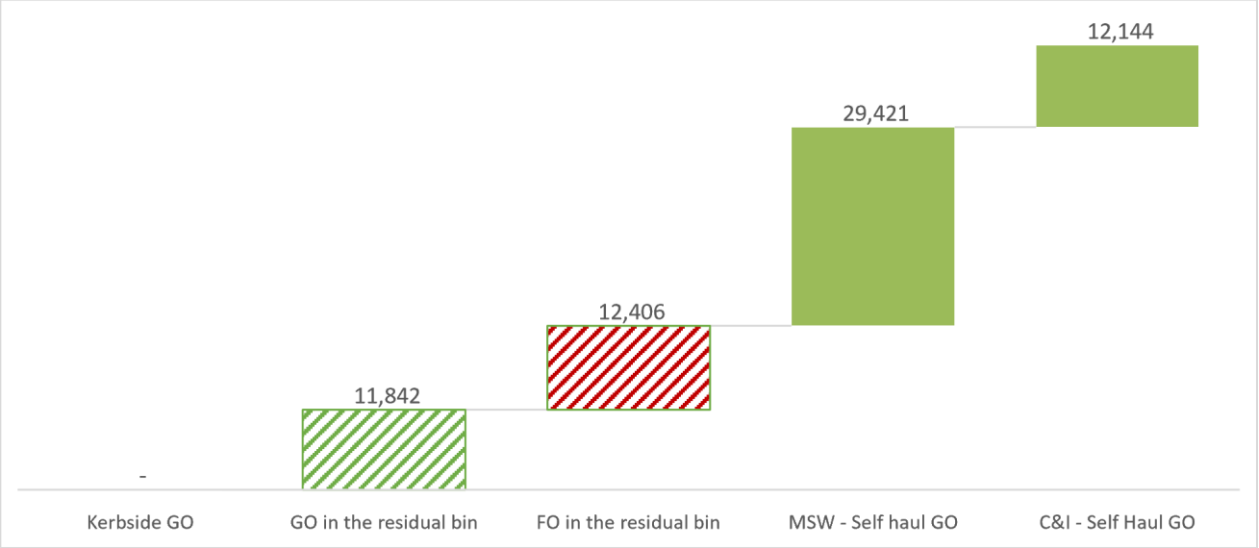


Figure 13 Estimated breakdown of organic waste managed by Councils in region

Geographical diversity also influences organics collection and processing across Central Queensland. For example, the Councils within the region with lower population density, households generally on larger blocks are more likely to have at home organics diversion solutions in place, such as compost heaps, chickens, or worm farms, or burning piles which manage larger proportions of food and garden organic waste streams, compared to higher density parts of the region such as in Gladstone Regional Council or Rockhampton Regional Council, where yard space may be more limited.

Away from reported kerbside organic waste, other organic waste streams are generated within the region. This includes a range of agricultural residues and wastes. Analysis undertaken by the Queensland Government in FY18-19 indicated that there was a combined total of 64,000 tonnes of food crop residues and 66,200 tonnes of wastes and other residues in the region. The latter includes material reported in the graph above.

4.2 Levers and interventions

4.2.1 Avoiding and reducing organic waste

Organic waste reduction or avoidance can be achieved through education with support from other levers, which may also link to regional or Council landfill diversion solutions. Under Queensland's Organic Waste Strategy there are specific actions to support National objectives to halve food waste, including a reduction in food waste of 10% per household by 2025. The Queensland Government currently has the license to the Love Food Hate Waste branded education and engagement program developed by WRAP[38] in the UK although other programs are also available. Larger Councils within the region already provide some education materials such as Rockhampton Regional Council's "Living Sustainability" tips on Minimising Food Waste.[39] Existing Councils within the region provide education packages that include information supporting residents who are composting at home. The ability to commit resources to education varies across Councils within the region, particularly those Councils who do not have dedicated education resources.

[38] WRAP, 2022. Love Food Hate Waste – Why we're here
[39] Rockhampton Regional Council, 2022 Minimising Food Waste https://www.rockhamptonregion.qld.gov.au/CommunityEvents/Environmental-Sustainability/Living-Sustainably/Minimising-food-waste

The roll out of state-backed education or behaviour change campaigns such as deployment of Love Food Hate Waste materials will require significant additional resources to have a significant impact. Education could be delivered at a regional scale for issues such as behaviour change to avoid food waste without impacting individual Council service delivery. This could be delivered to commercial or industrial premises. Avoiding household generated food or garden organic waste being disposed of into a residual bin could be supported by the provision of at-home composting equipment such as compost bins or worm farms supporting education campaigns.

4.2.2 Alternative pricing strategies / pay as you throw

Aligned with education and behaviour change is the development of a bin sizing and price incentive strategy. This approach, currently being considered by several Councils in Queensland based on experience from elsewhere in Australia and overseas would seek to achieve higher landfill diversion by aligning bin volume pricing to the polluter pays principal and backing this up with targeted enforcement. This approach may also seek to include pricing mechanisms that prioritise recycling or organics collections over residual waste systems. State Legislation support is also critical to achieve result.

4.2.3 Levies and bans

4.2.3.1 Landfill levy and annual advanced payment

Organics managed within the residual waste stream and landfilled is subject to the landfill levy, except for waste generated in the Woorabinda Aboriginal Shire Council area. The current landfill levy applied to general waste in the regional zone is $88 per tonne disposed of, with the levy rate to increase by the rate of CPI in future years. The annual advanced payment for FY22-23 is 105%, which is scheduled to reduce to 100% for Banana Shire Council, Central Highlands Regional Council, and Livingstone Shire Council through to at least FY29-30. Gladstone Regional Council and Rockhampton Regional Council are scheduled to receive progressively lower annual advanced payments over the same period as described in Section 2.2.1. The continued return of landfill levies paid by the three Councils through the continuation of annual advanced payments allows the continuation of the commitment of no-direct impact to households, however, provides little financial disincentive to reduce the amount of organic waste going to landfill.

For Gladstone Regional Council and Rockhampton Regional Council the cost of landfill disposal will increase by nearly $90 per tonne in FY30-31. Compared to the original levy and annual advanced payment settings, this represents an increased levy liability (assuming current disposal rates) of approximately $6.7 million for Gladstone Regional Council and $13 million for Rockhampton Regional Council over the same period. This provides a potential opportunity to consider the benefit of introducing further organics diversion to offset or minimise the impact of these upcoming costs.

4.2.3.2 Landfill bans

The Queensland Government is currently exploring the potential for banning of organic waste from landfill to help increase diversion.[40] Individual landfill facilities could also adopt bans however this is considered unlikely in the region. It is expected that should the Queensland Government decide to legislate bans on organic waste to landfill within the region, there would be a very long-lead time to allow local government and industry to adjust, and to ensure collections and post-collection processing infrastructure could support the flow of material.

[40] State of Queensland, 2022. Queensland Organics Strategy and Action Plan.
https://www.qld.gov.au/environment/management/waste/recovery/reduction/organics-strategy

4.2.4 Introducing new organics collections services

Most Councils in the region provide a transfer station facility for self-hauled green organic waste across the MSW, C&I and C&D streams, noting no organic waste is captured in the C&D stream. No kerbside collection services are provided in the region, although Rockhampton Regional Council has recently undertaken a kerbside food and garden organic (FOGO) collection trial, which has been continued for residents who participated in the trial whilst Council formalises its own Plans. The trial also include garden organic (GO). Therefore, in summary 3 systems were operated, including FOGO with supplied caddy liners, FOGO without supply of caddy liners and GO. FOGO was operated weekly with a reduction in the 140L residual waste bin to a fortnightly collection from weekly. For the GO collection configuration, the system operated with weekly 240L waste bin collection and fortnightly 240L GO bin collection.

An option for all Councils could be to introduce a new kerbside organics collection service. An estimate of potential material within the household organic waste system for each Council is shown in **Table 12** based on the FY20-21 dataset and audit data.

Table 12 Potential organics in kerbside waste per LGA

LGA	Potential Food Organics in residual bin (tonnes per annum)	Potential Garden Organics in residual bin (tonnes per annum)	Total potential organics (tonnes per annum)
Banana Shire Council	550	520	1,070
Central Highlands Regional Council	1,240	1,180	2,420
Gladstone Regional Council	3,250	3,100	6,350
Livingstone Shire Council	1,820	1,740	3,560
Rockhampton Regional Council	4,690	4,480	9,170
Woorabinda Aboriginal Shire Council	90	90	180

Key decisions for new organics collections within the region would need to include:

- Which Councils will introduce a service, and the drivers for this including cost of landfill disposal cost, geography, ability to meet any increased costs, and the general direction of council and commitments made in other strategic documents and Planning.
- Who the service is offered to, whether to households, or for commercial premises, and the areas of service (i.e., not all councils provide a household garbage/recycling service to all households within the region). This includes consideration of whether individual councils provide the service.
- The type of material to be collected (e.g., whether to include all food wastes including meat, bones, dairy and fruit and vegetable scraps) or a restricted list. Councils may also wish to commence a kerbside garden organics collection service first, with a view to considering implementation of a kerbside FOGO service in the future.
- The frequency of service provided to optimise collections vs cost, and the potential to reduce the kerbside general waste collection frequency from weekly to fortnightly to offset new collection cost.
- Options for take up by residential or commercial service providers, including whether the service provided is mandatory, opt in, or opt out, noting that universal systems tend to have higher diversion rates.

- The type of facility to be constructed for processing, noting that some technologies are considered better for odour management than others however this also depends on the nature of feedstock. It is noted that Council's may choose to utilise existing facilities within the region.

Additional costs to support new services would include new organic waste bins (assumed 240L) for all households receiving the new service. Where the existing residual (garbage) bin is not red (typically older garbage bins are dark green lidded) it may also be necessary to replace the bin lid to avoid confusion with the light green coloured organics bin, and to meet national harmonisation standards. Additional at home infrastructure such as kitchen caddies and bin liners may also be required, which add additional costs to implementation. The indicative one-off cost of new household equipment required for introducing a new FOGO service is estimated to be in the range $60 to $84 per household depending on whether councils provide a kitchen caddy and liners for residents.

Table 13 Indicative Costs for Collection Consumables

Item	Cost per item excluding GST
Mobile bin (240L)	$45
Delivery & distribution of bins	$15
FOGO kitchen caddy liners including delivery	$13 (pack of 200)
Kitchen caddies including delivery	$11
Re-lidding of mobile bin	$11-$21

Source: Benchmarked data. Indicative pricing from suppliers.

4.2.5 Education to support a new kerbside organic collection

The introduction of a new collection service for organic waste within the region would require supporting education and engagement prior to and during implementation. Evidence from Victoria indicates whole of system education costs including a range of waste education and reduction measures for a 3-bin system including FOGO collections should be estimated at approximately 5% of overall waste management costs. Additional funding may be required in the first year of a new service to include business as usual, improvements to the yellow bin service and food waste avoidance, and organics education including and food waste avoidance estimated at $8 per household (noting if Councils decided to introduce a garden organics collection service these costs may be reduced). The breakdown of this cost is shown in **Table 14**.

Table 14 Indicative Costs for Education

Item	Cost per household per annum excl. GST (2021/22)
Business as usual (assumed for single or two bin system)	$4 per HH/yr
Improvements to the yellow bin service and food waste avoidance (see Section 5)	$8 per HH/yr
Organics education including FOGO education and food waste avoidance	$8 per HH/yr

Source: Council provided information.

To support a new organic collection education, Councils could continue soft enforcement through bin tagging which is generally already applied for the kerbside recyclable collection. Councils already have powers under local laws to apply penalties for offences around bin collection and materials placed in bins, which could be utilised or modified to support implementation. It is assumed that these activities are captured within the $8 per household per year cost for FOGO service implementation education.

4.2.6 Post collections infrastructure

Organic waste processing infrastructure is required to recover or recycle a greater volume of material. There are a small number of established organic waste processing facilities, including shredding/grinding and composting within the region which could potentially provide a solution but may not have appropriate scale or technology under current operations to meet feedstock supply and environmental performance requirements.

Organic waste processing infrastructure will also be required to recycle a greater volume of material. At present in the region most garden organic waste received by Councils is processed into a mulch. For Rockhampton Regional Council, most of the mulch is used by a commercial composter in Gracemere (NuGrow) and JJ Richards/CQ Compost operates a composting facility in the Central Highlands Region. Generally, the mulch product has little or no value, and is often given away, but more commonly used within landfill facilities for operational purposes, and in some cases stockpiled. The collection of food waste, either individually or via a mixed food and garden organics service (FOGO) will require more involved processing but have outputs that are generally of higher value. There are several considerations when choosing organics processing infrastructure, including the type and quantity of feedstock, quality of product required, and key location specifics such as proximity to sensitive receptors or product offtakers. There are a range of technologies available to process the FO, GO and FOGO stream. A summary of these are presented in **Table 15**.

Table 15 Organic waste processing options summary

Description	Mulching	Open windrow	Covered aerated static pile (CASP)	Covered inoculated static pile (CISP)	In-vessel composting	Anaerobic Digestion
Process	Use of grinding equipment to create a mulch product.	Composting via open windrow methodology	Composting process enhanced by piped air supply with use of a membrane cover system to manage odours.	Process enhanced by fermentation – compost pile is inoculated with specialised microbes and covered.	Composting undertaken in tunnels with air circulated beneath tunnels; open windrow for maturation.	The breakdown of organics by microorganisms in an enclosed oxygen free environment
Suitable feedstock	Garden Organics	Food and/or Garden Organics	Food and/or Garden Organics	Food and/or Garden Organics	Food and/or Garden Organics	Food Organics
Capital cost	Mobile Plant	$0.5M-4M	$4M-$12M	$1M-$5M	$20M-$27M	$10M -$30M
Estimated operating cost	$10-$40 / tonne	$30-$120 / tonne	$50-$70 / tonne	$50-$70 / tonne	$20-$120 / tonne	$100 to $200/tonne
Output product	Mulch	Compost	Compost	Compost	Compost	Biogas, Energy, Digestate

Note: indicative costs provided based on <15ktpa organics processing facility; real costs would form part of detailed business case
Capital costs exclude site preparation, output product quality depends on quality of input. Detail based on benchmarking

Key considerations for organics processing facilities in the region are:

- Type and volume of feedstock
- Location of facility, including number of facilities required within a region
- Transport costs, and benefit of location within a precinct
- Existing facilities and technologies that could provide a service, and whether a new service might impact their ability to continue operation.
- Specific technology to be deployed to meet specific location requirements.
- Facility procurement, ownership, operations, and funding models which provide greatest value for money
- Timeframes for intervention and required go-live date
- The potentially to introduce a garden organics service first as a precursor to a future FOGO service
- The requirements of the Queensland Government's model operating conditions for processing food waste as part of the FOGO stream

There are a small number of existing composting (and grinding/shredding) operators within the region. The FOGO and GO trials run by Rockhampton Regional Council utilised local processors noting that the scale of the trial for processing is different to the predicted processing capacity need in Rockhampton. Additional technologies may be deployed at a smaller scale to manage organic waste locally, including anaerobic digestion which may be an option at a small scale for more remote communities or linked to agriculture (e.g., anaerobic digestion at abattoirs).

4.2.7 Establishing a market for recycled organics

At a regional scale several offtake markets will need to be identified for recycled organic products. Product quality may dictate the end market, but end market demand may also drive manufacturing of certain products containing recycled organics. In the region the urban amenity market and landscaping is identified as a key target and the establishment of new composting facilities in the regional could be expected to contribute to this. Councils within the region may drive continued demand for this material by using on their own parks and gardens. Other markets may include intensive agriculture, broad acre agriculture or rehabilitation of mine sites, however the product value is likely to vary. Agriculture is generally assumed to be able to utilise large volumes of FOGO derived compost, but further work is required to establish supply or offtake agreements, and perhaps proven quality and benefit. The material may be sold in bulk, but further investment may be required to include screening and bagging infrastructure. The southern part of the CQ region is in relatively proximity to a high demand region (Wide Bay Burnett) for organic soil amendment products, and this could pose a viable pathway to an end market. However, information provided by Councils to support this Plan indicates a price of $30/tonne for a FOGO derived compost product may not be achievable based on feedback from operating facilities elsewhere in Australia, with economic analysis considering a zero price for the organic waste processing output.

Product quality is likely to determine the end price and applicability for all end markets. Contamination of both self-haul organics as well as future kerbside collections is a critical issue that has not yet been resolved. At a household level, education will be important in ensuring items that are not suited to composting are not placed in a FOGO collection service bin. Although compostable, some single-use containers can add additional contaminants, and do not currently meet the definition of FOGO in Queensland.

There also remains additional concern in operation of organics processing facilities with the presence of emerging contaminants such as PFAS in all waste streams, including organics. These concerns need to be addressed in waste collection, processing, and product quality to maintain offtake agreements.

4.3 Major options considered

Major options considered for how organic waste is managed in the region are presented in the following table and discussed in subsequent sub-sections:

Table 16 Major organic waste decisions

Decision area	Business as usual	Options				Rationale
Priority of focus on organic waste stream	Limited specific focus on organic waste diversion	Not a priority focus		Priority focus		Clear driver for Gladstone and Rockhampton with annual advance payment change. Each council can focus on own organics solutions.
Point of organics separation	At home composting + self-haul + one individual GO collection	Organics collections for individual Councils as business case and economic conditions dictate		FOGO collections for whole of region		Gladstone and Rockhampton to progress development of organic collections for own LGA. Other Councils to continue BAU.
Waste stream composition for collection	Garden Organics / Green waste only	Garden organics only (BSC)	Food organics only	All garden organics and some food organics	All food and garden organics	Feedstock for organics collection to be determined by each individual Council with aim to standardise across region/state as necessary.
Waste stream for self-haul	Garden organic waste only	Garden organics waste only	Food organics only	All garden organics and some food organics	All food and garden organics	All Councils to continue to offer self-haul garden waste at transfer stations.
Processing technologies	Mulching	Small scale organics infrastructure	Open Windrow	CASP or CISP or other covered	In-vessel composting	Councils to work through individual solutions for processing technologies. BAU mulching to continue.
Market development	Mulch product used locally, given away, some challenges	Limited intervention	Moderate level of support or intervention to establish local offtake markets for all products		High level of support or intervention	Secondary market for recycled organics requires further establishment and support.
Approach to behaviour change: Food waste avoidance	Delivery through waste education team members. Limited broader support	Limited focus	Priority focus at individual Council scale		Priority focus at state and regional scale	Food waste avoidance can be delivered at regional scale to tie in and leverage state-based support. Messaging at regional level but requires consideration of individual Council needs. Assumes state led and funded.
Approach to education - collections	Delivery through existing education programs	Limited focus	Priority focus at individual Council scale		Priority focus at regional scale	Different collections will require different approaches. These may need to be specific to Councils operating services.
Non-infrastructure organics solutions	No solutions offered	Provision of at home composting solutions (program)		Provision of community composting facilities to allow food scrap diversion at local sites within region		Additional non-infrastructure solutions to allow participation where new services unviable. Assumed State led and funded.

Cells in GREEN reflect decision made; CHRC – Central Highlands Regional Council, BSC – Banana Shire Council, GRC – Gladstone Regional Council, LSC – Livingstone Shire Council, RRC – Rockhampton Regional Council, WASC – Woorabinda Aboriginal Shire Council

4.3.1 Priority of focus on organics waste stream

It is estimated that around 50% of the kerbside residual bin collected from households in the region is organic in nature. With residual waste disposal capacity becoming constrained in the medium term across several Councils, and the known greenhouse gas emissions caused by organic waste in landfill, there is a clear need to divert organic waste from landfill in the region. However, this is tempered by the geography of the region and the economic and policy conditions including waste levy settings for all Councils except Gladstone Regional Council and Rockhampton Regional Council, for which business cases still need to be finalised to determine the operational setting within which diversion of organics is of greater benefit than the impending and increasing landfill levy liability.

For the other Council areas, kerbside organic waste diversion beyond existing self-haul solutions are not a priority, although individual councils may decide to offer a new service in the future aligned with their own policy goals or in response to changing state policy. Efforts should be made to allow participation in organic waste reduction and diversion activities at a local scale through access to food waste avoidance programs or other participation events such as at home or community composting. Small-scale organics processing may also be an option, particularly in areas with low population.

4.3.2 Organics separation approach

In FY20-21 approximately 41,000 tonnes of green waste were self-hauled to transfer facilities in the region. It is assumed these services will continue to be offered in all Councils that currently provide them. For Banana Shire Council, Central Highlands Regional Council, Livingstone Shire Council and Woorabinda Shire Council separate kerbside collections are not a priority in the short-term under current levy and policy settings, due to the potential cost impact on household and relatively low resource recovery benefit. Education activities that focus on food waste avoidance and at home or community composting activities should be supported. These Councils may progress kerbside organic waste collection in the future, because of local policy change or through community or council led change.

4.3.3 New household organic waste collection services in Gladstone and Rockhampton

Separate household kerbside organic waste collection services could be offered in Gladstone Regional Council and Rockhampton Regional Council pending completion of further analysis of the cost of implementation and approval of business cases by Councils. New services for collection at the kerbside will incur additional costs, which may be offset partially by reducing the residual bin collection from weekly to fortnightly. To support economic analysis, it was assumed 80% of households currently receiving a waste collection service would receive a kerbside food and garden organics service. There could be opportunities to collaborate on collection contracts, with benefits from duplication of procurement activities and minimising the need for new trucks etc. To support the roll out of a new kerbside collection system, significant and early investment is required in education to drive initial behaviour, followed up by ongoing education efforts.

Development of a specific business cases will support the best value combination of cost versus service and impact on residual bin collections. In the future this service may expand or a new service to collect commercial food waste from commercial customers will be explored.

4.3.4 Processing technology

Mulching is a favourable solution for processing self-hauled garden organic waste in most Councils. Refinement of the technology to be used by those Councils who choose to collect FOGO waste is a key consideration. This includes the potential to collaborate on a larger scale regional type facility, or for Councils (Gladstone Regional Council and Rockhampton Regional Council) to develop their own processing capability. This may depend on the level of investment required. Options for composting processes are subject to business case progression, as well as the regulatory environment. The Department of Environment and Science is currently considering the risks associated with processing FOGO and specific requirements for processing facilities which is expected to dictate to a degree location of facilities or technology to be deployed and will dictate cost. A further consideration in the region is the integration of existing green waste processing into future composting activities.

Existing private sector facilities in the region includes the NuGrow composting facility at Gracemere, near Rockhampton, and CQ Compost located at Emerald, both of which operate open windrow composting facilities which could potentially receive, and processing Council collected wastes depending on the procurement pathway Councils decided to follow. Other private sector facilities could be established in the region to support both council contracts and commercial organic waste processing needs.

4.3.5 Infrastructure ownership and facility delivery

There are a range of ownership and funding options available for organic recycling technology. This will be reviewed and considered during the development of business cases and funding requests, however, could include options for Councils to own facilities, design, build and operate, or engage the private sector to do one or all the options. The decision will be made on the most cost-beneficial approach and impact on ratepayers.

Where the private sector is engaged to deliver services relating to organic waste collection or processing, decisions for technology will reside with the solution provider and be reflected in the gate fee paid by the Council or other waste providers. This approach reduces operational risk to Councils however reduces the control Councils have on price, and it would be expected that there would be penalties or increased gate fees associated with poorer quality material delivered.

4.3.6 Improved understanding of whole of region waste stream composition

There are a range of different organic wastes that could be collected across the region. Business as usual activities for Councils receive a large proportion of garden organic waste through the self-haul system including from both the household and commercial streams which is mulched and has little residual value, often given away. Across the region green waste will continue to be processed in this manner.

For Councils that decide to include additional collection systems including the FOGO stream an opportunity is provided for composting activities providing a higher quality output than mulching. Improved or refined data is required to support new systems, including the potential contribution of commercial food organics, and those that are not captured as waste (i.e., agricultural residues etc.,) but may support either public or private investment in new processing facilities. The work undertaken by the Queensland Government on organic material flows should be shared more broadly and used to support holistic discussions around potential feedstocks at a regional level not just limited to waste managed by Councils. This work also requires regular update.

4.3.7 Market development

Market development activities are required to support both existing activities through mulching and the compost product to be produced by the organics processing facility. Whilst there is confidence that a market exists, or links with offtakers can be identified, further work is required to connect supply with potential users. This can be facilitated by individual Councils, through procurement of product for use within urban amenity and by the Queensland Government where recycled organics can be deployed in the road reserve. Use in agriculture may require further refinement of offtake product, strong quality management, and a period of trial with agricultural users to demonstrate product quality. Mulched product, though likely lower value, also has been challenging for some Councils to find a market for. The price of any organic waste processing derived product varies significantly with quality, with a range of between $0 and $130. The establishment of a market for high-quality product should be a consideration of business case activity, as it can determine the processing technology required.

4.3.8 Approach to behaviour change and education

For organic waste there are two clear elements for action. Behaviour change aligned to the Queensland Government supported campaign options such as Love Food Hate Waste program will support the entire region reduce the amount of food waste generated and proportions of food waste in waste. It is expected and essential that the Department of Environment and Science will provide support through resources, both financial and collateral, to allow regional delivery. This messaging should be delivered at a regional scale, initially through the establishment of a regional waste education strategy, to allow all Councils to participate fully and allow economies of scale in messaging, however in the region it was also highlighted that individual Councils may need to tailor education packages to their own needs, whether specific to new collection or processing systems, or timeframes associated with other engagement activities. It is expected that Woorabinda Aboriginal Shire Council will have its own community specific education strategy.

For individual Councils messaging around existing services may be targeted to improve the quality of self-hauled green waste provided to Council transfer stations, as this has an implication on mulch product quality. Where Councils approve the introduction of a kerbside organics collection a specific education and awareness campaign in the lead up to commencement will be required. It is expected that education coupled with behaviour change or enforcement activities will be required to ensure compliance with scheme requirements and to take actions to minimise contamination. Specifically in relation to penalising poor behaviour it is expected and essential that the Queensland Government will take the lead on legislating penalties, rather than individual Councils being required to introduce new penalties into local laws.

4.3.9 Regional collaboration on community initiatives to reduce organic wastes

The potential to support or develop trials for community composting, specifically in parts of the region that are unlikely to move to a kerbside organics service in the immediate term, is identified as an opportunity to allow residents to participate in organics diversion activities and is consistent with the Queensland Organic Waste Strategy and Action Plan. There are activities such as licensing arrangements, identifying sites, and procedures to encourage community composting that are better suited for development by the Queensland Government than by individual councils.

4.3.10 Tackling problem organic wastes including biosolids

Regional collaboration to assess jointly higher order end uses in the region for recycled organics derived from green waste were identified as an opportunity. Additionally, the development of an approach to managing biosolids, noting successful projects in South-East Queensland (for example the Logan City Biosolids Gasification project or an Urban Utilities project pelletising biosolids for use as a fuel), particularly with the potential for regulatory change regarding the presence of emerging contaminants in biosolids.

4.4 Expected outcomes

For this Plan, there are clear environmental and social benefits to implement new kerbside organic waste collections and processing solutions throughout the region, however there is no clear economic incentive for Banana Shire Council, Central Highlands Regional Council, Livingstone Shire Council or Woorabinda Aboriginal Shire Council to implement such a solution. There are expected benefits for Gladstone Regional Council and Rockhampton Regional Council to progress the development of an organic waste collection and processing solution which will commence when practicable and approved by individual Councils.

A FOGO collection service in Gladstone Regional Council and Rockhampton Regional Council is predicted to capture an estimated 12,900 tonnes (initially upon commencement), rising each year through sustained investment in education and as population grows. Other councils may introduce their own services, and build their own processing facilities, or take advantage of existing facilities. The outcome in this Plan assumes:

- A new FOGO system captures 35% of food organics and 85% garden organics from the residual bin[41] estimated to be 1,000 tonnes (food) and 2,349 tonnes (garden) diverting 4,175 tonnes of organic waste from landfill in Gladstone Regional Council, and 1,500 tonnes (food) and 3,500 tonnes (garden) diverting around 5,000 tonnes of organic waste from landfill in Rockhampton Regional Council.
- Additional garden organics captured with the provision of a new kerbside service (i.e., some material may currently be managed at home or that is currently self-hauled is captured in the new FOGO service, estimated at 4,500 tonnes.
- This includes the impact of education as well as the capture of existing food and garden organic waste currently in the residual bin, plus additional garden organics added to the system by residents.
- After implementation, across the region, there would still be an estimated 14,300 tonnes of organic waste in the residual bin.

Should Banana Shire Council, Central Highlands Regional Council, Livingstone Shire Council or Woorabinda Aboriginal Shire Council decide to introduce a new kerbside organics service benefits based on volumes could generally be scalable, however due to distance and need for additional composting infrastructure costs could escalate significantly. The addition of a FOGO collection service for all other councils would add an extra 1-2% to the MSW kerbside recovery rate and likely have marginable impact on the regional recovery rate for all streams.

Figure 14 provides an estimate of the annual cumulative tonnes of FOGO waste collected through the potential Gladstone and Rockhampton FOGO collections. The lines are a reference mark showing the total amount of FOGO waste currently in the residual bin.

[41] RAWTEC, Analysis of NSW Kerbside Green Lid Bin Audit Data Report 2020

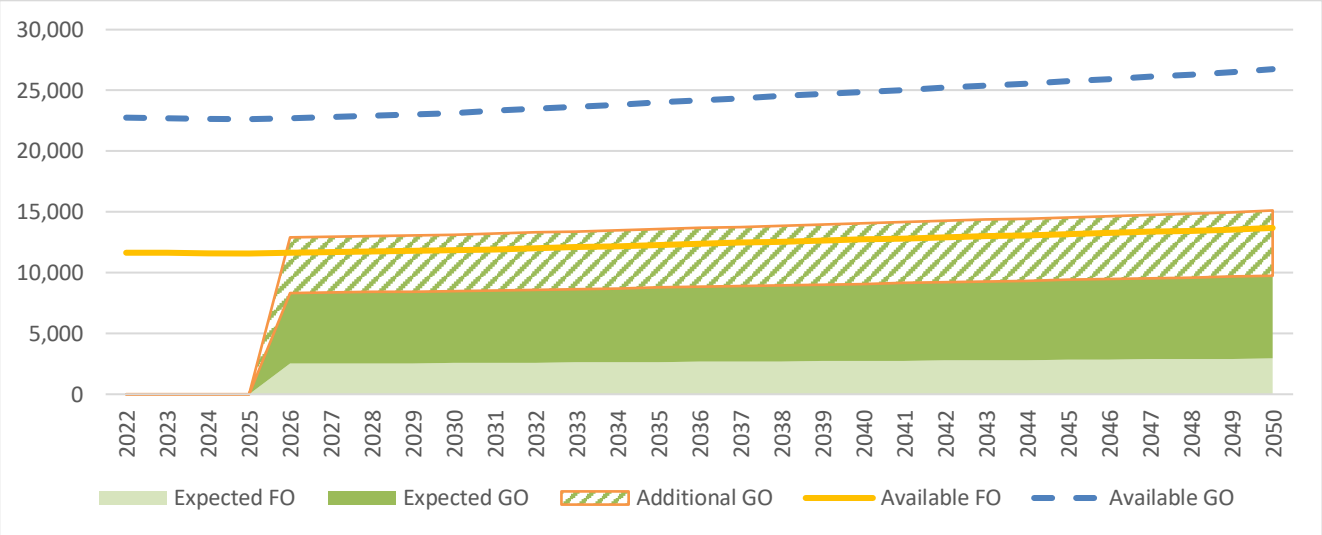


Figure 14 Future State for Organics collections

Community composting is considered to provide a modest reduction in the food waste disposal reduction applied outside of Gladstone and Rockhampton; however overall, the combination of existing green waste processing across the region, growth of community composting, and FOGO collection and processing in Gladstone and Rockhampton is estimated to improve the regional MSW kerbside recovery rate by 16%. This contributes to an overall recovery rate increase across all streams of approximately 4% from 51% to 55%. If introduced in FY25-26, the estimated emissions savings from organic waste diverted from landfill to composting just for diverted material are 98,000 t/CO^2e[42] over the period FY25-26 to FY30-31.

Table 17 summarises the expected outcomes for the region in implementing the RWRRMP regarding organic wastes.

Table 17 Expected Outcomes – changes to organic waste performance

Metric	Current (FY20-21)	Forecast 2030	Forecast 2040
Household organic waste recycling rate[43]	23%	31%	35%
Household organic waste diversion tonnage	29,421 tonnes	41,000 tonnes	45,000 tonnes
Contamination rate[44]	To be baselined early during commencement	<5%	<5%

[42] Australian Government, Department of Climate Change, Energy, the Environment and Water, 2022. Australian National Greenhouse Account Factors, November 2022
[43] Rate includes both self-haul garden organics and FOGO services
[44] Target contamination rate should be determined by processing technology and end market need

4.5 The cost of making the change

Economic analysis undertaken to support the Plan has identified that the expected cost of making the change at a regional scale or for individual Councils would include:

- Capital, operating and lifecycle costs – for the establishment of new organics processing infrastructure, plus transfer and bulking infrastructure (if required for transport to a centralised facility). These costs also include one-off costs for the delivery of new bins, caddies, and liners for households. Costs may increase depending on the processing technology. For example, costs of anaerobic digestion or covered aerated/inoculated static pile have higher capital costs than an open windrow system. It is assumed that a facility (or facilities) will be built in the region, rather than using existing facilities and Councils paying a gate fee.
- Transport costs – these include both the delivery of new kerbside collections and transport of organic waste to a centralised facility from across the region where required.
- Education costs – education costs commencing before the establishment of new services and continue through service provision to support the change and ongoing use of the system.

This analysis includes a rapid cost benefit analysis. For implementation of the organic waste component of the Plan, it was assumed that new organic waste processing facilities deploying open windrow technology would be built in Rockhampton and/or Gladstone. The modelled facility size for each would be small (<15,000 tonnes per annum processing capacity). This would be supported by new kerbside collections, assumed weekly, offset by a reduction in the residual waste collection services to fortnightly collections. It was assumed that the kerbside FOGO collection service would be rolled out to 80% of households in Gladstone and Rockhampton. The estimated whole-of-life costs for the introduction of FOGO collection and processing services in Gladstone and Rockhampton, over a modelled 32-year period is estimated to be **$45 million** (present value[45]) or annualised at **$25 per household per year** over the whole period compared to business as the business-as-usual scenario. In summary:

- The kerbside collection cost is estimated to be **$19.5 million** (present value) reflective of the addition of 52 weeks of FOGO kerbside collection and reduction of 26 weeks of residual waste collections over the period.
- Overall CAPEX and OPEX costs associated with construction and operation of the organics processing facilities required is estimated to be **$25 million** (present value) over the forecast period. This assumes a simple open windrow facility can be established in each region with minimal land acquisition or site preparation costs (e.g., at an existing council facility).
- Initial one-off costs for the purchase of new bins and other consumables (kitchen caddies, liners etc.,) estimated to cost **$1.5 million** for Gladstone Regional Council and **$2.2 million** for Rockhampton Regional Council.[46] These costs may vary depending on the final service configuration and decisions made by Councils (e.g., provision of liners for caddies).
- Additional one-off costs may be required to replace existing residual bin lids with Australian Standard red lids, estimated at between $10-$21 per household.
- Education costs (included in the OPEX costs above) associated with the introduction of a new kerbside organic waste collection service are estimated to be **$0.14 million** per year for Gladstone Regional Council and **$0.21 million** per year for Rockhampton Regional Council, assumed to start 2-years prior to commencement of a full service.

[45] Note whole of life costs are discounted at a rate of 7% per year and presented as present value costs.
[46] Cost based on $84 per household establishment costs

It is assumed that FOGO collection would be impracticable to introduce at this stage in Banana Shire Council and Woorabinda Aboriginal Shire Council due to scale. It is also assumed at this stage that Central Highlands Regional Council and Livingstone Shire Council do not have the economic driver (i.e., 100% annual advanced payment meaning levy cost is not realised) to add additional kerbside collection services. Nothing in this Plan or modelling undertaken precludes any council from deciding to implement a kerbside organics collection service.

Further refinement of the cost estimate would be expected as initially Councils establish whether regional collaboration for organics collections (between Gladstone and Rockhampton) is feasible or whether individual facilities may be required. Likewise, consideration of the benefits or costs of providing a collection service with a third-party private sector processor should be explored noting the presence of private processing facilities in the region.

Additional costs may be incurred in implementing the Plan for:

- Support required to implement food waste avoidance education and behaviour change. This is included within whole of region education costs alongside activities identified in **Section 5**.
- Costs associated with developing a regional feasibility study for problematic organic wastes such as biosolids and timber.
- Costs associated with the roll out of at home composting solutions such as worm farms or compost bins. This is assumed to be a whole of state response coordinated by the Queensland Government.
- Costs associated with the establishment of community compost facilities within communities in Central Queensland. This is assumed to be a whole of state response coordinated by the Queensland Government.
- Updates to material flow analysis commissioned by the Queensland Government to provide a snapshot of current material flows, demand and supply across the region and neighbouring regions to maximise the potential for reuse and recycling in the region.

A breakdown of expected costs for implementation of this Plan is presented in **Appendix D**.

4.6 Supporting the change

4.6.1 Getting to the decision point for investments

Councils require a significant understanding of the business case for delivering new service before making a decision that affects their ratepayers. The preparation of a business case for a proposal requires significant investment in time and potentially the procurement of specialist economic, engineering, and other technical services. Future funding requests associated with the implementation of this Plan will likely require a gateway approval from State Government entities, who will expect documentation of a high standard to support any application.

4.6.2 Funding support for Capital Expenditure

The introduction of a new kerbside organics service in the region is expected to cost more than the current service offering to provide additional collections and support gate fees or operational costs at a new processing facility. This includes preparing business cases that will consider existing fleet capacity and capability in the context of an additional collection service, and the establishment of a new organics processing facility. Ownership and delivery of the latter are to be established, but whether Council or privately owned, capital costs are expected to be significant.

A new organic waste processing facility may be located within a Precinct or existing industrial zone land. Support will be required from the host Council or from the Queensland Government to facilitate the establishment of the precinct to support organics or other resource recovery activities (see **Section 5**) which may be financial, Planning and approvals. This includes a clear role for the Queensland Government to support establishment of both enabling infrastructure and industry attraction for new businesses to fill the precinct. There may be benefit to co-locating an organic processing facility in a future precinct development. The cost of the enabling infrastructure is included in the whole of life cost estimate, however broader precinct costs would require additional investment.

4.6.3 Behaviour change and education support to support food waste avoidance

Central to this Plan is the establishment of regionally focussed education and behaviour change programs. Engagement is required, plus the potential for support through partnerships with the State Government to fully recognise the benefits of a food waste avoidance program, and other behaviour change activities under the National Food Waste Strategy. This should be extended not just to new programs, but for existing services such as self-haul green waste to ensure product quality targets can be met.

4.6.4 Clarity of regulation

Clarity is required around regulation of sites processing food waste (FOGO) at scale as this has a cost implication on ratepayers as well as siting of facilities. Immediate clarity is required from the Queensland Government to ensure clear and transparent application of legislation that enables rather than hinders the establishment of organics processing facilities. This includes providing certainty on the type of facility required to process FOGO. Clarity is also required to how the Queensland Government intends to use landfill disposal bans about organic waste. This need for clarity or certainty also extends to how emerging contaminants (e.g., PFAS) potential in organic waste derived products are managed.

4.6.5 Setting the parameters of community composting

Community Composting could be deployed throughout the region, including in remote and regional communities. Whilst unlikely to have a high cost, consideration of funding for the development of state-wide education and information resources, education staff support, and support to facility community action should be provided by the Queensland Government. Priority should be given to Councils and populations without access to an organic waste service in the first instance, however documents and guidance should be available to all.

4.7 Timeframes

The proposed timeframe for implementation of the organics stream are:

Table 18 Organics implementation timeframes

Immediate action (within next 2 years)	Within next 5 years	Within next 10 years
Education & Behaviour Change		
ALL: Development and implementation of Regional Education Strategy incorporating food waste avoidance behaviour change program (all)	Update and continuation	Update and continuation
DES + Councils: Consider how State based legislation/regulation or individual Council action may need to be implemented.	DES + Councils: Implementation of agreed approach	Continuation

Immediate action (within next 2 years)	Within next 5 years	Within next 10 years
ALL: Education and behaviour change to support better quality of self-hauled green waste to transfer facilities (all)	Continuation or commencement	Continuation
	ALL: Support state-based roll out of at home composting or worm farm equipment subsidisation (pending State funding & administration) linked to avoidance particularly in non-urban areas considering	
Organics Collections		
GRC, RRC (Pending approvals) develop regional feasibility study for FOGO collections including detailed cost estimate for each Council to manage locally or transport to a regional facility.	GRC, RRC (pending approvals): Commence FOGO collections for each Council	GRC, RRC (pending economics): Continuation of FOGO collection.
Processing solutions		
ALL: Continue to process green waste under BAU	Continuation	
ALL: Collaborate with DES to develop guidance on community composting	ALL: Implement community composting where feasible and guidance allows, and significant community support exists	
ALL: Development of an organics processing facility or procure contract to compost kerbside collected FOGO pending business case & council approval	ALL: Construction and commissioning of organics processing facility, or utilisation of private facility pending business case and council approval	All: Continued operation. Grow feedstock type and scale as market dictates
	ALL: Develop alternative solution to land application for biosolids	ALL: Implement alternative solution for biosolids if triggered by change in regulation or economics
Market development		
	ALL: Collaborate on regional solution for biosolids	ALL: Implement regional solution
	ALL (pending economics): As part of business case, identify opportunities for Councils to drive offtake of processed organics product particularly high value product	ALL: Implement and continue to drive offtake solution
Data & Information		
ALL: Work with DES to refine data associated with non-Council managed organic waste within region and identify opportunities to collaborate on processing or supply. Collaborate as part of overarching data strategy.		

Note: Timeframes in this table relate to expected delivery as agreed by Councils in developing this Plan. Timeframes do not preclude action taken by other councils as individual needs and policy dictate. Cells in GREY indicate action not expected to commence during the timeframe

4.8 What could affect implementation

The following variables could affect implementation of the organic waste component of this Plan:

- Changes to regulation or rules relating to the processing of food wastes within composting facilities, and in particular the stipulation of technology type specific to this processing.
- The updating of Australian composting standards (e.g., AS 4454 Composts, soil conditioners and mulches) with more stringent controls associated with the nature of emerging contaminants or other issues that hamper the distribution of recycled organics, including products derived from organic waste.
- The price of recycled organics product (e.g., compost, etc.,) can vary significantly. The typical compost product generated by existing composters running FOGO projects in Victoria and NSW may achieve only $20/tonne for their outputs, whereas high-quality (and low contamination) outputs reported in strong agricultural market areas may achieve up to $120 per tonne. The establishment of high-quality output producing facilities coupled with market development activities could achieve a lower overall whole of life cost for organics diversion.
- Changes to the landfill disposal levy (i.e., incremental prices in levy rate greater than CPI) or annual advanced payments could impact the viability of decisions made to support this Plan, including making the economics of kerbside FOGO collection more or less viable.
- The Queensland Government are considering the potential to introduce landfill disposal ban for certain types of wastes including organic wastes. The introduction of a ban on organic waste to landfill (either holistically or for single streams) would support the establishment of a local or regional scale infrastructure. For those Councils with existing landfill gas to power generation facilities a ban on organic waste to landfill could potentially affect the commerciality of these systems, although this would also support a general reduction in greenhouse gas emissions from landfills and promote diversion.
- The expectation in implementation of the education and behaviour change components of the Plan imply reduction in food waste as well as a movement towards low levels of contamination in organics collection services. This will require ongoing effort and financial commitment to reinforce this messaging throughout delivery of the service offering.
- Incorporation of other organic waste streams could allow for growth of proposed processing facilities over time (e.g., commercial food waste, agricultural wastes, timber etc.,).

5 Material recycling and recovery

This section captures actions and interventions associated with the kerbside recycling scheme and materials recovered or potentially recoverable and recyclable across the region. Challenges in recent years for the kerbside collected bin have stemmed from restrictions on the export of mixed recyclables firstly due to restrictions in China and other receiving countries due to quality or contamination issues, and more recently due to the implementation of export bans on certain unsorted waste streams imposed by the Commonwealth Government. This section considers:

- The existing dynamics of the recyclable waste stream in Central Queensland
- Potential levers and interventions
- Major options considered
- The expected outcomes of the preferred options
- What is required to support the change; and
- What may change during the implementation of the Plan

5.1 Waste stream dynamics

Within the region Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council and Rockhampton Regional Council currently offer a kerbside commingled recycling service. At present collected recyclables are delivered by truck to Visy in Brisbane and ReGroup in Mackay following a fire at the privately owned and operated MRF in Rockhampton in November 2020. These four Councils are currently collaboratively procuring a replacement recyclable reprocessing service to replace the service lost by the MRF fire. This process is expected to complete by the end of 2023, with a new contract commencing from 6 November 2023, and may result in either recyclate processed in region at a new MRF or sent to a facility out of region. Each Council that collects kerbside recyclables. It is noted that Rockhampton Regional Council collects residual waste by day labour and recycling under contract. Therefore, all Councils collect recycling under a contract.

In FY20-21 a total of 122,092 tonnes of material generated in the region is recovered (assumed recycled), of which kerbside collected waste represents 12,784 tonnes. A further 109,309 tonnes is self-hauled to Council managed facilities within the region comprising 5,698 tonnes of household, 7,662 tonnes of C&I and 95,959 tonnes of C&D waste. **Figure 15** presents a breakdown of where recyclate is apportioned in the region from the base case for the first year of modelling, combining audit data with projections.

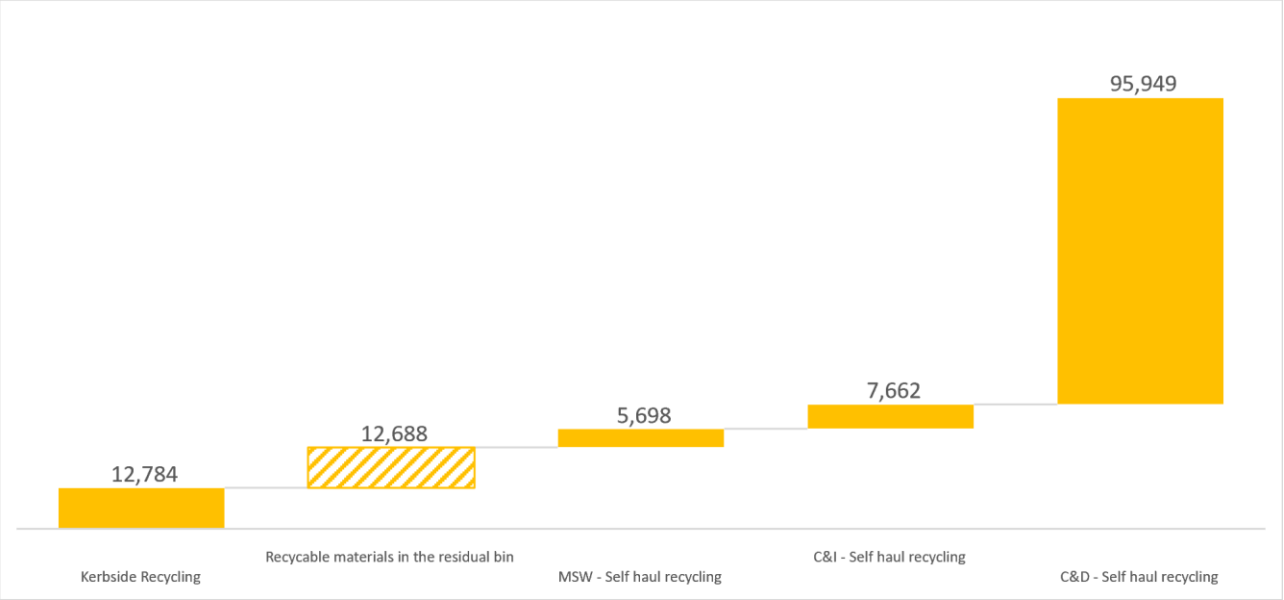


Figure 15 Proportion of recyclable material forecast in each source (FY20-21)

The overall recovery rate (including organic waste) is 37% for the MSW stream. The overall recovery rate for the C&I stream is 28% and the C&D stream is 77% (it is noted that approximately 80% of this recovery is due to clean earth reuse). Contamination in the yellow-top bin is a significant issue across the region with the regional contamination rate an estimated 20%. Contracts with the MRF operator typically have penalties for excessive contamination, and this also can affect downstream quality and price of MRF sorted materials. Waste education is provided across the region which strives to drive the avoidance of waste and drives better performance in existing services; however, dedicated resourcing for waste education officers is necessary. Waste education provision is dependent on funding and resource availability, with larger Councils having greater resources.

Some self-hauled C&I materials are recovered within the region, although recovery rates are relatively low at 28%, and the majority is understood to be sent to landfill in mixed loads. Wastes in the C&D stream achieve a regional recovery rate of around 77%, with Councils recycling and recovering large proportions of this material received at Council facilities. The levy, operational since July 2019 is likely to have driven this diversion rate with a common response observed across Queensland, alongside exemptions for operational use of clean earth within resource recovery facilities. It is noted that councils in the region have generally proactively managed C&D waste and so may not have seen significant improvement because of the levy.

Although Councils in the region manage a relatively high proportion of non-household waste, private sector businesses operate in the region, including providing waste collection services on behalf of some Councils. There may be gaps in the reported data for private sector operations not captured in the annual waste data survey by the Queensland Government. These gaps may represent opportunities for material that could be processed locally.

5.2 Levers and interventions

5.2.1 Refuse, reduce, avoid, and reuse through education

For kerbside collection, education of households is critical for reducing contamination. The Queensland Government is currently preparing a behavioural change campaign under its State Education and Behaviour Change Initiative (EBCI) which is understood to include Statewide advertising as well as toolkit resources to be deployed locally at a regional or individual Council scale. Education around putting the right thing in the right bin will not necessarily significantly impact recovery rates, but education around what can and should go in the recycling bin is also critical to minimising contamination. Likewise helping residents understand what happens to their recycling and validating that it is recycled and turned into new products is critical, as is understanding what non-kerbside recycling options may also be available. Funding for education is not just initial funding but requires ongoing funding throughout the lifetime of this Plan.

5.2.2 Policy and legislation

At a national scale the phase out of materials, especially plastics or other packaging materials that are harder to recycle would help to drive better quality in the commingled bin; however, this cannot be controlled by those collecting the waste locally and requires Queensland and Commonwealth Government intervention. The waste industry, including both Councils and private industry are responsible for managing the end-of-pipe products produced and consumed by residents and visitors to their regions and Council areas. As such they can have limited impact on the materials that flow through the economy and ultimately become waste. Alignment with upcoming recommendations regarding harmonization of bins should be incorporated, where relevant to the services offered, noting that a case for a separate glass collection as currently being implemented in Victoria does not appear to offer significant benefit to existing arrangements and infrastructure. More assistance is needed from the Queensland and Commonwealth Governments on this front.

There are several circular economy transition changes currently being progressed that may achieve some of the higher order 10Rs before the material becomes waste such as changes to right to repair legislation. These activities over time may impact the material flows eventually becoming waste, most likely through delaying the transition of a product to waste by keeping products in use for longer.

5.2.3 Regulation and enforcement

Enforcement activities will support education, but Councils need to be able to enforce requirements or even penalise repeat offenders. This could be undertaken under either local laws, or preferable consistent laws at a state-level to allow repeat offenders to be penalized for their repeated poor behaviour. This could include the introduction of alternative pricing systems or potential removal of service.

5.2.4 Collection systems

Collection systems for materials that can be recycled or recovered (excluding organics and residual waste which are addressed in other sections) rely on a combination of kerbside recycling collections (in Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council and Rockhampton Regional Council areas) or via the self-haul system. Private sector operators undertake collections within the region, although typically this is understood to be for niche wastes (e.g., liquid regulated wastes), for businesses with multi region collection contracts, or where they are contracted to provide a collection service on behalf of a Council. Councils often end up managing large amounts of the non-Council collected waste at resource recovery facilities.

Enhanced material recovery and recycling also requires improvements to self-haul facilities for both household waste and that generated by the private sector operators, particularly in parts of the region where Councils manage a high proportion of the C&I and C&D stream. This would include better segregation and separation of problem wastes which typically end up in landfill such as tyres, timber, mattresses, e-waste, paint, and construction wastes. Separation of these wastes needs to be supported also by existing or future product stewardship schemes providing a service to all Councils, and not just those on major routes, or subsidising the transport from more regional areas into a centralised hub to allow collection and reprocessing.

In areas where there are kerbside services there are numerous household hazardous waste products (e.g., mattresses, paint tins, batteries, household chemicals etc,.) that cannot be collected from the kerbside, but often end up in the yellow top bin as contamination, or the residual bin where they can cause issues such as fires or contamination. Education can support the non-inclusion of this material in kerbside service bins, but a clear pathway for these materials to be recycled at Council transfer stations should be expanded. Dedicated household hazardous waste transfer facilities (such as the NSW Community Recycling Centres (CRCs)) would help facilitate better capture of these materials. In NSW such facilities are state funded, and there is a clear role for the Queensland Government to support establishment of facilities across the region.

Alignment with an expanded Container Refund Scheme with the updated scheme capturing wine and spirit bottles from late 2023 helps to remove lower quality items, as well as items that cause contamination of other streams (e.g., broken glass to paper/card) which may improve the quality. These changes may impact the flow of material into the recycling processing solution which in turn have a material impact on processing contract rates (i.e., less volume being processed typically increases cost to Councils for processing). Councils indicate that annual weight reduction through MRFs may amount to 10-15% less because of the change.

5.2.5 Processing infrastructure

Material recovery facilities typically process and sort wastes. For kerbside recycling they provide a service that sorts the commingled feedstock into respective streams for further processing. There is currently no MRF within the Central Queensland Region, with the Rockhampton located privately operated MRF closing in November 2020 following a fire. Several Councils in the region are collaborating on a new recyclable processing service which is anticipated to be in place by the end of 2023, expected commencement data of 6 November 2023. In the interim, kerbside collected material is sent to the council owned MRF in Mackay or Visy in Brisbane for sorting. MRF costs vary depending on size and scale, and the technology deployed. The following table provides indicative costs for MRF technology for context.

Table 19 Indicative Costs for an MRF

Item	Capacity (tpa)	Gate Fee ($/tonne)	CAPEX	OPEX	Reference
Small MRF	5,000 – 10,000	$30-$190 per tonne	$2 million - $8 million	$0.8 million - $2 million per year	Arcadis, 2018[19] Infrastructure Victoria 2020[48] COMSEQ[47]
Small-medium sized MRF	10,000-15,000	$180-$200 per tonne	$15 million	$0.8 million - $2 million per year	Council-provided information
Medium MRF	25,000 – 50,000	$30-$140 per tonne	$10 million - $20 million	$30-$60 per tonne or $3 million per year	Infrastructure Victoria 2020[48] Council-provided information

Costs indicative based on published information, Council provided information, or consultant benchmarked data

[47] Southeast Queensland, Council of Mayors, 2020. Waste Management Plan
[48] Infrastructure Victoria, 2020, Waste and Resource Recovery Infrastructure Gap Analysis, https://www.infrastructurevictoria.com.au/wp-content/uploads/2020/05/2.-Resource_Recovery_Infrastructure_Gap_Analysis_Final_IV.pdf

Following sorting at an MRF, or taking materials collected individually under specific schemes or at Council transfer facilities, material can be reprocessed into a resource reprocessing facility. These reprocessing facilities take pre-sorted materials and change their physical and/or chemical nature, adding value to the processed material so that it can become a feedstock for a manufacturing process or otherwise re-enter the economic cycle.[49] Reprocessing facilities typically manage single-stream materials, such as paper, cardboard, plastics, glass, timber, metals, batteries, e-waste, tyres, and oils.

Table 20 Indicative Costs for Reprocessing

Item	Capacity tonnes per year	CAPEX	OPEX per Year	Reference
E-waste processing - batteries	4,000	$1.75 million - $2.2 million	$250,000-$300,000	Infrastructure Victoria, 2020[48]
E-waste processing - batteries, monitors, and televisions	5,500	$2.8 million - $3.4 million	$400,000-$500,000	
E-waste processing - solar panels	5,000	$1.5 million - $10 million	$250,000 - $550,000	Infrastructure Victoria, 2020[48] Council provided information
Glass beneficiation (large scale)	108,000	$8.1 million - $13.34 million	$1.5 million – $2 million	Infrastructure Victoria, 2020[48]
Small scale paper and cardboard processing	20,000	$3 million - $3.5 million	$300,000 - $400,000	
Medium scale paper and cardboard processing	50,000	$8.5 million - $10 million	$750,000 - $850,000	
Plastics processing - flaking and pelletising Plant	10,000 – 20,000	$6 million - $14 million	$1 million-$2 million	
Tyre processing	15,000	$6 million - $8 million	Unknown	

Costs indicative based on published information, Council provided information, or consultant benchmarked data

The establishment of post-processing infrastructure can be supported by Councils, working with industry and Queensland Government agencies to reduce barriers to entry. The establishment of precinct type infrastructure allowing short transport distances between MRF and post-sorting processing, and the provision of long-term leases on prepared, connected (e.g., to services) and appropriately approved or zoned land can also facilitate the reduction of barriers for processing infrastructure. Councils may play a facilitation role.

5.2.6 Market development

At present all kerbside collected recyclable material is sent out of region however this may change soon with the new service tender currently being considered. There is limited post-sorting processing for these materials in region. There is localised glass reprocessing at the Kriaris Recyclables Processing Plant located in Rockhampton (opened in mid-2022), which takes locally generated container refund scheme glass and reprocesses the glass into fines which are used in construction. Furthermore, a new Solar Panel Recycling facility is to be established in Biloela by Solar Recycling Corporation, where 99% of the material is earmarked for recovery and reuse. Novum Energy Australia also processes off the road tyres and conveyor belts sourced from the mining industry through a waste to energy process at in Biloela.

[49] Queensland Waste and Resource Recovery Infrastructure Report 2019

All kerbside collected recyclable material is sent to either Mackay or the Visy facility in Brisbane, and processed out of region, most likely in South-East Queensland and beyond to be processed into new material. Whilst this remains a good resource recovery outcome, there may be opportunity to establish new industry to process this material in region, thus creating secondary markets and minimizing the long-distance transport of waste. But this requires private sector investment where Council and Queensland Governments' role is to facilitate through identification of land (e.g., in precincts) or for utilities connections, and provide certainty of supply that gives industry the confidence to invest. The new recyclate processing contract may change this. Councils and the Queensland Government can support demand for recycled content through their own procurement policies and strategies such as is happening in Rockhampton Regional Council with recycled glass to road base. When the levy commenced in Queensland in July 2019, support was also provided to councils to support the transport of recyclables from regional centres to reprocessing facilities. The Queensland Government should consider reintroducing this program to support implementation of this Plan.

5.3 Major options considered

Options are limited for commingled collections where existing contracts are active. Education is critical to help lift the quality of material that enters the post-collection recyclate processing service via the kerbside bin, but also to ensure dangerous materials do not enter any other bin.

Table 21 Major recyclable waste decisions

Decision area	Business as usual	Options			Rationale
Increasing coverage of kerbside collections	Kerbside collection in CHRC, GRC, LSC and RRC	Current level of service	Increasing number of households serviced in each Council area	Expand service to all Councils	Existing services are optimised. BSC has an option to take part in regional reprocessing solution. WASC to maintain BAU
Getting more from kerbside recycling	Current recovery rate is 18%	No significant action	Individual Councils take action to address	Significant action – addressed at state and regional scale	Bin audits indicate a further 12.6kt of the residual bin could be diverted into the kerbside commingled bin.
Reducing contamination	Current contamination rate is 20%	No significant action	Individual Councils take action to address	Significant action – addressed at state and regional scale	Including support from DES, behaviour change focussing on getting more from the kerbside bin and reducing contamination.
Enhanced and improved transfer facilities	Transfer facilities in each LGA	No significant action	Significant action – individual Councils upgrade transfer facilities	Significant action – regional scale transfer facilities	Upgrade and enhancement of transfer facilities in each LGA as necessary to better segregate recyclable wastes and participate in product stewardship scheme.
Number of future recycling post-collection solutions required	No existing post-collection sorting solution	Recycling processing solution procured individually		Collaborative procurement of recycling processing solution.	Regional procurement already underway.
Household collection contracts	Each Council providing service has separate contract	Individual Council procurement	Sub-regional collaboration on collection contracts (inc. out of region)	Whole of region collaboration on collection contracts	Region to progress discussions depending on expiry dates of existing contracts and best solution for region/Council.
Household post collection sorting and processing services	Recyclate sent out of region for processing under contract	No significant action (continuation of existing model)	Regional collaboration on recycling processing contract	Regional collaboration on location, setting, ownership and operation of future MRF	Decisions to be made by individual Councils in response to tender prepared under regional collaborative approach.
Improve knowledge of material flows for recyclate in region	Data held by DES/Councils limited.	No significant action	Individual Councils develop material flow analysis for each LGA	Regional collaboration to identify refine material flow analysis	Collaborate as a region with the Queensland Government to identify scale of other wastes and materials in the region.
Increased recycling and post-processing technology	Limited recycling or post-processing infrastructure	No significant action	Individual Councils attract new technologies and providers to LGA	Regional collaboration for new technologies and consideration of location	Need to attract and support establishment of new processing infrastructure for wastes not currently recycled.
Establish a regional precinct	No existing precinct	No significant action	Establish individual recycling facilities in each LGA	Regional collaboration on precinct including hub and spoke approach	Working with State Development and Councils to develop precinct and attract new recycling and secondary processing industry to region.

Cells in YELLOW reflect decision made; CHRC – Central Highlands Regional Council, BSC – Banana Shire Council, GRC – Gladstone Regional Council, LSC – Livingstone Shire Council, RRC – Rockhampton Regional Council, WASC – Woorabinda Aboriginal Shire Council

5.3.1 Behaviour change and education are critical deliverables

For the Councils in the region that offer a kerbside commingled recycling service there is an opportunity to capture more material, and for that material to be better quality. There may be opportunities to expand the number of dwellings offered a service, however it is generally considered that coverage is optimal when balanced with the cost of collecting from areas with very low population density with trucks travelling long distances. A new service could be offered in Banana Shire Council, however it is estimated that there is only 550 tonnes per annum of commingled recycling currently being disposed of, so benefit of capturing this material is unlikely to outweigh the costs. It is not expected that Woorabinda Aboriginal Shire Council will offer a kerbside recycling collection service due to scale and cost.

There is an opportunity, through education and enforcement, to both reduce the level of contamination in the kerbside collection recycling bin whilst also increasing the volume of acceptable recyclable materials collected. What enters the yellow top bin will be captured to a degree by a proposed state-wide education campaign encouraging behavioural change. This is funded by the Queensland Government at $17M for the next 4-years (over the period FY-22-23 to FY26-26) and will include partnerships opportunities for Councils. There may be a cost to participate, and it might be reasonable to assume the deployment of additional staff to support the campaign which may require financial support, with necessary funding support needed to extend beyond 4-years. This could be from direct funding, the procurement (and funding) at a regional scale, or the allocation of resources procured centrally by the Queensland Government. Regional collaboration may help to gain efficiencies in the roll out of this behaviour change approach. This package of behaviour change should explore use of consistent approach to continued poor behaviour as a last resort, which could be supported by modifications to existing Waste Management local laws enacted by each Council in the region.

5.3.2 Improved or new transfer facilities for community and business recycling

Self-haul facilities receiving household, commercial and industrial, and construction and demolition waste streams represent a large proportion of waste managed in region. At an individual Council level there is a need to improve the ability of facilities to capture problematic wastes to pull away from kerbside and offer opportunity to participate in recycling in areas where kerbside collection is limited (i.e., parts of LGAs where kerbside is not economic). Several recent upgrades have been undertaken by Livingstone Shire Council and Rockhampton Regional Council. Upgrades to other transfer stations may be required to facilitate better segregation of wastes, and arrangements, particularly in more remote locations, need to be in place to aggregate and transport wastes for reprocessing and recovery. The recently commissioned $3 million Resource Recovery Centre in Yeppoon is a good example of achieving better separation of wastes for residents with financial support received from the Queensland Government.

Upgraded facilities to segregate waste however are limited by the cost of transport, particularly the further a collection site is from aggregation or from processing infrastructure. In some cases, it may be considered economically beneficial to do nothing (i.e., stockpile) with this material, or dispose of to landfill than transport at cost. Regional transport assistance may be required to help support flow of material towards centralised sites, avoiding their loss to landfill but mitigating transport costs.

5.3.3 New contract for kerbside recycling processing

Four Councils in the region are currently collaborating at a sub-regional scale to tender a new kerbside collected recycling processing contract. As Councils have gone to the market for external providers, it is unclear whether the solution will require a new in region material recovery facility or material will be transported out of region for processing. The establishment of a new material recovery facility in the region could provide the best cost solution for councils, however this will be decided by member councils.

5.3.4 Improved knowledge of recyclable material in region

Data relating to the nature of waste captured at the kerbside is generally granular and of good reliance and captured by Councils through existing data management systems that flow through to the Queensland Government. Data quantity and quality is lower or absent for wastes not managed by Councils. This limits the visible feedstock available for certain types of waste that are expected to flow through the region, which may present an opportunity for localised processing. The Queensland Government has developed materials flow analysis for organic waste, e-waste, and textiles however this data is not publicly available. The region will work with the Queensland Government to provide data and intelligence to update and support future material flow analysis to enable regional analysis to be undertaken to support new business establishment. It is noted that existing material flow analysis data, particularly in regional Queensland, is limited by confidentiality of data providers as aggregation is not usually possible.

5.3.5 Establish an enterprise recycling precinct and attract investment in new industry

A potential option within the region is to collaborate on a regional approach to the attraction, siting, and establishment of new recycling businesses. This includes collaboration with the Queensland Government to develop a Recycling Enterprise Precinct adopting a hub and spoke approach. Under this approach is the establishment of a centralised “Transform Precinct” where most primary and secondary processing will be undertaken, supported by “Prepare Precincts” within the region (and outside of region) where material is pre-processed prior to transport. Work has been prepared by the Queensland Government to identify a location strategy and guidelines to allow precincts to be developed in a consistent manner.

Whilst the funding source for establishment of the precinct is uncertain, it is assumed that Councils will not be required to contribute to establishment fees. Councils can also support the establishment of facilities by providing certainty of supply for wastes that they manage which will contribute to feedstock assessments for business cases for new facilities.

To reduce barriers further support is recommended for the transport of recyclable materials to spokes, or from spokes to the regional processing facility. This can help to support the establishment of new industry within the region. The Queensland Government has previously provided transport assistance for recycling, particularly in remote locations to facilitate greater resource recovery. Whilst long-term sustainability of logistics should be the aim of new business, support over a defined period may encourage investment.

5.3.6 Regulation that supports resource recovery and landfill diversion

There are ongoing issues with the environmental regulator part of the Queensland Government in relation to restrictions around resource recovery activities at facilities that do not have appropriate facilities to separate before the material is at the tip face. This is a particular concern for smaller Councils within the region where landfill and on-landfill resource recovery activities are hindered by the application of the landfill levy. This includes the use of clean earth for operational purposes on landfill where a resource recovery area may not be the most optimal location for diversion and inability to remove recoverable items (i.e., scrap metal and bulking concrete) from mixed loads at the tip face. This is driving the perverse outcome that recoverable waste is being disposed of in landfill to ensure levy regulation is being achieved. This approach could be resolved by intervention from the Queensland Government.

5.3.7 Promoting the 10Rs hierarchy

Opportunities to promote higher order activities under the 10Rs framework should be sought in the region. This could include supporting resale or reuse of materials through existing tip shops on Council resource recovery facilities. Opportunities to repair and refurbish could be promoted in the region, either through identifying specific areas within a precinct site, or through the encouragement or establishment of repair facilities within individual Council areas. Rockhampton Regional Council's Upcycle Village initiative, where council is working with Multicultural Australia to upskill trainees in construction using recyclable items is an example of a scheme that could be replicated elsewhere in the region and state. This should include working collaboratively with ratepayers to identify opportunities for services such as repair centres or cafes to be established. These likely require minimal funding but could be supported through education activities or minor funding for booking of locations (such as Men's Sheds, PCYCs etc.). Funding for the establishment of community repair services should come from program funding by the Queensland Government.

5.4 Expected outcomes

At present 12,784 tonnes of kerbside recycling material is collected by Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council and Rockhampton Regional Council. A long-term solution to how kerbside collected recyclables are sorted and sent for processing is required in the region, with Councils already collaborating to identify the most preferable solution individually and for the region. As this waste is already sent for recycling, this solution may have modest impact on recovery rates, but the chosen solution will seek to minimise the cost to Councils.

Education to encourage greater use of the kerbside bin for household recyclables could reasonably divert a further 4,295 tonnes of material from the residual stream by FY30-31. The addition of a kerbside service by Banana Shire Council and Woorabinda Shire Council is considered unlikely as it would only add less than 600 tonnes for processing per annum. Forecasting to support this Plan indicates that the volume of available material for kerbside recycling will increase to 16,700 tonnes per year by FY30-31, 19,655 tonnes by FY40-41 and 21,244 tonnes by FY50-51.

An important element of engagement and behaviour change is buy-in from residents within the participating communities. A region wide Education Strategy will be developed with investment from the Queensland Government to support both additional staff resources as well as funding for advertising to support implementation. This is important across all streams and gives ownership. Communities will be better informed as to what should go in their bin, and what happens to the waste that is collected. This education needs to be sustained and should not be viewed as a one-off intervention. Woorabinda Aboriginal Shire Council will develop their own community focussed waste education strategy.

Evidence from other regions suggests that education and behaviour change campaigns could reduce contamination in the kerbside commingled bin from the regional contamination rate of 20% contamination with <10% the target by FY30-31 and <5% by FY40-41. Whilst the Queensland Government is currently baselining contamination rates as part of a kerbside education and behaviour change program and initiative, which should define target contamination rates, other Councils in Australia have sought to achieve 2% contamination[50] although this is expected to be challenging. Contamination rates would form a new baseline for the procurement of a new recycling processing or MRF contract for the region. This would be part of the Regional Education Strategy.

[50] NSW Government, Department of Energy and Climate Change, 2007. Reducing Contamination of Dry Recyclables and Garden Organics at the Kerbside – The NSW Experience, https://www.epa.nsw.gov.au/~/media/EPA/Corporate%20Site/resources/warrlocal/070211-kerb-dry-recycling.ashx)

Enhanced transfer facilities for non-kerbside waste will give residents better opportunities to participate and remove hazardous or harmful materials from the kerbside collected waste, protecting a new MRF or recycling processing contract, as well as reducing the potential for these materials to get into the organics and residual waste streams. Provision of these facilities should be dependent on the establishment of collection, processing and treatment systems for these wastes being available in region, or for transfer out of region. There is little benefit in providing better sorting and separation for there to be no processing available.

Wine and spirit bottles will be the heaviest item in a bin and will contribute significantly to reduction in weight. The inclusion of wine and spirit bottles in the expanded container refund scheme in late 2023 will increase diversion but reduce volume in the kerbside recycling bin where proceeded. Less weight also means more bins can be collected per truck; however, there is a need to manage compaction ratios so that product is not over compacted.

Table 22 presents the expected outcomes from the material recycling and recovery stream by way of metrics to measure the performance of this action.

Table 22 Expected Outcomes – material recycling and recovery

Metric	Current (FY20-21)	FY30-31	FY40-41
Kerbside MSW recycling rate (Proportion of kerbside waste collected sent for recycling (excluding organics))	18%	22%	25%
Kerbside recycling tonnes (Material collected at the kerbside sent for recycling)	12,784 tonnes	16,700 tonnes	20,000 tonnes
Contamination rate in the household kerbside recycling bin (Contamination rate as reported by waste audits)	20%	< 10%	< 5%

5.5 The cost of making the change

The economic assessment considered the cost of incrementally adding to the intervention scenario described for organic waste in Section 4. The estimated costs for implementing the changes described for materials recycling and recovery include:

- Capital, operating and lifecycle costs – for the delivery and operation of a new material recycling solution within the region beyond existing business as usual costs, and processing facilities for local beneficiation. It is noted this does not include the establishment costs for a new precinct or capital costs for establishing new facilities which is assumed to be driven by private sector involvement.
- Transport costs – which include the ongoing increased cost in region from local improved transfer stations to a regional facility.
- Education costs to support behaviour change activities described in this section (assuming these would be delivered in tandem with organic waste behaviour change and new system implementation). Evidence collected during the development of this Plan suggests approximately 5% of overall operating budget would be allocated to education to achieve best practice results.

Through analysis undertaken to support this Plan, the estimated whole-of-life costs for the introduction of the proposed interventions to the material recycling and recovery stream is **$44 million** (present value) over the economic model lifetime.[51] This can be summarised as an incremental cost of **$25 per household per year** (present value) compared to the base case (and on top of the organics diversion cost per household for Gladstone and Rockhampton). In summary:

- The economic analysis includes an assumption that a new MRF will be constructed in the region estimated to cost **$18 million** in CAPEX. The operational cost of this also includes a portion of the gate fee assumed to be above existing Planned gate fee for processing in the region (based on the gate fee for the previous MRF), capturing the difference as new operational cost.
- Small scale improvements to transfer facilities have been estimated without formal assessment of need or build-up of designs. For the purpose of this economic modelling, it is assumed the cost of upgrades will average $1.25 million in CAPEX, comprising **$7.5 million** in overall expenditure with resulting increases in OPEX and an allowance for transport. This value may vary depending on specific upgrades required by member councils. Councils may also need funding support to develop specifications for design upgrades, which may be determined by the establishment of a precinct structure within the region or for individual facility upgrades.

[51] Includes discount rate of 7%

- Additional education costs will be incurred to both increase the capture of recyclable material at the kerbside (from the residual bin) and optimise levels of contamination. As part of a broader education strategy this could be developed at a regional level but implemented by each Council. Funding should support additional FTEs to provide education in partnership with the Queensland Government and partially under the Education and Behaviour Change Initiative. All councils should be able to access resources. Using the metrics discussed in Section 4, a further $8 per household per year is estimated to provide additional education funding across the region. Based on the total number of waste services offered across the region, this gives an overall per year estimate of **$0.68 million** to cover additional staff cost, marketing material and advertising. As a region there are clear benefits from working together on collaborative campaigns (in partnership with the Queensland Government) but it would be also reasonable for the distribution of funding to be allocated to a degree based upon scale (i.e., number of services) or population. Extrapolated over the period from FY23-24 to FY30-31 the overall funding required would be an estimated **$5.5 million**. This investment in education will need to be maintained on an ongoing basis beyond this period and this has been assumed in the waste flow and financial models.
- It is expected that Woorabinda Aboriginal Shire Council will require an individual community specific education and engagement strategy, working collaboratively across other services provided by Council.
- Within the economic analysis there is an additional cost considered for the development of beneficiation facilities. There would be a capital cost to build such facilities, which could be aligned with the proposed precinct Plans. The economic analysis includes new beneficiation facilities, noting there is already glass reprocessing in Rockhampton. In the cost per household presented it is assumed the capital costs associated with the development of new beneficiation facilities would be funded by industry, potentially with industry support funding from the Queensland Government and would not have a direct impact on Council or householder cost, so these costs are excluded.

5.6 Supporting the change

For the kerbside collection system getting better quality and greater quantity from existing services has a direct impact on overall recovery rates, with relatively low investment. The following supporting actions are required to move towards a future state for recycling:

- **Education resourcing and collaboration:** The Queensland Government has announced funding to support the development of a behavioural change and education campaign over the next 4-years targeting contamination of the kerbside comingled bin. At a regional scale Councils will benefit from collaboration to develop an approach, particularly for the three Councils currently providing a kerbside collection for recycling. Through a partnership approach with the Queensland Government, support could be provided to roll out the campaign, whether funding for additional education staff resources or for materials and events.
- **Establishing regional precinct infrastructure:** The region in collaboration with the Queensland Government may progress the development of Plans for a precinct to house resource recovery and secondary processing infrastructure. There are initial start-up costs associated with construction of a precinct, including Planning, enabling infrastructure (roads, connections etc.,) that may present barriers to establishment or co-location of new resource recovery or secondary processing infrastructure. Both Councils and the State Government can support establishment of infrastructure at a centralised precinct hub, or at local spoke sites facilitating pre-processing and transport.

- **Upgrading or building new transfer, aggregation, and bulking facilities:** This Plan has identified the need to upgrade existing or build new transfer facilities within the region.[52] This will facilitate the better separation of materials brought to local transfer facilities. This includes better separation of household hazardous wastes. New facilities designed to accommodate better separation, plus the potential for storage of collected material for longer to allow bulk transport would help to reduce the cost of transport but require capital investment. This also includes the potential for the Queensland Government to support the establishment of community recycling centres to target household hazardous wastes.
- **Offsetting transport costs for recyclables.** The hub and spoke approach, and collection of recyclable materials at transfer facilities will require the transport of these materials to either a precinct, or out of region for processing. Transport costs may require short-term support through grant funding to reduce barriers for supply to new facilities, however a long-term strategy may need to be developed to ensure viability of these arrangements in the medium to long term. Take back schemes or reverse logistics could also be explored to support transport of materials.
- **Procurement for recycled content.** Through updated local, Queensland and Commonwealth Government procurement, there is an opportunity to drive the uptake of recycled material demand by specifying use of recycled product in procurement documentation and tendering processes. The Department of Transport and Main Roads in Queensland has a significant opportunity to drive this process within the region.
- **Improved granularity and availability of data:** Data quantity and quality is generally good for Councils within the region, and through weighbridge transaction software records of transactional data have a high degree of reliability. There are gaps in the data set that limit the discussion with regard to the total volumes of recyclable material that flows through the region, which in turn hinders the development of new reprocessing or remanufacturing solutions. This includes the C&I stream for which there remains opportunities to reduce and avoid waste going to landfill. Whilst Councils in the region have provided some knowledge of private processing tonnes, records are not complete.

[52] Note transfer facility upgrades will be identified by individual councils as part of funding requests, with detail need analysis and design not considered at this stage. Some councils may have sufficient capacity and technology already.

5.7 Timeframes

Table 23 Recycling Stream implementation timeframes

Immediate action (within next 2 years)	Within next 5 years	Within next 10 years
Education & Behaviour Change		
QGOV + ALL: Development of Regional Education Strategy incorporating behaviour change and education associated with 1) reducing contamination and 2) improving recovery of the kerbside commingled recycling bin, working with DES to support behaviour change campaign. Options to refine messaging for BSC and WASC where no kerbside bin is provided. Develop KPIs for contamination, diversion rate and lost material and audit Plan to measure performance.	QGOV + ALL: roll out and continued delivery of regional campaign associated with existing collections. Delivery mixed between region and individual Councils.	ALL: Update and continuation
	ALL: Collaboration and information sharing on how local Planning policy could drive better outcomes from construction activities. May require action from Queensland Government.	
Collections		
ALL: Consider regional or sub-regional collections approach when contract expiry dates align.	ALL: Update and continuation.	ALL: Update and continuation.
ALL: Develop business cases/Plans for enhancements to existing, or new transfer facilities (where necessary) to facilitate better segregation of self-haul recyclables and capture household hazardous materials	ALL: With funding support, construct and commission improved transfer facilities	Continued operation
Regional infrastructure & precinct		
QGOV + ALL: Collaborate on establishment of a regional scale precinct (hub) with identification of site and location of potential feeder (spoke) sites across region.	QGOV + ALL: Construct enabling infrastructure for precinct (road, utilities, approvals etc.,) within Continue to collaborate on approach to providing feedstock to processing sites within precinct	Continued
Processing solutions		
Develop new regional recycling service provision to replace existing. Region or individual councils to consider incorporating BSC or WASP where possible and required. New service commences as soon as possible once contracted and approved by councils in the region.	Continued operation	Continued operation. ALL: consider review and renewal options prior to end of contract period.

Immediate action (within next 2 years)	Within next 5 years	Within next 10 years
	ALL: Working with Queensland Government agencies to establish and attract new resource recovery processing or secondary material processing facilities within precinct.	Continued support.
Market development		
	Queensland Government + ALL: Work with State Government agencies to improve uptake of recycled materials in procurement.	
	Commonwealth Government + ALL: Work with Commonwealth Government to refine approach by insurance companies to better recover and recycle disaster waste currently sent to landfill	
Data & Information		
QGOV + ALL: Collaborate to obtain and understand material flow data from the region from Council and non-Council managed streams with a view to supporting establishment of recycling and reprocessing technologies in region.	ALL: Update and refinement under regional data strategy	ALL: Update and refinement under regional data strategy
QGOV + ALL: Collaborate to collect data on contamination and materials within all kerbside bins to facilitate improvement and to align with identified KPIs.	Continuation and commitment to recurrent annual kerbside audits	Continuation

Note: Timeframes in this table relate to expected delivery as agreed by Councils in developing this Plan. Timeframes do not preclude action taken by other councils as individual needs and policy dictate. Cells in GREY indicate action not expected to commence during the timeframe

5.8 What could affect implementation

This Plan provides certainty over the direction and actions required to support Queensland's Waste Management and Resource Recovery Strategy for the region. In the recycling space, flexibility or alternate delivery of the Plan may be necessary due to unforeseen circumstances, or potential challenges such as:

- Wine and spirit bottles will be included within the container refund scheme as of late 2023, which will further divert material from the kerbside recycling bin. If wine and spirit bottles are incorporated into the CRS, this will reduce the volume of material that needs to go to the existing, or a future MRF for sorting.[53] A future MRF or kerbside collected recyclable processing contract would need to allow for this, particularly as glass reprocessing will still be undertaken at this private facility. The benefits seen for MRFs under this scenario is that MRFs with CRS processor capability will benefit from a separate income stream by processing CRS collected material.

[53] It is estimated by Councils in the region that the introduction of wine and spirit bottles within the Container Refund Scheme will result in the loss of approximately 7% of prospective MRF material.

- Reduction in variability of materials in household products. Over time as the 10Rs and circular economy approach drives the rejection of materials used in products that cannot be reused or recycled, a simpler stream of products may develop. This in turn may support larger volumes of material for single stream reprocessing opportunities or less mixed waste processed in the MRF stream. This is likely to be a long-term outcome.
- There is a significant amount of investment required to establish the enabling infrastructure for a precinct, and for the establishment of new industry to lease land and contribute to the precinct objectives. If this precinct is not available at the time of construction, then implementation of these solutions could be delayed, or alternative sites may be required.

6 Managing Residual Waste in Central Queensland

Residual waste refers to the material left over and managed in, or out of region, after all other technologically, economically, and environmentally practicable alternatives are exhausted. This typically includes material captured in the household kerbside recycling bins, but also unsorted mixed loads delivered to transfer stations, and portions of C&I and C&D wastes. This chapter considers actions for the region to take to support the identification of an acceptable long-term solution for residual waste. Each of these are discussed in turn:

i) An overview of residual waste stream dynamics

ii) Discussion over key levers including potential costs and benefits

iii) Options considered

iv) Recommendations and agreed actions to move towards a 2032 outcome

v) Expected outcomes and cost of making the change

vi) Consideration of what may change in execution

6.1 Residual waste stream dynamics

A total of 159,613 tonnes of residual waste was managed in FY20-21 via landfill. By FY30-31, with greater organics diversion and improvements in capture from the kerbside streams, the amount of residual waste is expected to be 180,615 tonnes (allowing for growth) across the MSW, C&I and C&D streams, growing to 193,074 tonnes by FY40-41 and 212,240 tonnes by FY50-51. Forecast growth in residual waste is predominantly driven by population growth in Livingstone Shire Council, Gladstone Regional Council and Rockhampton Regional Council local government areas. For the household MSW stream only, Councils are forecast to need to manage 69,482 tonnes of residual waste in FY30-31, 72,740 tonnes in FY40-41 and 78,282 tonnes by FY50-51. The proportion from each stream is shown on **Figure 16**.

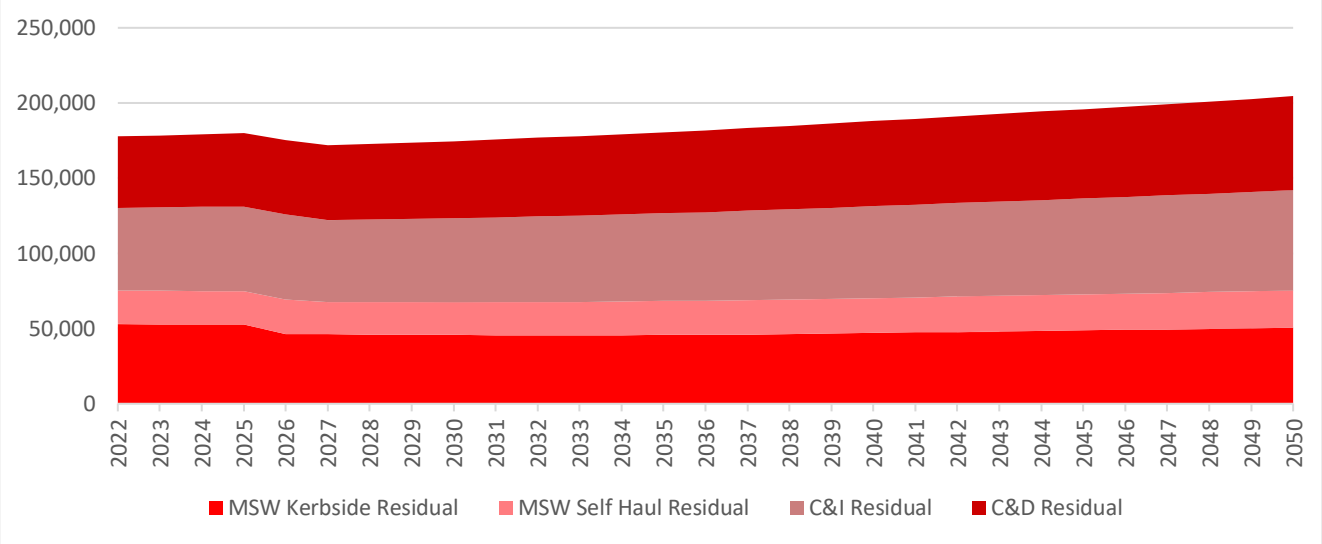


Figure 16 Current forecast – residual waste within the region to 2050

There were 10 landfills reported in the region in FY20-21, although it is noted that a small number are approaching capacity, there is no immediate need for new landfill capacity within the region.

The Queensland Waste Management and Resource Recovery Strategy and supporting Action Plan *Queensland's Energy from Waste Policy* both clearly present a role for energy recovery within waste management. There is relatively small-scale energy from waste facilities located in Gladstone (Northern Oil Refinery) and the in-development Biloela based Novum Tyre to Fuel facility. Councils will need to identify a longer-term approach to managing residual waste with the option being to continue to send waste to landfill, or to look to develop an equally long-term energy from waste solution.

6.2 Levers and interventions

6.2.1 Avoidance and residual waste reduction

Education programs associated with reducing food waste, diversion of food and garden organics and improving returns in the kerbside recycling bin and providing more choice for recycling when away from home there is expected to be a knock-on effect on the quality and quantity of waste in the residual waste bin.

6.2.2 Landfill levy and bans

The landfill levy rate is scheduled to increase with the prevailing rate of inflation over the forward estimated period. For residual waste, the levy rate is paid on all waste disposed of to landfill. As previously detailed within the region all Councils except Gladstone Regional Council and Rockhampton Regional Council receive 100% of the levy paid on household waste that goes to landfill as an advanced payment. The landfill levy liability, the difference between levy paid and annual advanced payment, will continue to reduce to 20% by FY30-31 increasing the operating cost of this service to Gladstone Regional Council and Rockhampton Regional Council, which is likely to need to be passed onto ratepayers. It is assumed that the annual advanced payment to mitigate additional cost to households will continue to apply for Banana Shire Council, Central Highlands Regional Council and Livingstone Shire Council at 100% of levy paid on household waste, noting there is a commitment from the Queensland Government to review the annual advanced payment arrangements by 2025. It is also assumed that a levy will not be applied to waste generated by households in Woorabinda Aboriginal Shire.

The introduction of landfill bans for additional materials will further support diversion from landfill and reduce the amount of residual waste generated. This work has not yet been completed by the Queensland Government, and implementation is likely to focus on materials that either pose an unacceptable risk when placed in landfill or where economically feasible recycling exists for a product.

6.2.3 Infrastructure – landfill capacity and new landfill

Landfill capacity is constrained within the region in the medium term, with only Gladstone Regional Council having sufficient long term approved capacity. In considering the options for residual waste, a strategy could be for existing landfills to be extended, with new cells added horizontally or vertically where space allows or for the establishment of a regional scale landfill. The true cost of adding additional landfill capacity extends beyond solely traditional capital and operational expenditure, but into provisions for capping, closure and post-closure, and long-term geotechnical and environmental monitoring for 30 years beyond exhausted airspace capacity.

Landfills are often cited as a major landfill gas emitter, however actions in the region removing a portion of the putrescible component may reduce these emissions. The traditional view is that energy recovery of material that otherwise would go to landfill would be environmentally beneficial however evidence from Scotland has cited the reducing emissions benefit of incineration (with energy recovery) technology that is processing a higher proportion of fossil fuel derived non-recyclable wastes (e.g., plastics),[54] particularly with the expected growth of alternative renewable energy sources in Queensland. It is noted however that Scotland has several operational EfW facilities and Planning approvals in place for several further facilities, compared to the region which has none. The carbon benefits would need to be explored further in a life cycle assessment as part of a future business case.

6.2.4 Infrastructure – Energy recovery

The Queensland Waste Management and Resource Recovery Strategy places an emphasis on the waste hierarchy with energy recovery placed higher than landfill. The following provides a general summary of potential options for energy from waste (EfW) in the region.[48]

Table 24 EfW technologies and options

Description	Combustion	Pyrolysis	Gasification	Processed Engineered Fuel as fuel substitute
Indicative capacity	50ktpa to 200ktpa plus	Range from 10ktpa to 70ktpa	Approx 50-100ktpa	Range from 50ktpa to 250ktpa
Process	Moving grate combustion technology with energy recovery	Thermal breakdown of waste in the absence of air.	Thermal breakdown & partial oxidation of waste under controlled oxygen environment	Development of fuel from waste
Suitable feedstock	Mixed residual waste with limits on certain materials	Single source feedstock or PEF/RDF derived from MSW/C&I mixed waste that is homogenised and uniformly sized.	Requires pre-processing system to extract unsuitable materials (glass, inorganics, metals etc.,). Can target specific feedstocks at smaller scale. Some technologies use mixed waste feedstock.	Post-processed mixed waste targeting non-recyclable plastics, cardboard, paper, textiles, and waste timber.

[54] Scottish Government, 2022. Stop, Sort, Burn, Bury – incineration in the waste hierarchy: independent review, from https://www.gov.scot/publications/stop-sort-burn-bury-independent-review-role-incineration-waste-hierarchy-scotland/documents/

Description	Combustion	Pyrolysis	Gasification	Processed Engineered Fuel as fuel substitute
Capital cost	$300M-$500M	$9M-$119M	$150M-$200M	$40M
Indicative gate fees	$140-$350 per tonne	$180-$300 per tonne	$180-$300 per tonne	$100-$200 per tonne
Output product	Electricity, heat, steam, metals	Biochar	Syngas converted to electricity	Engineered fuel
By products	Flue gas residues Incinerator bottom ash Fly ash	Bio-oil and syngas	Biochar / slag material Flu gas residues	Pre-processing wastes (i.e., rejected material)
Environmental concerns or benefits	Would need to operate under EfW Policy and environmental limits Relatively large footprint Would require EIS	Pyrolysis is not harmful to the environment when it is done properly. Some reasons for pollution from pyrolysis include incomplete pyrolysis, no gas recycling, oxygen entry, improper feedstock, dangerous disposal of products and inappropriate storage and transport.	Limited emission as closed system. Emissions managed under EfW policy and environmental limits.	Greater proportion of residual waste goes to landfill. Can require long-distance transport Can offset use of fossil fuels (e.g., if burnt in cement kiln)
Community concerns or benefits	Untested in North Queensland. Would require long community interaction and strong social license.	Tyre pyrolysis has a poor compliance record with Planning and EPA requirements in Victoria. In Queensland, a pyrolysis Plant, treating tyres and plastics, is in the process of obtaining approval.	Typically deployed in smaller scale Plants. Larger Plants may have similar challenges to combustion	Generates a fuel product. Fuel may be utilised out of region
Technology certainty	Proven technology at large scale: smaller scale also proven internationally. By-products 20-25% of feedstock and require approved pathway for reuse.	Limited maturity. Largely unproven on mixed wastes such as un-treated residual MSW. There are no pyrolysis facilities or proposals for mixed waste in Australia.	Technology still developing, particularly at large scale. Some high profiles with facilities in Europe. Unproven on required scale in Australia. Small scale deployment for specific wastes viable or can be deployed on mixed feedstock	Existing technology deployed in Australia servicing local and international markets. It is understood that Cement Australia has approved the use of PEF in the Gladstone Cement Kiln.

Note: Accurate costings would form part of detailed business case; technology solutions may vary significantly

Capital costs exclude site preparation, output product quality depends on quality of input. Detail based on benchmarking

Whilst there is a clear acceptance of the role of energy from waste within Queensland, its deployment has been hindered to date by a lack of need (e.g., levy or other fiscal drivers, general availability of landfill airspace), or by a lack of community support. Key questions to be answered in the region in relation to EfW would be:

- Timeframes when an EfW facility is required to come online and expected benefits (compared to the modified current state) compared to landfilling. A life cycle analysis should be undertaken as part of business case development.
- The approach to be taken to engage with the community and broader stakeholder groups to develop a proposal that allows engagement prior to key decisions being made and supports the community.
- The type of technology to be deployed.
- A solution for incinerator bottom ash allowing its safe and environmentally sound reuse and recycling, ideally within the region, would help support the development of future business cases. This will require liaison with the Queensland Government to facilitate through existing policy and legislation.
- The ownership and contracting approach for development of a facility. Typically, there would be some private sector interest in providing investment, alongside opportunities for co-ownership or even for Councils to own themselves, although this is likely undesirable.
- The cost and affordability of a long-term energy from waste facility warrants further scrutiny. Whilst there is a need to secure a long-term solution for how residual waste is managed, Councils will need to decide based on best value for their ratepayers.

Individually procured or delivered larger scale traditional EfW may be beyond even the largest Council within the region based on a current technology assessment. Smaller scale portable EfW is already deployed for processing of some specific wastes, such as tyres, however technology is still emerging, and cost-effectiveness and reliability may not be attractive at scale and by-products (e.g., biochar) remain challenging for reuse. Over the next several years this is expected to change, as technologies are proven to be operable and profitable for technology providers, which may present an alternative to conventional residual waste solutions. Emerging technologies are to be monitored for suitability in regional areas and for regional economies of scale.

The development of a processed engineered fuel facility may also provide a pathway to take advantage of the fuel demand of the Cement Australia Cement Kiln in Gladstone, as a substitute for fossil fuel-based fuels, however feedstock is likely to be more specific and this will result in a larger volume of residual waste to be managed via landfill.

6.3 Options considered

Major options considered for how residual waste is managed in the region are:

Table 25 Major residual waste decisions

Decision area	Business as usual	Options		Rationale	
Short term residual capacity considerations	No action on existing capacity	Do nothing	Individual Council action	Immediate regional solution	In the immediate term Councils continue to manage their own landfill airspace.
Long term residual waste solution needed	Existing landfills manage residual waste	Do nothing	Individual Council action	Develop long-term regional solution	Councils to work through individual solutions for processing technologies.
Residual waste solution	Landfill	Extend existing landfills	Close smaller landfills and move to regional landfill	Develop energy from waste solution as a region	Councils to work together to progress feasibility and develop business case to support establishment of EfW within the region as well as regional landfill
EfW technology preference (if progressed)	No current EfW	Combustion with energy recovery	Gasification or Pyrolysis	Processed engineered fuel	Viability and preferred solution for EfW to be established through further R&D and may be a combination of solutions
Other problem wastes: timber, contaminated soil, PFAS etc.	Manage via existing arrangements (e.g., landfill)	Do nothing (BAU)	Develop individual Councill solutions	Develop regional solution to problem wastes	Regional collaboration to identify alternative management solutions or safe disposal options for range of problematic wastes or emerging contaminants within the region
Management Plan for disaster wastes	Manage under existing arrangements	Do nothing (BAU	Councils develop individual solutions	Collaboration at regional scale to manage disaster wastes	Regional collaboration to allow rapid response to need to manage disaster wastes within the region.

Cells in RED reflect decisions made; CHRC – Central Highlands Regional Council, BSC – Banana Shire Council, GRC – Gladstone Regional Council, LSC – Livingstone Shire Council, RRC – Rockhampton Regional Council, WASC – Woorabinda Aboriginal Shire Council

6.3.1 Short term residual capacity considerations

In the short-term Councils will continue to manage their own landfill airspace where available. There is no regional driver for immediate short-term action.

6.3.2 Deciding between long-term residual landfill or energy from waste

At a regional scale there is a need to develop a collaborative long-term approach to residual waste management. Whilst the need is not immediately pressing, solutions could take 10-years from concept through to commissioning and would likely require significant community engagement. If managing this waste within the region, as is the preference, then the choice is clear that it is either additional landfill airspace, or a form of energy from waste, including the potential to process some residual waste into a fuel for use as a substitute to fossil fuel-based fuel. Long-term landfill capacity will need to be maintained in the region, even if EfW was adopted to manage residual waste or other problem wastes.

6.3.3 Bulking and transfer facilities to support regional collaboration

Regardless of whether EfW or long-term landfill is the most cost-effective solution for residual waste in the region, the existing transfer infrastructure is likely to require upgrade. In a similar manner to the need for improved segregation of recyclables at council transfer facilities, bulking facilities are likely to be required to support transport to a regional scale facility. This should be accounted for when Councils upgrade existing transfer facilities. Rockhampton Regional Council has a significant transfer facility located at the Lakes Creek Road Waste Management Facility which it is expected could be utilised if sending residual waste out of region or bulking to send to EfW.

6.3.4 The cost of transport

The development of regional solutions for any waste streams necessitates a discussion around the benefits of transport versus managing locally. In the past the Queensland Government has offered subsidies for recycling, however support for waste transport subsidies is considered unlikely.

6.3.5 Transport to support EfW

If the region decides to develop a regional EfW facility, it may be predicated on agreements for feedstock supply from outside of the region. There is a well-developed and extensive road and rail network between regional centres, which could support the aggregation of waste within one region. This would require collaboration outside of this Plan, at an extra regional scale.

6.3.6 Managing disaster waste

A long-term management approach to disaster waste within the region was identified as a collaborative opportunity for the region. The establishment of an approach that allows for the rapid deployment of a Plan when a disaster occurs to avoid confusion or delays in how this material can be managed. A further issue was raised with the required disposal of disaster waste directly to landfills via insurance companies. Much of this material is considered as potentially recoverable. Action would be required at a Commonwealth Government level to support this change.

6.3.7 Managing problem wastes

Additional to biosolids already identified, the region manages several other problematic residual wastes. This includes timber, contaminated soils, asbestos and material containing emerging contaminants. Councils will collaborate at a regional scale to develop solutions for these wastes and identify appropriate management Plans.

6.4 Expected outcomes

Decisions supporting how residual waste is managed within the region could have a direct impact on households. The quantity and quality of residual waste is dependent on the avoidance and diversion activities undertaken in the region. Solutions and actions are not just around additional resource recovery, but also ensuring that there is sufficient residual treatment and disposal capacity in the region in the long-term to meet the needs of a growing population. It is expected that residual waste will continue to be sent to landfill in the short-medium term.

6.4.1 Residual waste management - landfill

It is expected that within the next 5-years the region will have developed a clear understanding of the expected costs and benefits of moving towards either long-term regional scale landfill or a regional scale EfW solution. If landfill is the preferred solution, capacity will need to be able to manage as a minimum 69,482 tonnes of residual MSW per year in FY30-31, 72,740 tonnes in FY40-41 and 78,282 tonnes by FY50-51, however across the region Councils also manage significant volumes of the C&I and C&D streams. Based on current proportions and a long-term forecast, Councils in the region will still need to manage between 177,000 and 190,000 tonnes of residual waste per year by FY30-31 and potentially 205,000 to 220,000 by FY50-51. Additional capacity can be progressively added over time. If all residual waste continues to go to landfill, the resulting recovery rate in 2032 will be 56% with little change through to FY50-51. This recovery rate assumes improvements to organics recovery and material recovery as described in prior sections.

Figure 17 presents the whole of region resulting residual waste (blue line) forecast following application of the actions presented in **Section 4** and **Section 5**.

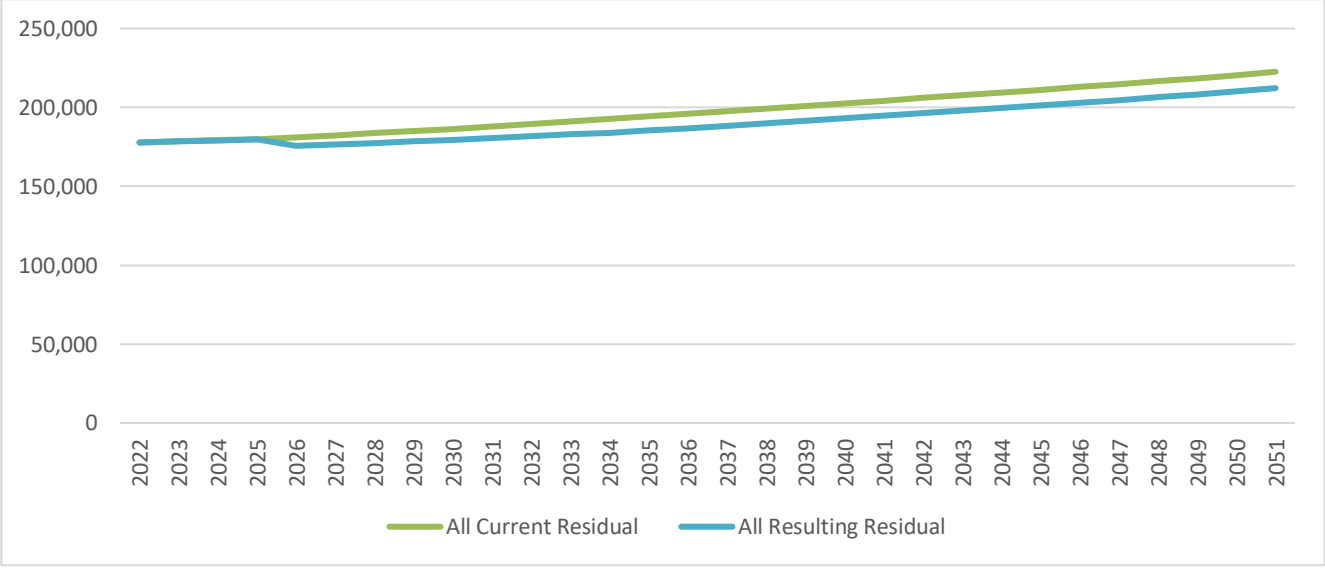


Figure 17 Forecast whole of region residual waste arisings (landfill scenario)

6.4.2 Residual waste sent to energy from waste

6.4.2.1 Traditional combustion

If EfW is selected as the preferred solution, then it is expected that a combination of the MSW, C&D, and C&I streams will be captured. Not all residual waste will be suitable for EfW, with some problem wastes such as asbestos containing materials or contaminated soils requiring alternative management. Additionally, a relatively large component of the EfW residual output includes Incinerator Bottom Ash (IBA) for which there is uncertainty over the potential reuse of this material. The deployment of an EfW solution capturing residual waste in the region would significantly increase the regions resource recovery rate to an estimated 80%. Under this option, an estimated 95,000 tonnes of residual waste from the MSW and C&I streams would be diverted from FY35-36[55] into the EfW facility per annum, with the MSW stream contributing 50,000 tonnes. The estimated cost of introducing EfW to the region is complicated by ownership and procurement options, and the scale of facility. The indicative benefit to the MSW stream is shown in **Figure 18**.

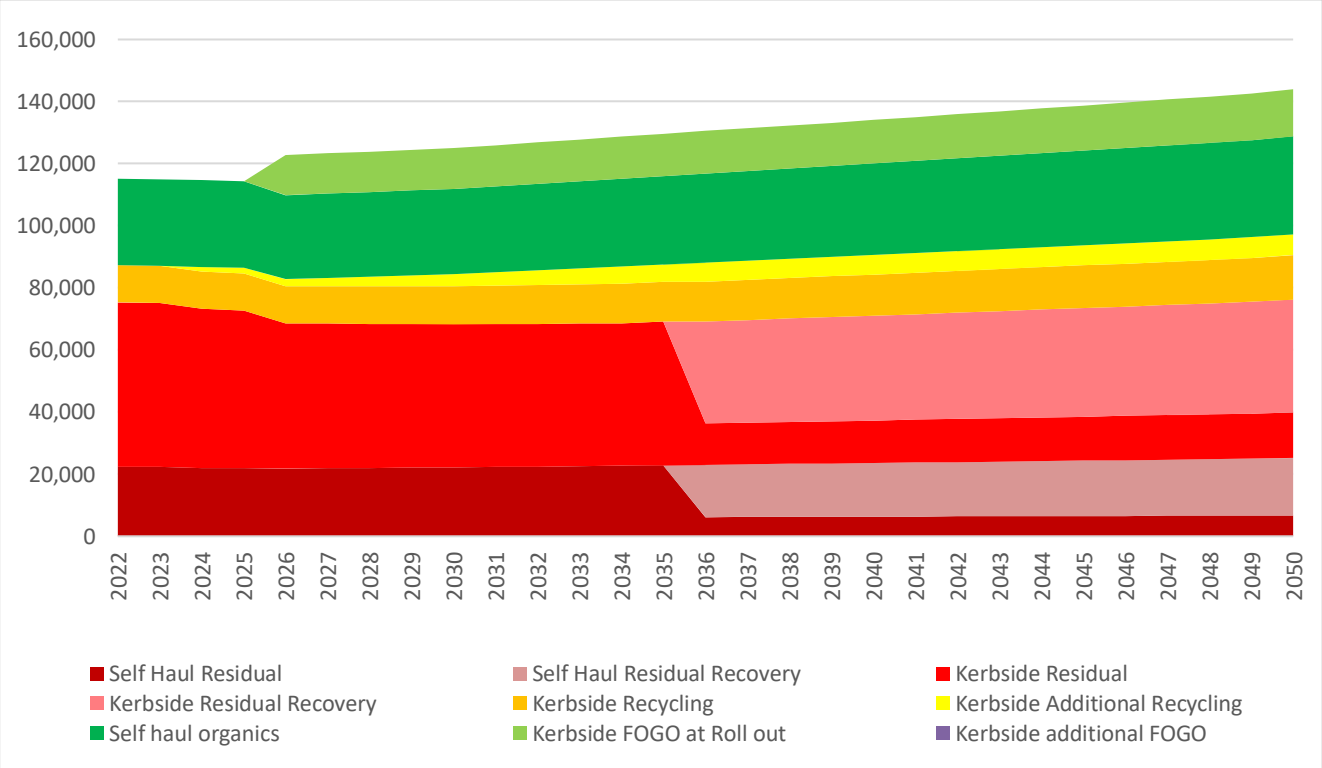


Figure 18 Future State for Kerbside Residual Waste management with energy recovery (Combustion)

There is a high degree of uncertainty over adopting an energy from waste via combustion solution in the region. Notably volumes of residual waste managed by Councils are low compared to traditional combustion volumes required for a facility, suggesting private sector involvement would be required, and from this Councils (either individually or as a region) would likely need to commit feedstock in the long-term. Contributions of feedstock may also be required from the non-council managed C&I waste in the region. Alternatively, residual waste could also be sent out of region to a combustion EfW facility, noting these do not presently exist in Queensland. **Figure 19** presents the impact on the whole-of-region resulting residual waste. This demonstrates that the region would still need to manage an estimated 106,000 tonnes of residual waste in landfill in 2050.

[55] It is assumed FY35-36 would be the first year a combustion based EfW facility might commence operation within the region, if constructed. This commencement date may vary pending Council or investor decisions.

Figure 19 Forecast whole of region residual waste arisings compared to current state (EFW via combustion)

6.4.2.2 Portion of residual waste processed into a fuel and then deployed

If the development of a waste to PEF facility is the preferred solution, then it is expected that there may be more of a focus on the C&I stream to provide feedstock, and have higher amounts of rejected feedstock which ends up needing to go to landfill. As an alternative to the EfW option suggested above, the deployment of a waste to fuel solution capturing residual waste in the region is estimated to support a resource recovery rate of 73%.

Under the waste to PEF scenario in the region, it is likely that the target feedstock will be derived from self-haul MSW, the C&I and some limited parts of the C&D stream. This will depend on the actual fuel product to be developed which will be dependent on the solution, and proponent producing and selling a product. For this assessment, the forecasting assumes 50% of the MSW, 60% of the C&I may be suitable for fuel manufacturing and can be diverted from landfill. Based on available data, most of the C&D waste managed in region is non-combustible (e.g., clean earth, contaminated soils etc.,) (see **Figure 20** and **Figure 21**) and so is assumed not to be relevant to energy from waste or waste to fuels. This would divert an estimated 68,000 tonnes of waste from landfill in FY35-36 from the waste currently managed by Councils. Waste to fuel requires a more precise feedstock than combustion, hence the recovery rate is lower as more material is sorted and screened out during the fuel production process, and likely would focus on the more homogenous MSW (expected to primarily focus on the self-haul stream) and C&I streams leaving council with more residual MSW to manage than under the combustion option.

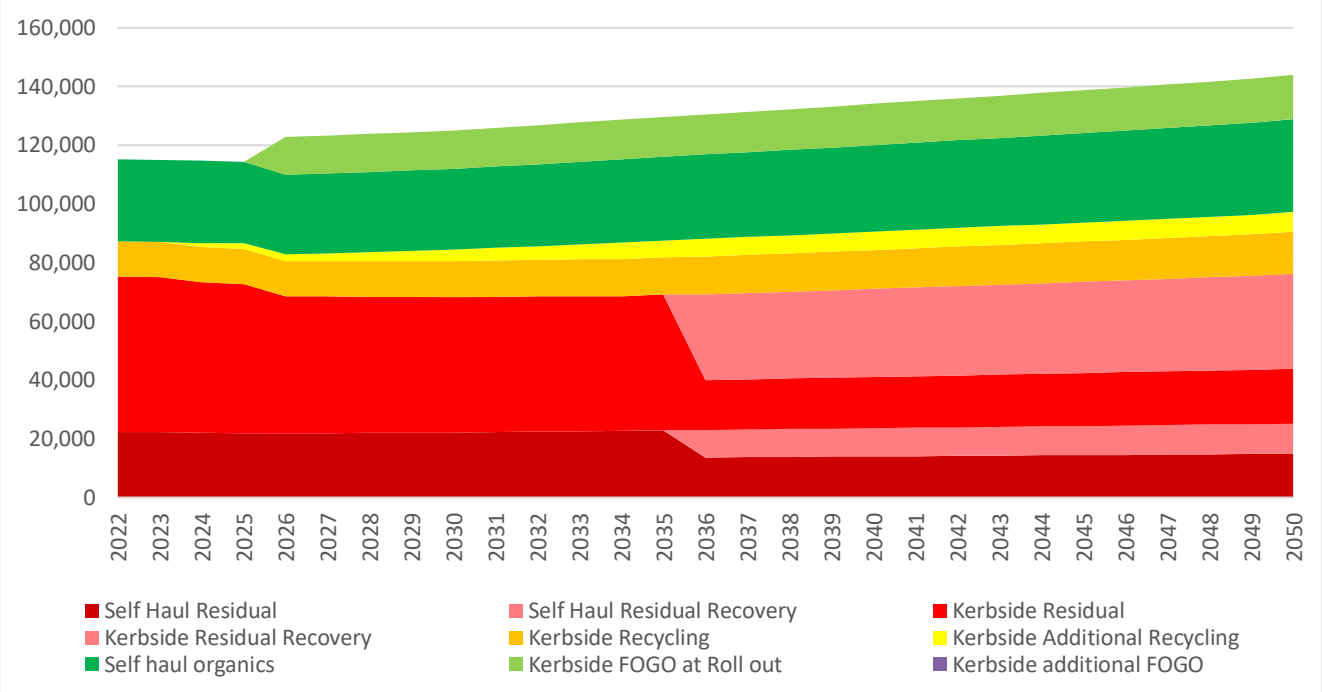


Figure 20 Future State for Kerbside Residual Waste management with energy recovery (Waste to PEF)

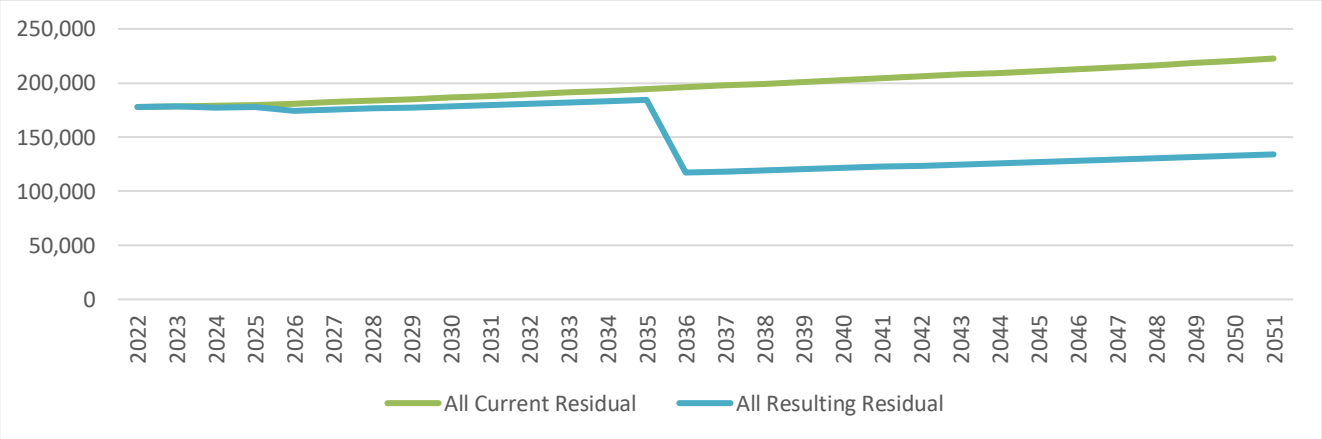


Figure 21 Forecast whole of region residual waste arisings compared to current state (Waste to PEF)

6.5 The cost of making the transition

For residual waste the solutions tested under economic analysis included the development of an EfW facility deploying combustion technology in the region, and the potential for a proportion of residual waste to be sent to a waste to fuel facility. There is a general expectation that the introduction of EfW is more expensive than BAU, even accounting for the cost of adding additional airspace for landfills. The costs of implementing EfW were considered in the context of decisions made in relation to streams discussed in Section 4 and Section 5. This assumes that actions taken before will affect the quantity and quality of residual waste available for EfW or for waste to fuel solutions. Costs included in the analysis include:

- Capital, operating and lifecycle costs – notably significant capital and operating expenditure costs associated with the establishment of a new combustion facility or lessor CAPEX for a fuel manufacturing facility in the region, assumed centrally located in the region, plus bulking and transfer infrastructure in other LGAs. The scale of the Plant deployed in this assessment may necessitate transport from out of region.
- Transport costs, including transport of bulked waste to a centralised facility

Managing residual waste will cost more for Gladstone Regional Council and Rockhampton Regional Council regardless of preferred solution. For other leviable councils business as usual costs will continue. The following costs are identified depending on the solutions chosen:

- **Residual waste to landfill:** Under the current proposed levy settings, by FY30-31 the increased levy liability after improvements in organics diversion and recycling capture are expected to be **$1.7 million per year** for Gladstone Regional Council and **$2.4 million per year** (in real terms) for Rockhampton Regional Council if all resulting residual waste continues to be sent to Landfill. This amounts to an additional cost per household of $74-$80 to account for the increased cost in landfill disposal allowing for a reduction in waste to landfill because of actions and interventions in this Plan. For the other levy paying councils in region (Banana Shire Council, Central Highlands Regional Council and Livingstone Shire Council), and for Woorabinda Aboriginal Shire Council, costs for sending waste to landfill are not forecast to increase above business-as-usual. Business as usual costs for new cell development, and for closing and rehabilitating former landfills may still be significant and require funding support.
- **Residual waste to an in-region combustion facility:** If a proportion of residual waste sent to an in-region energy from waste facility, the indicative whole-of-life costs for doing so are estimated to be **$293 million** (present value), assuming a facility is constructed using combustion technology capable of processing approximately 200,000 tonnes per annum. This means the facility would need to receive C&I and potentially some C&D wastes, as well as residual MSW from across the region. There may even be a need to secure feedstock from outside of the region. Economic analysis suggests that sending this material to EfW in region would cost an estimated $155 per household per year (present value) considering the levy benefit of not sending this waste to landfill. The economic analysis assumes such a facility would not be operational until at FY35-36. There is a high-degree of uncertainty in the cost per household per year which depends on the procurement approach, and, assuming a private-sector owned facility, the expected gate fee, as well as potential revenue. Consideration of saved landfill airspace also significantly affects the overall cost. All of these will require detailed consideration as the region progresses a solution.

- **Residual waste to fuel:** The alternative residual waste approach could be to send a proportion of residual waste was to a waste to fuel facility within the region. The indicative whole-of-life costs for doing so are estimated to be **$26 million** (present value), assuming capital and operational expenditure is required for a fuel manufacturing facility located central to the region, and the fuel is transported to Gladstone for use. The facility would process predominantly C&I and C&D wastes and a smaller proportion of the MSW stream. Economic analysis suggests that this alternative approach would have a lessor impact on households than EfW via combustion as the capital and operating expenditure is significantly lower. As with sending residual waste to a combustion EfW facility, there is a significant amount of uncertainty around the composition of fuel, the offtakers (the Cement Kiln in Gladstone is a possible user of the fuel) and offtake price (assumed to be zero in the economic model). This will require detailed consideration as the region progresses a residual waste solution.

6.6 Supporting the change

There is a choice to be made between the most economically beneficial approach to residual waste management in the region, whether acceptance of long-term landfill or the development of a long-term energy from waste solution. The latter will still require long-term landfill airspace, however significantly less. To support the definition of the future state for residual waste:

- **Long term strategic Planning requires support:** A long-term residual waste strategy for the Central Queensland region should be developed. This could be expanded to incorporate neighbouring Councils or regions to identify potential scale and transport costs. This strategy should identify and work in partnership with industry to identify feasible solutions but also expected costs versus the need to ensure residual landfill capacity is available. The Central Queensland region has the largest cement kiln in Australia which has a high energy demand and a willingness to look at alternative fuels for firing the kiln. The estimated cost of an initial study across multiple regions is $0.25M but this could be expanded further into the development of a business case for either solution which would increase by at least a further $0.75M.
- **Levy clarity supports Planning beyond the next 10-years:** long-term certainty of the waste levy rate and annual advanced payment is required. For residual waste that goes to landfill, where there are no other options, there is little benefit of applying a waste disposal levy other than to raise revenue as further diversion has been proven to be unachievable without an unreasonable cost burden on households and industry.
- **Managing by-products cost-effectively is not just the proponents job:** Where EfW is identified as the preferred option, and if the technological solution is combustion, then the management of incinerator bottom ash will continue to be a challenge for the owners and operators of the facility. It is understood that the Queensland Government is progressing the establishment of an End of Waste Code for IBA to allow its use in certain areas (e.g., bound in road pavements). This barrier needs to be removed to minimise cost to ratepayers and to allow the region to strive towards higher resource recovery targets. Reuse options need to be contextualised as part of the broader strategy.

6.7 Timeframes for delivery

The timeframes for delivery of the residual waste component of the Plan require the development or continuation of work to identify the feasibility and required timings for a solution to be in place. Long-term residual solutions are not required immediately, but the establishment of new landfill capacity or either a waste to PEF or thermal EfW solution could take 10 years to progress from inception to commissioning. **Table 26** summarises proposed timeframes for managing the residual waste stream.

Table 26 Residual Waste Stream implementation timeframes

Immediate action (within next 2 years)	Within next 5 years	Within next 10 years
Regional solutions		
	ALL: Collaborate on the development of long-term approaches to managing problematic and emerging wastes, including contaminated soils, asbestos, PFAS containing materials and biosolids.	ALL: Implement long-term approaches.
ALL: Develop long-term solution for regional infrastructure including either a regional landfill, processed engineered fuel or a regional scale energy from waste facility, processing from feasibility study to business case	ALL: Continue to refine long-term solutions for energy recovery and or long-term landfill	ALL: Construct and commission long-term infrastructure solution including provision of bulking facilities where out of LGA residual waste transport is required.
	ALL: Individual Councils to consider short term options to extend lifetime of landfills, or enter into agreement with other Councils to dispose of waste	ALL: Councils to construct and commission local landfill solutions
	ALL: Collaborate at regional scale on approach to managing disaster waste across the region to allow for efficient and effective organisation when a disaster occurs.	ALL: Implement

Note: Timeframes in this table relate to expected delivery as agreed by Councils in developing this Plan. Timeframes do not preclude action taken by other councils as individual needs and policy dictate. Cells in GREY indicate action not expected to commence during the timeframe

7 Implementing the Plan

The previous sections have identified current issues and opportunities and developed a series of preferred actions and approaches for how waste and resource recovery is managed in the Central Queensland Region.

7.1 Key actions & collaborations

This Plan has been developed to identify areas for Councils within the CQROC to collaborate in the delivery of waste services, as well as to identify and accept individual Council actions and decisions. Collaboration on strategy and progressing solutions within the region has been established through the CQROC Waste and Resource Recovery Working Group under the CQROC to develop this Plan. The region has varied economic and geographical conditions which has resulted in a Plan that has a combination of actions for regional collaboration and for individual Council action.

Figure 22 Regional Collaboration & Individual Council Actions

7.2 Delivery mechanism

The Plan will be delivered by the region via the Waste and Resource Recovery Working Group which will be formalised under the CQROC. The structure of a steering group and working group and its functionality has been endorsed by member councils. **Figure 23** provides a schematic of the proposed governance structure and function.

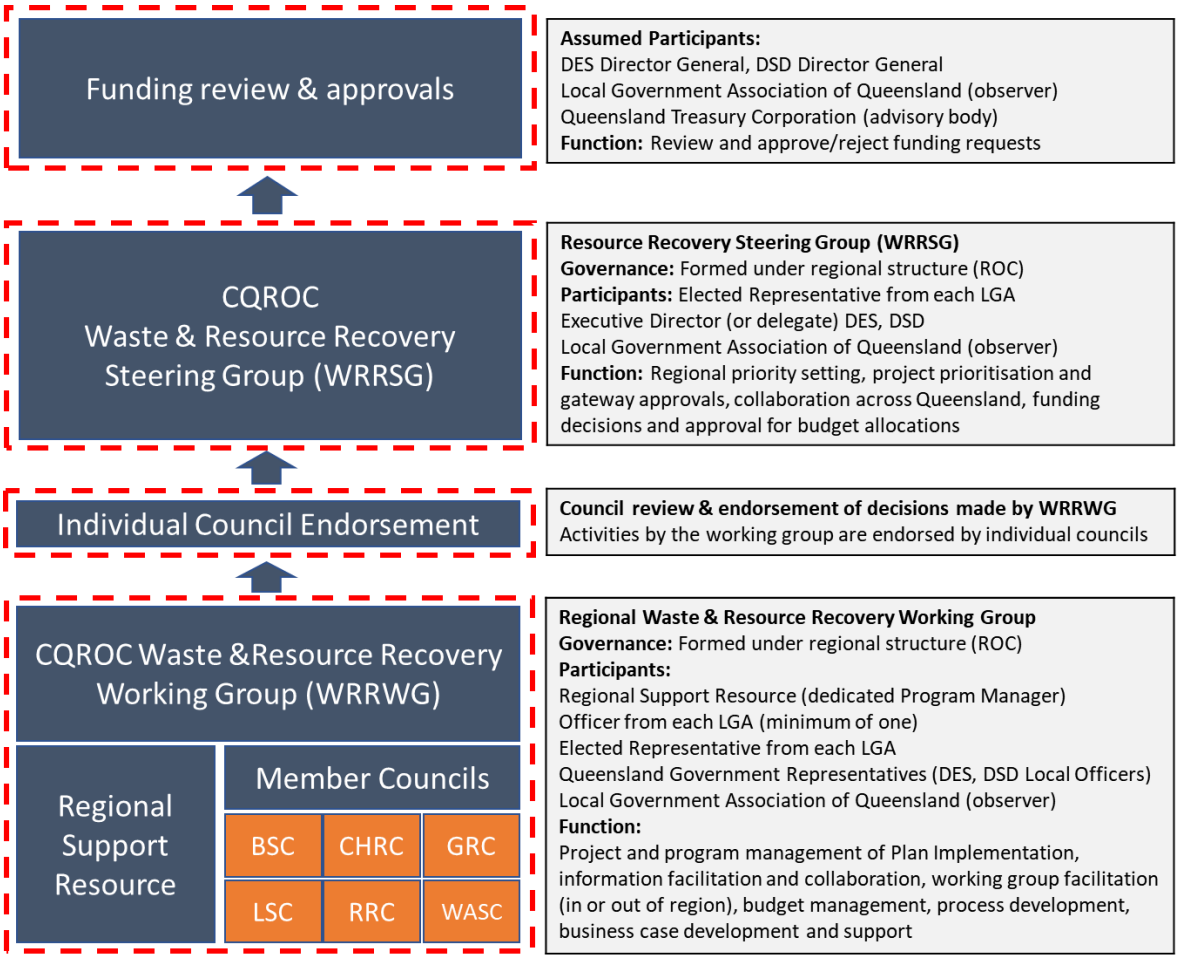


Figure 23 Governance and collaboration structure for implementation

7.2.1 CQROC Waste and Resource Recovery Working Group

Strategic ownership of this Plan and the underlying actions sit with the CQROC. Historically council officers have collaborated on waste issues, and a Waste and Resource Recovery Working Group was established under the CQROC to develop the Plan; however, no formal ongoing structure currently exists. This will need to be established as the first action in Implementing the Plan, including establishing terms of reference, participation expectations and implementation goals. This group will have responsibility to steer the outcomes of the region in resource recovery and recycling, including the following activities:

- Ownership, monitoring, and review of this RWRRMP
- Support identification and priorities (as per the RWRRMP) as they require decisions for funding from the Queensland Government decision making body
- Access support via a regional resource or centralised function for administration, funding, and development of supporting documentation and access to shared information.
- Collaboration on:
    - Education and behavioural change, including a regional Strategy
    - Data harmonisation, management, and reporting
    - Capacity building and education for resource recovery staff

- Establishment of circular economy community initiatives such as repair cafes or hubs, community composting, tool libraries
- Development of feasibility studies, business cases and other research activities relating to progressing regional solutions that benefit Councils in the long-term

The Queensland Government would be required to facilitate a coordinator for the established group to manage collaboration, progress against the Plan and generally be a champion for collaborative actions across the region. One full-time equivalent resource will be included as part of Plan Implementation to coordinate the regional Plan response and act as secretariat to the group.

Whilst detail will be developed as part of the terms of reference. Implementation of the Plan including an allowance for Council Officer time (above existing commitments), and a project or program manager is likely to be approximately **$0.23 million per year**. The majority of this is for new staff requirements to implement the Plan.

7.2.2 Regional Procurement Entity

Where the working group progress actions that will require the contracting (of more than one Council) of a service provider consideration of setting up a separate regional procurement entity would be advantageous. It is noted that the current model by Councils (with one Council leading procurement but each Council signing an individual contract) may continue to be the preferred approach. The actions that potentially would require either approach are:

- Procurement of technical or commercial advisory services relating to research and development
- Regional scale contracts for waste audit, surveys, software
- Development of a new contract(s) for kerbside recycling collections and processing
- Development of a long-term regional residual waste solution(s) or other problem wastes

For some elements of regional scale procurement at a regional scale (notably long-term contracts for collection or post-collections services) it is expected that the entity would need to have authorisation from the Australian Consumer and Competition Commission (ACCC) to collectively procure.

7.2.3 Support for delivery

To support the execution of the regional Plan, and the development of detailed business cases, procurement and contract development activities support will be required. It is understood that this function will be developed and funded by the Queensland Government, for which details are currently being finalised. This function will support:

- Governance and management system development for implementation of projects
- Project Management and scheduling associated with development of key initiatives.
- Non-technical support to development of business cases and funding Plans for key initiatives
- Support with preparation of information to support funding applications specific to the gateway processes setup by the Queensland or Commonwealth Government
- Support the coordination of the monitoring, evaluation and reporting requirements arising from the implementation of the Plan

7.3 Implementation Plan

An implementation schematic, bringing together the details of this Plan and timeframes for implementation has been developed as presented in **Table 27**.

While the RWRRMP provides the primary vehicle for accessing available funding from the Recycling and Jobs Fund, there may also be opportunities for initiatives to be funded that are outside the Plan. For example, a pilot at a local level to 'test' the suitability of a model or infrastructure for the region (or sub-region). It is recognised that the Plan needs to be a living document and that not all potential initiatives will have been identified in the Plan.

However, it is expected that the bulk of the funding will come through the projects identified in the Plan with a more streamlined pathway for funding approvals as it has already been identified in the Plan. In the first instance any projects identified that are outside the Plan would likely be discussed with the regional working and steering groups and the proposed regional support resource position that will be funded to support implementation of the Plan, to assess suitability for funding under the Plan or whether this would be considered under a separate funding process.

Councils, in participating in the development of this Plan and subsequent endorsement of or support for its finalisation and publication, can do so in the knowledge that this consideration does not obligate individual Councils to any funding commitment. Subsequent business cases developed as part of implementing the Plan and implementation decisions made by the region for implementing the Plan would normally include that detail.

Table 27 Implementation Schematic

Action	Responsibility	Immediate	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2040	2050
		Next 2 years			Within next 5 years			Within next 10 years					To 2040	To 2050
General														
Formalise regional waste working group to implement Plan	WRRSG, All													
Program management	WRRSG, WRRWG													
Regional collaboration (e.g., WRRWG meetings, action management, etc.)	WRRSG, WRRWG, All													
Organic Waste Management														
Participate in Education and Behaviour Change Initiative (assumed continuation) as part of regional education strategy – incorporating a food waste avoidance component	WRRWG, All													
Review potential for behaviour change regulation (new services)	GRC, RRC													
Roll out of at-home composting solutions (where appropriate)	QGOV, ALL													
Develop detailed business case for organics collection service for council approval including market development	GRC, RRC													
Commence new organic waste collection service education	GRC, RRC													
Procurement of organic waste collection solution	GRC, RRC													
Procurement of organic waste processing solution	GRC, RRC													
Commence and operate kerbside organic waste collection service (pending individual council approval)	GRC, RRC													
Continuation of self-haul green waste receipt and processing	All													
Roll out of community composting solutions including guidance (where appropriate)	QGOV													
Develop regional solution for biosolids and timber	RWRRWG													
Develop pathway to improve non-Council held data collection	QGOV, All													
Material Recycling & Recovery														
Develop Regional Education Strategy & Implement Participate in Education and Behaviour Change Initiative (assumed continuation)	WRRSG, RWRRWG, All													
Develop Council specific Education Plan for Woorabinda Aboriginal Shire Council and implement	QGOV, WASC													
Review & agree pathway for improved enforcement activity for poor household behaviours in kerbside bin service provision, and implement	WRRSG, WRRWG, CHRC, GRC, LSC, RRC													
Collaborate on regional kerbside recycling processing solution	WRRSG, WRRWG CHRC, GRC, LSC, RRC													
Seek opportunities to collaborate on regional kerbside recycling collections approach when contracts allow	WRRSG, WRRWG, All													
Develop business case, designs for new or improved transfer facilities	All (as required)													
Construct and commission upgrades or new transfer facilities	All (as required)													
Collaborate and refine need for establishment of regional scale precinct and ancillary satellite sites in accordance with precinct guidelines	QGOV, WRRSG, RWRRWG													
Construct enabling infrastructure for precinct	QGOV													
Establish new resource recovery processing facilities within precinct	GGOV													
Work with Queensland Government agencies to improve uptake or recycled materials in procurement	QGOC, WRRWG													

Action	Responsibility	Immediate	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2040	2050
		Next 2 years			Within next 5 years			Within next 10 years					To 2040	To 2050
Develop pathway to improve material flow data and knowledge across region for recyclable material	QGOV, WRRSG, All													
Collaborate to collect data on contamination within kerbside bins to improve education approach.	QGOV, WRRSG, WRRWG, All													
Residual Waste Management														
Councils to consider individual landfill capacity needs in short-medium and long-term	All													
Consider long-term options and approach to managing residual waste in the long-term, pending availability of facilities out of region	SG, WRRWG, All													
Design, construct & commission long-term residual waste solution (or enter into long-term supply agreements with privately owned facilities)	SG, WRRWG, All, QGOV													
Develop long-term approach to managing problem and emerging wastes	All													

Notes: BSC-Banana Shire Council, CHRC-Central Highlands Regional Council, GRC-Gladstone Regional Council, LSC-Livingstone Shire Council, RRC-Rockhampton Regional Council, WASC-Woorabinda Aboriginal Shire Council, QGOV-Queensland Government, All-All councils, WRRWG-Regional Waste and Resource Recovery Working Group, WRRSG-Regional Resource Recovery Steering Group

7.4 Roles and responsibilities

The Waste and Resource Recovery Working Group will have overall ownership of the Plan. Roles and responsibilities for implementation of the Plan sit primarily with individual councils collaborating under the WRRWG, and with Queensland Government involvement. A RACI (responsible, accountable, consulted, informed) matrix has been developed to describe the participation of various stakeholders in delivering the regional Plan. It is expected that this matrix is updated as implementation of the Plan progresses by the WRRWG.

The definitions adopted for the RACI matrix are in **Table 28**, with the matrix presented in **Table 29**.

Table 28 RACI definitions

Item	Definition	Abbreviation
Responsible	Entity responsible for completing the work associated with the action/task, may be split across multiple entities	R
Accountable	Entity responsible for signing off/approving the outcome of the task. May reside with Councils to sign off, or with funding entities or gateway approvals to sign off.	A
Consulted	Provides input into the delivery of the task/action based on their specialist knowledge or experience.	C
Informed	Important to keep stakeholders engaged/informed as an activity progresses or decisions are made.	I
Where required	Identifies where RACI action will sit if the activity is required. This may denote an activity where Council in the future decides to progress a particular option.	*
Not required	Specific to decisions made in this Plan, to complete the RACI, not required is applied to stakeholders who do not have role in addressing specific tasks or actions.	NR

Table 29 RACI Chart – Plan Implementation

Action	RACI										
	QGOV (DES)	QGOV (DSD)	RRSG	WRRWG	Banana Shire Council	Central Highlands Regional Council	Gladstone Regional Council	Livingstone Shire Council	Rockhampton Regional Council	Woorabinda Aboriginal Shire Council	Industry
General Actions											
Formalise regional waste working group to implement Plan	C	C	I	NR	A	A	A	A	A	A	I
Program management	C	C	I	A	R	R	R	R	R	R	NR
Regional collaboration (e.g., WRRWG meetings, action management, etc.)	C	C	I	R	A	A	A	A	A	A	C
Liaison with State Agencies, PMO, industry	C	C	I	A	R	R	R	R	R	R	C
Organic Waste Management											
Participate in Education and Behaviour Change Initiative (assumed continuation) as part of regional education strategy – incorporating a food waste avoidance component	A	I	NR	R	R	R	R	R	R	NR	A
Review potential for behaviour change regulation (new services)	C	I	NR	I	I	I	A/R	I	A/R	I	C
Roll out of at-home composting solutions	A/R	I	I	C	I	I	I	I	I	I	I
Develop detailed business case for organics collection service for council approval including market development	C	C	C	I	I	I	**A/R**	I	**A/R**	I	C
Commence new organic waste collection service education	I	I	I	I	I	I	A/R	I	A/R	I	I
Procurement of organic waste collection solution	I	I	C	I	I	I	A/R	I	A/R	I	C
Procurement of organic waste processing solution	I	I	C	I	I	I	A/R	I	A/R	I	C
Commence and operate kerbside organic waste collection service (pending individual council approval)	I	I	C	I	I	I	A/R	I	A/R	I	R
Continuation of self-haul green waste receipt and processing	I	I	NR	I	A/R	A/R	A/R	A/R	A/R	A/R	NR
Roll out of community composting solutions including guidance	A/R	I	NR	I	I	I	I	I	I	I	NR
Develop regional solution for biosolids and timber	C	C	NR	R	A	A	A	A	A	C	C
Develop pathway to improve non-Council held data collection	I	C	I	R	A	A	A	A	A	C	I
Material recycling and recovery											
Develop Regional Education Strategy & Implement Participate in Education and Behaviour Change Initiative (assumed continuation)	R	I	C	I	A/R	A/R	A/R	A/R	A/R	A/R	NR
Develop specific Waste Education Plan for Woorabinda Aboriginal Shire Council	A/R	NR	NR	I	I	I	I	I	I	A/R	NR
Review & agree pathway for improved enforcement activity for poor household behaviours in kerbside bin service provision, and implement	A/R	I	I	I	A/R	A/R	A/R	A/R	A/R	A/R	C
Collaborate on regional kerbside recycling processing solution	I	I	I	I	C	A/R	A/R	A/R	A/R	C	C
Seek opportunities to collaborate on regional kerbside recycling collections approach when contracts allow	C	C	C	R	C*	A/R	A/R	A/R	A/R	C*	C
Develop business case, designs for new or improved transfer facilities	C	I	C	R	A*	A*	A*	A*	A*	A*	I
Construct and commission upgrades or new transfer facilities	C	I	C	I	A*	A*	A*	A*	A*	A*	I

Action	RACI										
	QGOV (DES)	QGOV (DSD)	RRSG	WRRWG	Banana Shire Council	Central Highlands Regional Council	Gladstone Regional Council	Livingstone Shire Council	Rockhampton Regional Council	Woorabinda Aboriginal Shire Council	Industry
Collaborate and refine need for establishment of regional scale precinct and ancillary satellite sites in accordance with precinct guidelines	R	A/R	C	R	R	R	R	R	R	R	C
Construct enabling infrastructure for precinct	C	A/R	A	I	I	I	I	I	I	I	C
Establish new resource recovery processing facilities within precinct	C	A/R	A	I	C*	C*	C*	C*	C*	C*	R
Work with Queensland Government agencies to improve uptake or recycled materials in procurement	A	A	I	I	R	R	R	R	R	R	C
Develop pathway to improve material flow data and knowledge across region for recyclable material	A/R	C	NR	C	C	C	C	C	C	C	C
Collaborate to collect data on contamination within kerbside bins to improve education approach.	A/R	I	NR	C	A*	A*	A*	A*	A*	A*	NR
Residual waste management											
Councils to consider individual landfill capacity needs in short-medium and long-term	I	I	NR	I	A/R*	A/R*	A/R*	A/R*	A/R*	A/R*	NR
Consider long-term options and approach to managing residual waste in the long-term, pending availability of facilities out of region	C	C	C	I	A/R*	A/R*	A/R*	A/R*	A/R*	A/R*	C
Design, construct & commission long-term residual waste solution (or enter into long-term supply agreements with privately owned facilities)	C	C	A	R	A/R*	A/R*	A/R*	A/R*	A/R*	A/R*	R*
Develop long-term approach to managing problem and emerging wastes	C	I	NR	R	A/R*	A/R*	A/R*	A/R*	A/R*	A/R*	C

7.5 Cost estimate

A high-level cost estimate for implementation of this Plan has been developed for the period between FY23-24 (year 1) through to FY30-31 (the year to which regulated changes to the annual advance payments has been forecast). Costs have been developed with a level of accuracy at p50 and should be considered indicative, and subject to change as Plans are refined and the level of funding available is confirmed. The estimated cost for implementation (excluding residual waste management) is **$66 million** over the period FY30-31. A breakdown is presented in **Appendix D**.

7.6 Funding

Funding needs to support implementation of the preferred option has been identified within Sections 4-7 as specific to initiatives across each stream. The following summarises prospective funding sources.

7.6.1 Local Government funding & financing

Local government can fund the provision of resource recovery infrastructure and initiatives through Council revenue, which is primarily derived from municipal rates, other duties, and charges, or transfers from Federal and State Governments. Depending on the population size, Local Governments often have limited resources to directly support capital investment in resource recovery infrastructure and initiatives.

7.6.2 Private sector funding & financing

The significant capital costs to construct and deliver the packages suggests that co-funding with non-government organisations and private sector proponents may be viable. The private sector can participate in a variety of capacities, from concept and design, to construction, operations, and maintenance. They can also provide financing to a greater capacity than the public sector and relieve Local Governments of borrowing constraints. However, by assuming financial risk in the proposed project, the private sector will require confidence in an expected return. The private sector will typically be involved in two ways – a traditional public-private partnership (PPP) model, or through complete ownership of the process and operations. Local Government may attract private sector investment by providing land, concessions, guaranteed feedstocks, or product offtake agreements. Private funding is most likely to be sought for options that incur high capital costs such as anaerobic digestions or an energy from waste facility, or for facilities where private sector expertise and innovation are critical.

7.6.3 Queensland Government funding - Annual Advanced Payment for Local Governments

The forward estimates for the period to FY25-26 has resulted in the payment of **$28.3 million** to the region in annual advanced payments. For Banana Shire Council, Central Highlands Regional Council and Livingstone Shire Council these are required to be used to offset the amount paid on the levy to avoid passing those costs onto households. Gladstone Regional Council and Rockhampton Regional Council have received $15.6M of this total, the landfill liability is expected to be higher than this amount over the same period, even if interventions commenced in 2025. This is the return of levy paid on household waste going to landfill, progressively reducing in value to FY30-31. Over the period to FY30-31 and following the interventions described in this Plan, Gladstone Regional Council will an additional **$8.2 million** and Rockhampton Regional Council **$10 million** in landfill levy compared to prior to the changes to annual advanced payments.

7.6.4 Queensland Government funding – Infrastructure

Funding from the Queensland Government typically occurs in the form of direct investments, grants, and subsidies. The Queensland Government may provide cash transfers to Local Governments, direct investments in projects, or offer low-interest loans.

Queensland Treasury Corporation (QTC) is the central financing authority for the Queensland Government and provides financial resources and services to the Queensland Government. Typically, QTC does not provide project-specific funding for Local Government so Councils should seek resource recovery infrastructure funding from QTC as part of their annual funding request. This is a collective request across the whole-of-council for funding support, within which requests for waste and recycling specific funding may be bundled. There may be potential for a group of Councils to set up a special purpose vehicle (SPV) to request funding for a specific project as a group, however, there is no precedent for this.

Access to grant funding from the Queensland Government typically requires the proponent and the project to meet a certain set of criteria which may include funding requirement, potential economic impact, location, partnership arrangements with the private sector and several other factors. Relevant to Councils, grant funding may be dependent on the location and scale of the proposed infrastructure. Resource recovery facilities in larger LGAs are likely to be self-sufficient owing to the expected scale and output of the facility and therefore may not require grant funding. However, small facilities may rely more on grants and transfers from the Queensland Government as their revenue may be uncertain and slow to achieve.

The Federal Government may be able to fund the delivery of the project however, the benefits for the broader Australian economy would need to be explicitly demonstrated. A concessional loan from facilities such as Northern Australia Infrastructure Facility (NAIF) or the Clean Energy Finance Corporation (CEFC) may be appropriate as these loans can be offered below the market rate of interest and often provide other benefits such as long payback periods, grace periods in which only interest or service fees are due, and interest holidays.

Public funding may be used for low to medium technology options, such as organics composting (e.g., open windrow or similar), local community solutions including community composting and repair hubs, funding for education and landfill expansion.

7.6.5 Government funding – Subsidising & supporting new systems

Financial mechanisms for resource recovery operations vary widely however, operational expenditures must be financially self-sustaining. There are recent and relevant examples of failed resource recovery projects in Queensland that utilised grant funding for capital expenditure however, ultimately collapsed due to the inability of the owner to support operational costs. Operational expenditures can be managed through traditional methods of improving businesses' processes and maximising revenue streams, including gate fees, and selling products such as compost.

Australian Carbon Credit Units (ACCUs) may also be utilised to secure ongoing financing. ACCUs are a financial instrument awarded to eligible energy efficiency, renewable energy generation and carbon sequestration projects that result in a reduction of greenhouse gas (GHG) emissions. One ACCU represents the avoidance or removal of one tonne of carbon dioxide equivalent GHG. CCUs are a financial product that can reduce the total capital expenditure for an emissions reduction project. ACCUs are traded or sold on the National environmental commodity market, through carbon market agents, to organisations looking to offset their carbon footprint or meet emissions reduction obligations. ACCUs are also purchased by the Federal Government in a commitment to decarbonise Australia's economy through emission reduction projects. ACCUs may be applied for organic waste diverted from landfill.

7.6.6 Government funding – non-infrastructure

Through the delivery of grant programs additional funding may be provided by the Queensland or Commonwealth Governments to support non-infrastructure solutions. These include education, such as the already commenced support program for improving kerbside behaviour support, or the roll out of love-food-hate-waste education packages. These programs should be developed to account for the non-infrastructure interventions presented in this Plan to support participation and education activities across the region.

7.7 Managing change

It is expected that the economic, environmental, and technical assumptions that this Plan is based on will change over the next 10-years, as documented in the individual stream sections. It is important that in implementing the Plan, the WRRWG is aware of and able to respond or react to disruptions caused by policy change, industry, or technology. The biggest potential disruptors are:

- Changes to the levy rate (beyond the forecast CPI increases) and annual advanced payments (beyond the current state) – the potential introduction of a reduction in annual advanced payments to those Councils in the region who currently receive the full levy amount returned. Even the gradual reduction in payment would likely increase the cost of waste management for ratepayers within these Councils whilst adding limited resource recovery or other benefits.
- Policy changes imposed by the Queensland Government or Commonwealth Government that have a direct impact on the services provided by Councils (e.g., the introduction of landfill disposal bans or mandatory collections).
- Changes to the composition of waste within household and other streams due to action taken by the Commonwealth Government on imported materials.
- The change in packaging materials, particularly an increase in the type of packaging used to favour a greater proportion of recyclable packaging.
- The development of new technologies, or the establishment in Australia of technologies that are more commonly deployed elsewhere in the world (e.g., proven small-scale EfW technologies or anaerobic digestion).
- Landfill disposal bans for certain types of problematic wastes (e.g., e-waste, batteries, tyres etc.,) may be implemented by the Queensland Government over the Plan period

7.8 Monitoring and review

Responsibility for monitoring of this Plan will reside with member Councils under the overall leadership of the CQROC. It is expected that Plan implementation will reside with the WRRWG under the CQROC. Key metrics to be monitored area:

Table 30 Monitoring parameters

Criteria	Measurement	Rationale
Formalise a regional delivery mechanism or structure to support Plan implementation	Mechanism in place by 1 July 2023	To facilitate implementation of the regional Plan a mechanism should be formalised and in place by 1 July 2023 to maintain momentum.

Criteria	Measurement	Rationale
Action tracking and accountability	Working group develops action tracking register with specific dates for action of key players. Project Management tracking against actions. Quarterly updates reported back to Councils.	The implementation of the Plan has a series of actions, and sub actions to deliver. These actions require allocation to specific Councils or other actors (e.g., State Government) who should be held to account. Project Management reports should be prepared Quarterly to track progress and correct delays.
Regional Targets		
Contamination percentage in comingled kerbside recycling	Measurement of contamination via standard methodology reported at least annually.	To measure impact of behaviour, change program in achieving target of <5% contamination.
Regional resource recovery target (all streams)	Current: 51% 2030: 56% 2040: 60%	To measure long term progress and commitments under Plan to achieving regionally specific resource recovery target rates. This assumes that organics diversion commences in Gladstone and Rockhampton prior to 2030.
Organics specific targets		
Household organic waste recycling rate	Current: 23% 2030: 31% 2040: 35%	This Plan sets out the potential for organics diversion rates for kerbside organic waste via new collections. Organics recycling rate combines self-haul and new kerbside services.
Organics collection contamination rate	Current: Baseline to be established 2030: <5% 2040: <3%	Where service provided, data will be collected on contamination rates as a proxy for effectiveness of education and awareness campaigns.
Kerbside recycling specific targets		
Regional kerbside recycling diversion target (excluding organic waste)	Current: 18% 2030: 22% 2040: 25%	Diversion rate to increase because of education but excluding organic waste diversion. Measured by Council data records, annual returns.
Kerbside recycling tonnes (material collected at the kerbside sent for recycling)	Current: 12,784 tonnes 2030: 16,700 tonnes 2040: 20,000 tonnes	Target takes account of increased population but also improved capture of more material from the residual bin
Regional kerbside recycling contamination rate	Current: 20% 2030: <10% 2040: <5%	Contamination rate to be measured through audits undertaken by participating Councils.
Residual waste monitoring		
Collect data on type and management fate of residual waste	No specific target	As a function of other streams, the regional should continue to monitor how residual waste is managed to facilitate future opportunity development. Revisit relevance of targets if long-term solution is developed.

Appendix A:

Investment Logic Mapping & Strategic Rationale

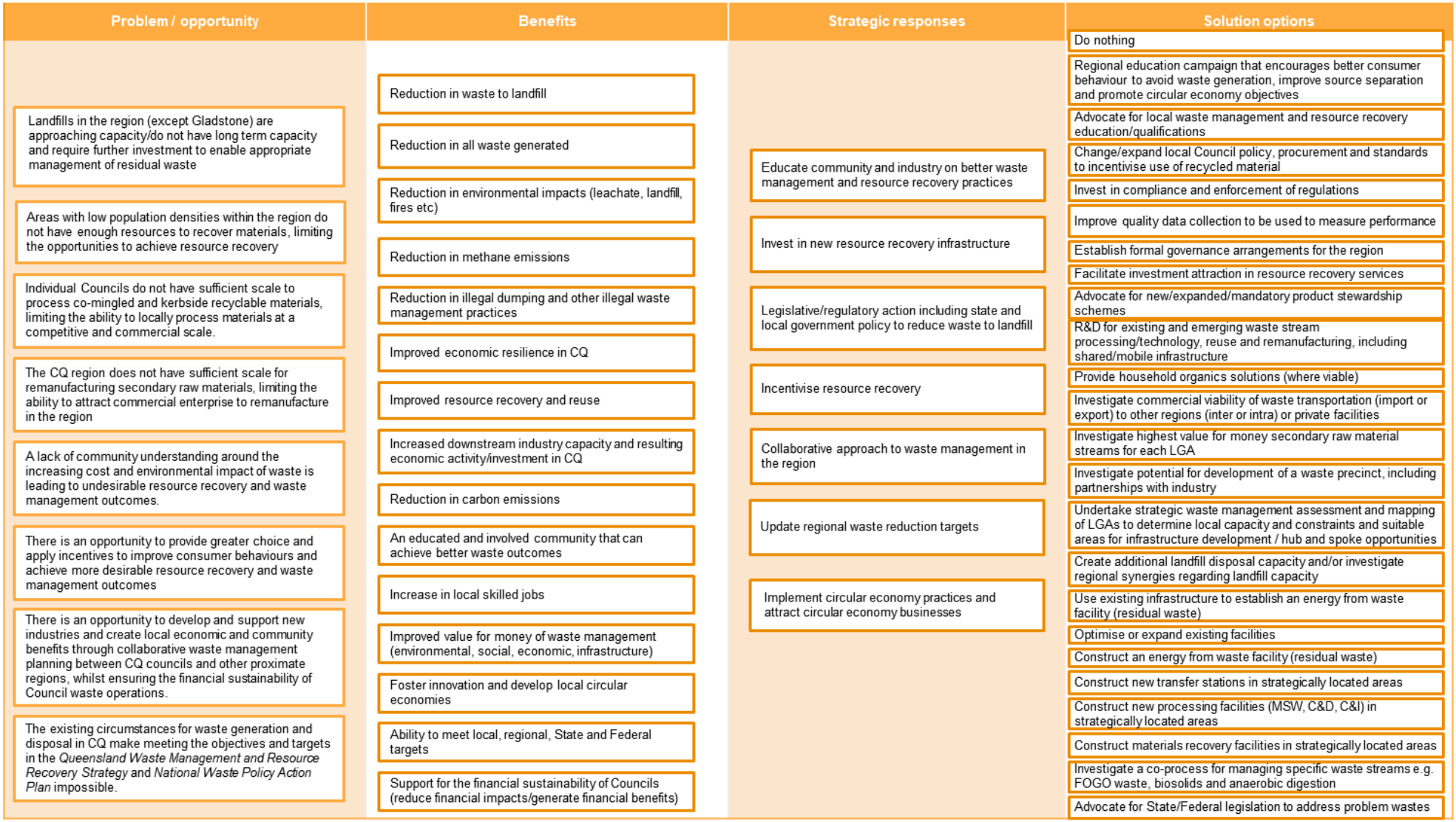


Figure A1 Strategic Rationale and Investment Logic Mapping Workshop Outcome

Appendix B:

Economic Analysis

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Regional Waste & Resource Recovery Management Plan - Cost Benefit Analysis

Central Queensland Regional Organisation of Councils

May 2023

pwc

Strictly private and confidential

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Contents

1	Introduction	3
1.1	Project context	3
1.2	Project objectives	3
1.3	Study area	4
2	Economic appraisal framework	5
2.1	Overview	5
2.2	General approach and limitations	5
2.3	Cost benefit analysis methodology	6
3	Base Case and project options	7
3.1	Base Case	7
3.2	Solution descriptions	9
3.3	Options	10
4	Costs	14
4.1	Capital expenditure	14
4.2	Operational Expenditure	15
4.3	Summary of costs	18
5	Benefits	20
5.1	Overview of benefits	20
6	CBA results	27
6.1	Summary of costs and benefits	27
6.2	Sensitivity analysis	29
6.3	Effect on households	29

1 Introduction

The purpose of the report is to evaluate the economic viability of implementing the Regional Waste and Resource Recovery Management Plan (RWRRMP) package solutions in the Local Government Areas (LGAs) which make up the Central Queensland Regional Organisation of Councils (CQROC). This chapter includes:

- Project context
- Project objectives
- Study area.

1.1 Project context

Councils in Central Queensland have identified that there is a strategic need to improve regional waste management and resource recovery practices. Currently, landfills in Central Queensland are reaching capacity (except Gladstone) and require further investment to enable the management of increasing residual waste. However, at the end 2021 it was announced that there would be a differential levy rate for waste generated in some Councils, as well as a progressive reduction in the differential annual advanced payment to the 2030-31 financial year. In the Central Queensland region, Rockhampton and Gladstone Regional Councils will experience a reduction in their advanced payment from 105% to 20% by FY30-31. For all other Councils in the Central Queensland region, annual advanced payments are scheduled to be 100% over the same period. Therefore, it is critical that waste is increasingly diverted from landfill in Rockhampton and Gladstone Regional Councils (and Central Queensland more broadly) to achieve broader resource recovery objectives.

To achieve this, improved recycling and resource recovery practices are required. Central Queensland LGAs have relatively small populations and are dispersed, meaning that transportation costs for waste management are often prohibitive and there is currently insufficient scale locally for commercially viable resource recovery for waste streams. Some Councils are unable to economically collect or sort recycled materials, resulting in a lack of recovered materials that could be processed and remanufactured, meaning that it is difficult to attract downstream industries and private investment to the region. Furthermore, there is often a lack of community understanding around waste management and little incentive to improve waste management practices, resulting in increased waste disposal to landfill. It is also worth noting that community-based recycling schemes such as Redcycle are struggling to maintain operations due to a lack of domestic processing capability and downstream markets. Therefore, without intervention, Central Queensland LGAs will struggle to meet the objectives and targets in the Queensland Waste Management and Resource Recovery Strategy and National Waste Policy Action

In response to this, SLR and PwC have been engaged by the Local Government Association of Queensland (LGAQ) to develop a RWRRMP to confirm the strategic need, investigate potential options to improve waste management and resource recovery practices in the region, and to agree on a collaborative pathway forward. This Cost Benefit Analysis (CBA) considers the solutions as discussed and agreed upon by CQROC.

1.2 Project objectives

The objectives of the overarching plan are to:

- Maximise the value of waste, including problematic waste streams
- Deliver the best pathway for the region that identifies opportunities for government co-funding arrangements, and industry investment or co-investment
- Provide councils with the data and options analysis required for them to make informed decisions about policy, location of infrastructure and optimal value for money investment, and non-infrastructure options
- Support improved waste management, resource recovery and recycling practices to contribute towards agreed regional and State targets
- Encourage and support opportunities to embed circular economy principles into business-as-usual practices, including through sustainable procurement principles
- Encourage and support job creation and economic and market development opportunities
- Improve environmental outcomes for the community

- Identify non-infrastructure and social and community benefits and
- Establish and maintain collaborative relationships with key stakeholders to drive long-term sustainable outcomes.

The intention of the RWRRMP is to provide long-term direction to 2050 of the needs of the region in terms of critical waste streams, infrastructure, and the identification of a particular suite of levers required to achieve regionally-specific and agreed targets. Specific activities and actions in the short- to medium-term are identified, where there is a relatively high degree of certainty in process and outcome. Longer-term activities and actions are expected to be implemented later in the program of works or require further refinement and development. It is anticipated that the plan will require a degree of flexibility.

The scope of the RWRRMP is defined by engagement with stakeholders. Focus is on waste and recyclate typically managed within the region by local government. In regional Queensland, local government often manages large proportions of the commercial and industrial (C&I), and construction and demolition (C&D) waste streams, due to the absence of private post-collection processing facilities. Activities and actions will be identified in the Plan for key streams, with a view to continuously seek opportunities to capture new and emerging or problematic streams as implementation progresses.

The RWRRMP aims to seek a balance between defining a clear implementation plan for the best whole of system outcome for the region, while reflecting the needs and wishes of each individual council and their rate payers, with the base assumption to minimise cost impact to councils and current waste operations.

1.3 Study area

The CQ region comprises the Local Government Areas of Banana Shire Council, Central Highlands Regional Council, Gladstone Regional Council, Livingstone Shire Council, Rockhampton Regional Council and Woorabinda Aboriginal Shire Council. Where appropriate, the Plan may look outside of the region to neighbouring regions or individual Councils for benefit of Plan implementation.

The current population of the CQROC area is approximately 230,000[1] and predicted to grow to around 360,000 by June 2036[2] which is an increase of 2% per year over 25 years. Population projections[3] suggest growth in population will be most significant in Gladstone, Livingstone and Rockhampton LGAs, marginal in Central Highlands, and population will decline in Banana Shire and Woorabinda Aboriginal Shire Council between 2016 and 2041.

Central Queensland is a major contributor to the state and national economy, generating $17 billion in Gross Regional Product in 2019, primarily from the key industries of mining and agriculture. These key industries are widely dispersed throughout the region, with key mining operations conducted in the central, western and southern areas near Emerald, Blackwater, Biloela and Moura. Agricultural activities are located across the region from Banana through to Rockhampton, and the Central Highlands supports approximately 1.3 million head of cattle across its expansive LGA.

The region identifies key strengths[4] through cattle saleyards at Emerald and Gracemere, Beef Abattoirs at Biloela and Rockhampton, Coal power stations at Rockhampton, Biloela and Gladstone, wind energy developments and ports located at Gladstone, Port Alma and Emerald. These support key industries across the region including mining, construction, manufacturing, power and water, and agriculture, forestry and fishing. Agriculture is dominated by cattle and calves, contributing $1 billion to the economy.

1 Central Queensland Regional Organisation of Councils, 2022. Population. Accessed at https://cqroc.org.au/population/
2 Queensland Government population projections, 2018 edition; Australian Bureau of Statistics, Population by age and sex, regions of Australia, 2016 (Cat no. 3235.0).
3 DSDILGP (2013). Central Queensland Regional Plan. Accessed at https://dsdmipprd.blob.core.windows.net/general/central-queensland-regional-plan.pdf
4 Central Queensland Regional Organisation of Councils, 2022, CQROC Strategic Plan. Accessed at https://cqroc.org.au/wp-content/uploads/2022/02/CQROC-Strategic-Plan.pdf

2 Economic appraisal framework

This chapter outlines the economic appraisal framework implemented to assess the packages against the base case to recommend the most economically viable option for implementation in the RWRRMP. This chapter includes:

- Overview
- General approach and limitations
- Cost benefit analysis methodology.

2.1 Overview

The economic analysis was undertaken using a CBA framework that applies discounted cash flow techniques, in accordance with Infrastructure Australia (IA) guidelines. The CBA assesses the benefits and costs of the project options to evaluate whether incremental benefits exceed the incremental costs of achieving them.

The key steps undertaken in developing the economic appraisal are:

1. **Establish the economic appraisal framework:** Defines the approach and overarching methodology to be used for the economic appraisal and determine the key modelling assumptions
2. **Define the base case and project option scenarios:** Defines the base case, which represents the counterfactual against which the project options will be assessed and defines the project options
3. **Develop and incorporate cost estimates:** Incorporates delivery and operating phase cost estimates associated with the project options, into the economic appraisal
4. **Identify and quantify economic benefits:** Estimates the incremental benefits for the project options based on a range of inputs using economic assumptions/parameters. The economic benefits framework has been designed to reflect the impacts of the project on user groups in society
5. **Economic appraisal:** Involves discounted cashflow assessment within a cost CBA framework to determine key metrics including the benefit cost ratio (BCR) and the net present value (NPV).

This chapter is structured to provide a summary of each of the steps above.

2.2 General approach and limitations

CBA is an economic analysis framework that examines the broad range of economic, social and environmental impacts of a proposed initiative across all affected stakeholders. A robust CBA requires:

- Costs and benefits to be expressed as far as possible in monetary terms to allow options to be compared on a consistent basis
- Results to be discounted to ‘present value’ terms to allow for consistent comparison of impacts that may occur at different points in time
- The valuation of costs and benefits based on the impacts they have on the community as a whole
- A holistic approach that considers and quantifies impacts across all impacted parties, rather than a specific project proponent or stakeholder. The CQROC member LGAs are the referent group in this CBA.

2.2.1 Assumptions

The RWRRMP is based on high-level option specification and analysis and as such, a number of assumptions were made to define the inputs for the analysis and to undertake the CBA. The results of this CBA should not be relied on to form an investment decision and it is recommended that a detailed assessment of individual option components is undertaken. The broad assumptions include:

- A detailed quantification of costs was not undertaken for the options packages. All capital and operating cost assumptions were provided by SLR and are indicative and based on professional experience and benchmarking,

supplemented with desktop research. They represent basic building costs (where appropriate) and typical processing costs. Land acquisition and site preparation costs are excluded.

- Arcadis provided detailed waste generation data and waste flow modelling to determine potential volumes of resources that may be recovered under each package. PwC did not perform a detailed review of data quality or integrity and all data is assumed to be appropriate for the purpose of this CBA.

2.3 Cost benefit analysis methodology

CBA uses discounted cash flow analysis to convert future costs and benefits to a common time, the present value (PV). PVs are calculated by discounting future values using IA's recommended real discount rate of seven per cent per annum (which reflects the time value of money). These discounted costs and benefits are then used to produce conventional CBA measures of economic performance, including:

- **NPV** – the difference between the PV of total incremental benefits and the PV of the total incremental costs, which allows the project options to be compared on the same basis to determine the greatest net benefit to the community or the most efficient use of resources

- **BCR** – ratio of the PV of total incremental benefits to the PV of the total incremental costs. A BCR greater than 1.0 indicates that quantified project benefits exceed project costs. However, projects with BCRs less than 1.0 may still be considered to have net benefits if some of the benefits cannot be fully captures within an economic appraisal framework, for example, where data is unavailable to quantitatively measure additional benefits expected to result from the project.

These economic metrics are part of a broader initiative valuation process and should be considered in conjunction with non-monetisable costs and benefits, the results of a financial analysis, and the potential economic impact on the region. Revenues exceeding costs is not a sole reason to proceed with a project. It is essential to also consider community and social costs, as a project that causes significant harm to the community may not have a direct financial cost, but could still be damaging. If the BCR is below one, the project may still be suitable for government investment provided there are other project benefits which were not able to be monetised and included in the BCR (e.g. social benefits). The CBA uses both market and non-market monetisable costs and benefits to ensure impacts to the referent group are captured. Non-monetisable costs and benefits are detailed but are not quantified.

2.3.1 Parameters

This analysis requires a range of general assumptions which have been developed in line with relevant guidelines. The general assumptions are outlined in Table 1 and form the basis of the economic model. These are subject to sensitivity testing as appropriate.

Table 1: General economic analysis assumptions

Assumption	Value	Comment
Base year	FY23	The base year is the year the evaluation is conducted as the CBA is forward looking. Any costs of benefits incurred in the past years are treated as sunk and excluded from the analysis.
Pricing year	FY23	All values are expressed in FY23 dollars, in the year they are expected to be incurred.
Appraisal period	Construction period + 30 years operation	From commencement of operations of the first implemented solution (2024).
Discount rate	7%	Consistent with Queensland Government Business Case Development Framework and the Infrastructure Australia Assessment Framework as of November 2022. Sensitivity scenarios run at 4% and 10% as identified by Infrastructure Australia.

3 Base Case and project options

The base case and package options were defined in collaboration with LGAQ and CQROC LGA representatives. The package options address the following waste streams and recovery measures:

- Organics education, collection, and resource recovery
- Recycling education, collection, and resource recovery
- Residual waste disposal and resource recovery.

This chapter defines the base case and options packages, and includes:

- Base Case
- Solution descriptions
- Options.

3.1 Base Case

The base case is defined as the continued resource recovery and waste management scenario in the LGAs in CQ. It represents the 'do minimum' approach, whereby the majority of waste generated across the CQ is transported to landfills or the regional recyclate processing solution (noting due to fire there is no operational MRF in the region) without significant capital investment in alternative solutions or major operational changes.

The Central Highlands, Gladstone, Livingstone Shire and Rockhampton Regional Councils provide fortnightly comingled recycling collections services. None of the Councils provide an organics bin service. Banana Shire and Woorabinda Aboriginal Shire Councils are currently limited to weekly residual waste collection services.

The landfill capacity assessment undertaken in the Queensland Waste and Resource Recovery Infrastructure Report[5] identified that there are approximately 5.0 million tonnes of existing approved putrescible landfill capacity in the Central Queensland region. There is also ample inert landfill airspace in the region within private facilities[6]. Banana Shire Council is facing short- to medium-term landfill shortages with two primary local landfills closing since 2020.

The estimated landfill capacities and expected exhaustion years are presented in Table 2.

Table 2: Central Queensland council landfill capacity

Council	Annual disposal (2019, Tonnes)	Current approved capacity (tonnes)	Expected exhaustion of capacity
Banana Shire – Trap Gully Landfill	10,426	100,000	2024
Central Highlands – Blackwater Landfill	4,310	86,206	2039
Central Highlands – Lochlees Landfill	14,798	295,962	2039
Gladstone Region – Bernarby Regional Landfill	30,233	1,118,623	2056
Livingstone Shire – Yeppoon Landfill	19,672	806,546	2060
Rockhampton Region – Lakes Creek Road Landfill	54,493	1,332,011	2043

[5] Arcadis (2019). Queensland Waste and Resource Recovery Infrastructure Report. Accessed at https://www.qld.gov.au/__data/assets/pdf_file/0034/199249/qld-waste-resource-recovery-infrastructure-report.pdf

[6] Ibid

Council	Annual disposal (2019, Tonnes)	Current approved capacity (tonnes)	Expected exhaustion of capacity
Woorabinda Aboriginal Shire – Woorabinda Landfill	579	18,528	2051

Until recently, there was almost no secondary reprocessing of recyclable materials at the only MRF in the region in Rockhampton, meaning that all recovered materials were sent to other Queensland locations, interstate or overseas[7]. Recovery has been further impacted after the Rockhampton MRF in Parkhurst burned down in November 2020. However, there are two C&D recyclers in the region and significant recovery of garden waste via simple mulching at Council landfills[8]. Whilst Councils are still working through a regional recyclable processing solution, this analysis includes an allowance for a new MRF to be developed in the region.

Central Queensland has made progress in 2022 with newly established $2 million Kriaris Recyclables Processing facility that processes glasses from Rockhampton's Containers for Change program into glass sand for infrastructure projects[9]. Solar Recovery Corporation's solar panel recycling facility is also planned in Biloela that will recover a proposed 99 per cent of material from each end-of-life solar panel and junction box. The recovered materials are used as feedstock to local manufacturing streams.

The base case includes regulations set out in the following legislations:

- *Waste Reduction and Recycling Act 2008*
- *Environmental Protection Act 1994*
- *Local Government Act 2009.*

These legislation act on initiatives in the following strategies and policies:

- Queensland Waste Management and Resource Recovery Strategy (2019)
- Queensland Resource Recovery Industries 10-Year Roadmap and Action Plan (2019)
- Gladstone Regional Council Waste Management and Resource Recovery 2019
- Rockhampton Waste Strategy 2020-2030
- A new dimension: Strategy for the Management of Resource Recovery and Waste in Livingstone Shire to 2030
- Banana draft Waste Reduction and Recycling Plan 2022-2025
- Central Highlands draft resource Recovery Waste management Strategy 2022-2032
- Waste disposal levy
- First Nation communities waste strategy and Action Plans
- Queensland Energy from Waste Policy (2021)
- Queensland Organics Strategy and Action Plan 2022-2032
- Queensland Plastic Pollution Reduction Plan
- Single-use plastic items ban
- Plastic bag ban
- Containers for Change - container refund scheme[10].

[7] Rockhampton Regional Council. (2020). Waste Strategy
[8] Arcadis for Department of Environment and Science (2019). Queensland Waste and Resource Recovery Infrastructure Report. Accessed at https://www.qld.gov.au/__data/assets/pdf_file/0034/199249/qld-waste-resource-recovery-infrastructure-report.pdf
[9] Queensland Government. (2022). Recycled glass paves the way for Rockhampton roads, jobs
[10] This analysis does not account for the upcoming introduction (pending approval) from the State to include wine bottles and spirit bottles.

The base case also includes committed and funded waste projects include those which are committed and funded subject to further analysis.

3.2 Solution descriptions

There are several solutions implemented as part of each package to enable resource recovery. These solutions are described in Table 3. Detail on which solutions are included in each package is provided in Section 3.3. Some solutions detailed in Section 3.3 are considered in sensitivity testing.

Table 3: Description of solutions

Category	Solution	Description
Organics	Garden Organics (GO) to open windrow composting including collection.	Councils provide GO bin service to residents and implement kerbside GO collection for residential (in addition to existing self-haul collections). This waste is transported to open windrow composting facilities (either in-region or a regional facility). Waste is processed in an open air environmental where the materials break down in the presence of oxygen into compost or other soil improver products that can be sold into landscaping and agricultural markets.
	Food Organics and Garden Organics (FOGO) to open windrow composting including collection.	Councils provide FOGO bins to residents and implement FOGO kerbside collection for residential and commercial waste (in addition to self-haul green waste). This waste is transported to open windrow composting facilities (either in-region or a regional facility). Waste is processed in an open air environmental where the materials break down in the presence of oxygen into compost or other soil improver products that can be sold into landscaping and agricultural markets. It is noted that there remains uncertainty related to the Queensland Government requirements associated with FOGO processing and potential requirements to process this stream within a more expensive enclosed system but it is likely this will be determined on a case by case basis depending on risk assessment. For the purpose of this assessment, it is assumed that an outdoor composting site can be located in an area where risks can be managed satisfactorily for the regulator.
	FOGO to anaerobic digestion (AD) including collection.	Councils provide FOGO bin to residents and implement FOGO kerbside collection for residential and commercial waste (in addition to self-haul). This waste is transported to a dry AD facility and processed into biogas and digestate. AD decomposes FOGO waste by anaerobic bacteria in the absence of oxygen (usually in a sealed tank). Biogas and digestate are collected, and secondary products can be sold and reused.
Kerbside recycling	Comingled kerbside (new or BAU) with collection to materials recovery facility (MRF)	Councils willing to opt-in to collecting comingled kerbside recycling provide yellow lid bin and collection services. Recovered recyclables are transported to a regional MRF either direct or via transfer stations for sorting and processing. Paper and cardboard, glass, plastics, and metals can be sent from the facility for reprocessing. Councils are currently seeking a new recycling processing solution which may include a regional scale MRF, or transport out of region. This will replace the previous MRF that was destroyed by fire in November 2020.
Residual (including feedstock location)	Landfill	Councils invest in additional landfill capacity as required. This could be the addition of new landfill cells within existing facilities, or the construction of new landfills. Landfills could be at an individual Council scale, or collaboratively deliver a regional landfill servicing two or more councils in the region.
	Energy from Waste (EfW)/ Alternate Waste Treatment (AWT) in region	EfW/AWT facility is developed in region. CQ residual waste is provided as a feedstock. Energy recovery process is via incineration or alternative thermal treatment (e.g., pyrolysis or gasification). Energy is recovered from waste through a steam boiler and turbine as electricity, while heat, in the form of steam or hot water, may also be captured. Secondary materials are sold for reuse. EfW residual

Category	Solution	Description
		is disposed of in landfill or recycled. Recovery of incinerator bottom ash (IBA) may be a critical factor in the financial viability of an incinerator as 20% of input becomes bottom ash. Potential for this material to be used under an end-of-waste code once developed to avoid landfill cost
	EfW/AWT regional Attract feedstock from out of region	Large regional EfW/AWT facility is developed (c.150ktpa+). CQ residual waste is provided as a feedstock as well as additional MSW/C&I waste feedstock that is sourced from out of the region to achieve the scale required for larger facility. Recovery process is via incineration or thermal treatment. Energy is recovered from waste through a steam boiler and turbine as electricity, while heat, in the form of steam or hot water, may also be captured. Secondary materials (e.g., metals recovered from IBA or biochar from gasification) are sold for reuse. Recovery of IBA as above.
	Process Engineered Fuel (PEF) / Refuse Derived Fuel (RDF) Attract additional C&I and C&D waste from out of region through pricing	PEF is an overarching term given to waste derived fuels, which includes RDF. In this option a PEF/RDF facility is developed. This process prepares waste into a manufactured fuel to allow the energy contained in non-recyclable plastics, cardboard, paper, textiles, and waste timber that would otherwise be destined for landfill to be harnessed. CQ C&I and C&D waste is either self-hauled to either transfer stations or the facility for processing. Additional C&I and C&D waste from out of region is attracted through pricing to achieve the required scale. Pre-treatment is required to remove contaminants. PEF is a combustion fuel produced after processing and is typically derived from the dry fraction of waste. It is considered a partially renewable energy source and is well suited to providing fuel for use in industrial facilities. Secondary material is sold to markets (either onshore or offshore).
Beneficiation / Secondary processing	Local beneficiation (e.g. glass, tyres, etc)	A local beneficiation operation (or multiple facilities) are established to process recyclable materials that are either sorted at the MRF or self-hauled to transfer stations by residents (non-council managed waste). Local beneficiation could be established at the MRF to reduce transportation costs. It is anticipated for this option that private industry would provide the solution (i.e., facilities to process and convert recyclate into feedstock for manufacturing) however Councils may play an important role in facilitation and providing feedstock to these facilities, which in turn will help progress regional resource recovery rates.

3.3 Options

Nine options packages were assessed at the multi-criteria assessment (MCA) workshop. Packages were assessed against their ability to meet the objectives of the project, using criteria including:

- Waste diversion and resource recovery
- Environmental impact
- Downstream economic impact
- Cost
- Community impact.

The packages are displayed in Figure 1.

Package	Package 1	Package 2	Package 3	Package 4	Package 5	Package 6	Package 7	Package 8	Package 9	Package 10
Intervention level	Minimum intervention	Low intervention A	Low intervention B	Medium intervention A	Medium intervention B	Medium intervention C	High intervention A	High intervention B	High intervention C	High intervention D
Organics solution	-	GO to composting incl collection	FOGO to composting incl collection	FOGO to AD incl collection	FOGO to composting incl collection	FOGO to composting incl collection	FOGO to composting incl collection	FOGO to composting incl collection	FOGO to composting incl collection	FOGO to composting incl collection
Kerbside recycling solution	Business as usual (BAU) comingled	BAU comingled	BAU comingled	BAU comingled	Comingled Kerbside (new or BAU) with collection to MRF	Comingled Kerbside (new or BAU) with collection to MRF	Comingled Kerbside (new or BAU) with collection to MRF	Comingled Kerbside (new or BAU) with collection to MRF	Comingled Kerbside (new or BAU) with collection to MRF	Comingled Kerbside (new or BAU) with collection to MRF
Residual waste solution	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill + EfW/AWT (in region)	Landfill + EfW/AWT (regional)	Landfill + PEF/RDF	Landfill + PEF/RDF
Feedstock location	In region	In region	In region	In region	In region	In region	In region	Attract EfW feedstock i.e. MSW/C&I from out of region	Attract C&I and C&D waste through pricing	Attract C&I and C&D waste through pricing
Processing capacity	Out of region	Out of region	Out of region	Out of region	Out of region	Beneficiation locally (plastic, tyres)	Out of region	Beneficiation locally (plastic, tyres)	Out of region	Beneficiation locally (plastic, tyres)

Figure 1: Options packages

The three packages that scored the highest (illustrated above) were assessed in the economic appraisal and are:

- Package 3 - Low intervention B
- Package 6 - Medium intervention C
- Package 8 - High intervention B
- Package 10 – High intervention D.

It is important to note that each Council is different in geographic area, population, resource recovery capability and local economic drivers. The proposed packages are regional solutions, however, are not ‘one size fits all’. In addition to the proposed regional solutions, Councils can:

- Maintain existing service and other non-red bin activities such as self-haul etc.
- Opt-in (or -out) of proposed solutions for certain waste streams if it is not commercially feasible/viable, in favour of a more local solution
- Collaborate as a region on problem solving (e.g., disaster waste, problem wastes)
- Deliver regional education campaigns to improve community understanding and behaviour
- Provide feedstock to regional facilities, such as the regional MRF
- Collaborate for transport solutions or hub and spoke style models
- Participate in regional solutions in the future once sufficient capacity/demand is achieved locally
- Investigate opportunities to work with industry to facilitate or support non-council managed waste for example, tyres, plastic and glass.

The analysis is predicated on a number of assumptions, including:

- For each package, it is assumed that the waste infrastructure (e.g., FOGO processing, beneficiation facilities, EfW facility) is located at an appropriate location in the Rockhampton LGA (to be determined in the future) near the MRF, to estimate required transport costs.
- The package descriptions below are incremental to ‘business as usual’ waste management and resource recovery practices.

3.3.1 Package 3 – low intervention B

As a low intervention option, Package 3 involves the introduction of kerbside FOGO collection and composting in Rockhampton and Gladstone. It is assumed that open windrow facilities are constructed in both LGAs. All other waste streams are managed as per the base case. The package and its components are outlined in Table 4.

Table 4: Package 3 implementation (commencing operations)

	Banana Shire	Central Highlands	Gladstone	Livingstone	Rockhampton	Woorabinda
Kerbside FOGO collection	-	-	2026	-	2026	-
FOGO education	-	-	2024	-	2024	-

3.3.2 Package 6 – medium intervention C

As a medium intervention option, Package 6 incorporates the Package 3 FOGO solution, as well as expanded recycling collection in Central Highlands, Gladstone, and Livingstone (where households do not have an existing recycling service), as well as local beneficiation of collected recyclables. The package and its components are outlined in Table 5.

Table 5: Package 6 implementation (commencing operations)

	Banana Shire	Central Highlands	Gladstone	Livingstone	Rockhampton	Woorabinda
Kerbside FOGO collection	-	-	2026	-	2026	-
FOGO education	-	-	2024	-	2024	-
Expanded kerbside recycling collection	-	2026	-	2026	-	-
New regional MRF					2026	
Recycling education	2024	2024	2024	2024	2024	2024
Local beneficiation	-	-	-	-	2028*	-

**Available recyclate from all LGAs transported to beneficiation facility (assumed Rockhampton but could be located anywhere in region)*

3.3.3 Package 8 – high intervention B

As the highest intervention option, this package provides a solution for all headline waste streams. It incorporates an EfW facility to recover residual waste, in addition to the FOGO and kerbside recycling solutions included in Packages 3 and 6. Residual waste from all LGAs is transported to a regional facility in Rockhampton. The package and its components are outlined in Table 6.

Table 6: Package 8 implementation (commencing operations)

	Banana Shire	Central Highlands	Gladstone	Livingstone	Rockhampton	Woorabinda
Kerbside FOGO collection	-	-	2026	-	2026	-
FOGO education	-	-	2024	-	2024	-
Expanded kerbside recycling collection	-	2026	-	2026	-	-
New regional MRF					2026	
Recycling education	2024	2024	2024	2024	2024	2024

	Banana Shire	Central Highlands	Gladstone	Livingstone	Rockhampton	Woorabinda
Local beneficiation	-	-	-	-	2028*	-
EfW facility	-	-	-	-	2036**	-

**Available recyclate from all LGAs transported to beneficiation facility (assumed Rockhampton but could be located anywhere in region)*

***Residual waste from all LGAs transported to EfW facility (assumed Rockhampton but could be located anywhere in region)*

3.3.4 Package 10 – high intervention D

As the highest intervention option, this package provides a solution for all headline waste streams. It incorporates a PEF/RDF facility to recover residual waste, in addition to the FOGO and kerbside recycling solutions included. Residual waste from all LGAs is transported to a regional facility in Rockhampton. The package and its components are outlined in Table 7.

Table 7: Package 10 implementation (commencing operations)

	Banana Shire	Central Highlands	Gladstone	Livingstone	Rockhampton	Woorabinda
Kerbside FOGO collection	-	-	2026	-	2026	-
FOGO education	-	-	2024	-	2024	-
Expanded kerbside recycling collection	-	2026	-	2026	-	-
New regional MRF					2026	
Recycling education	2024	2024	2024	2024	2024	2024
Local beneficiation	-	-	-	-	2028*	-
PEF/RDF facility	-	-	-	-	2036**	-

**Available recyclate from all LGAs transported to beneficiation facility (assumed Rockhampton but could be located anywhere in region)*

*** Residual waste from all LGAs transported to PEF/RDF facility (assumed Gladstone but could be located anywhere in region)*

4 Costs

The costs of the packages that form part of the economic analysis include capital, lifecycle and operating costs of new infrastructure as well as education costs, transport and collection costs.

4.1 Capital expenditure

Owing to the preliminary nature of the analysis, assumptions have been made regarding the technology, scale and location of resource recovery facilities and requirements in CQ. Sensitivity testing will utilise different technologies to understand how this effects the economic analysis.

The estimated capital costs (CAPEX) for the facilities were provided by SLR, using industry benchmarks, information from Councils, and supplemented with desktop research. Detailed cost estimates were not undertaken for the analysis and the costs do not include land acquisition or site preparation. A description of key cost inclusions in the core scenario is presented in Table 8.

Table 8: Capital cost inclusions

Capital cost item	Description
FOGO facility	Organic waste (kerbside) will be collected from Rockhampton and Gladstone and processed in region Location: Rockhampton and Gladstone LGA Technology: Open windrow composting Scale: Up to 30,000 tonnes per annum (tpa)
Transfer/bulking station infrastructure	New transfer stations/bulking stations may be required to sort waste in each Council area prior to be transported to the regional facilities. Allowance has been made for one station per Council that has opted in. Location: Specific location for upgrades or new facilities not known at this stage. Technology: Surface infrastructure amendments to provide new pads, storage locations, access roads and other enabling infrastructure. Cost estimates for these sites may vary depending on existing infrastructure, scale, complexity (i.e., if developed on landfill or new site) as well as specific mobile or fixed plant required. Scale: 10,000 tpa at each station
EfW facility	Residual waste will be collected from Councils across CQ and transported to a regional facility to be processed. Location: Rockhampton LGA Technology: Combustion (incineration with energy recovery) Scale: 250,000 tpa
PEF/RDF facility	Residual waste will be collected from Councils across CQ and transported to a regional facility in Gladstone to be processed. The fuel will then be transported for use, with the aim of sending to the Cement Kiln in Gladstone or other large solid fuel consumers in the region. Location: Gladstone LGA Technology: Waste to Fuel Conversion Scale: Up to 100,000* tpa
Bin provision	New kerbside organics and recycling services will require provision of bins to households. Provision for collection vehicles has not been included as the procurement and operating

Capital cost item	Description
	model for these new services is unknown (i.e. it has been assumed these are incorporated as part of a contracted bin lift cost (detailed in the operating costs)). Location: Councils introducing kerbside FOGO collection and/or expanding kerbside recycling collection Inclusions: 240L GO bin, FO kitchen caddy and liner, 240L recycling bin
Beneficiation facilities	Local beneficiation facilities have been assumed to include: • Plastic processing • Paper processing. For the purpose of this analysis, it is assumed that these facilities are located in Rockhampton.
Lifecycle cots	Lifecycle costs represent the cost of owning and maintaining a facility. The lifecycle costs have been estimated at 2.5% of CAPEX annually.

* Scale for PEF/RDF manufacturing to be determined through detailed assessment in collaboration with fuel offtakers

A summary of the capital costs is presented in Table 9.

Table 9: Capital costs ($2023, real, millions)

Component	Package 3	Package 6	Package 8	Package 10
FOGO facility (x 2)	5.70	5.70	5.70	5.70
Transfer/bulking station upgrades	-	5.00	5.00	5.00
MRF	-	18.00*	18.00	18.00
EfW facility	-	--	310.00	-
PEF/RDF production facility	-		-	15.00
Bin provision	3.57	3.58	3.58	3.58
Beneficiation facilities	-	13.25	13.25	13.25
Total CAPEX	**9.27**	**45.53**	**355.53**	**60.53**

4.2 Operational Expenditure

The estimated operating costs (OPEX) for the facilities were provided by SLR, using industry benchmarks, information from Councils, and supplemented with desktop research. Detailed operating cost estimates were not undertaken for the analysis. Table 10 presents the operating costs over the life of the project.

Table 10: Operating costs ($2023, real, millions)

Component	Package 3	Package 6	Package 8	Package 10
FOGO facility	41.36	41.36	41.36	41.36
Transfer/bulking station	-	2.02	2.02	2.02
MRF	-	28.67	28.67	28.67

Component	Package 3	Package 6	Package 8	Package 10
Bin collection costs	46.89	47.30	47.30	47.30
FOGO education	12.74	12.74	12.74	12.74
Recycling education	-	20.48	20.48	20.48
Transport costs	-	1.45	19.64	23.95
EfW facility*	-	-	377.06	-
PEF/RDF*	-	-	-	54.00
Beneficiation facilities	-	48.10	48.10	48.10
Total OPEX	**100.99**	**202.12**	**597.37**	**278.62**

* Note that the Operating Costs for the EfW and PER/RDF under Packages 8 and 10 do not start operations till FY36 and therefore only 15 years of costs are captured in the appraisal period.

Additional detail on the methodology for different components of OPEX is presented in the sections below.

4.2.1 Infrastructure costs

The proposed packages include the ongoing operation of resource recovery infrastructure in CQ. The inputs used to quantify the operating costs of these facilities are displayed in Table 11.

Table 11: Infrastructure operating cost input assumptions

Infrastructure	Input	Assumption
FOGO facility	$105/tonne 30,000 tpa facility	Utilising annual waste projections for FOGO provided by Arcadis
Transfer/bulking station	$60/tonne 10,000 tpa facility (each station)	Utilising annual waste projections for FOGO/recyclables provided by Arcadis
EfW facility	$225/tonne	Utilising annual waste projections for residual waste provided by Arcadis. Assumes IBA and other residue waste is diverted from landfill otherwise can be significant (+$10 million p.a)
PEF/RDF production facility	$3 million p.a	Utilising annual waste projections for residual waste provided by Arcadis
Beneficiation facilities	Paper: $0.35 million p.a Plastic: $1.5 million p.a	Utilising annual waste projections for recovered recyclable products provided by Arcadis

4.2.2 Bin collection costs

The proposed packages include the introduction or expansion of kerbside FOGO and/or recycling services. The inputs used to quantify costs are displayed in Table 12.

Table 12: Collection cost inputs

Component	Input	Assumption
Kerbside bin provision	FOGO service: Gladstone, Rockhampton Recycling service: Expansion of services for Central Highlands and Livingstone. Rockhampton and Gladstone already have service coverage equivalent to MSW bin.	Based on defined options and waste flow data
Kerbside collection cost ($/bin lift)	Inner regional: $1.95 Outer regional: $2.72 Gladstone: $1.66 Rockhampton: $1.39	Inner regional – Livingstone Outer regional – Central Highlands, Banana Shire, Woorabinda Provided by Arcadis
Households (new/additional)	FOGO service: • Gladstone: 25,175 households • Rockhampton: 32,557 households Additional recycling service: • Central Highlands: 164 households • Gladstone: no additional required • Livingstone: 44 • Rockhampton: no additional required.	Number of new household collection services to match current kerbside MSW collection coverage in each LGA.

4.2.3 Education costs

The proposed packages include provision for education regarding the introduction of organics and expanded recycling collections to households that do not already offer this service. The inputs used to quantify costs are displayed in Table 13.

Table 13: Education cost input assumptions

	Input	Assumption
Ongoing collection support – weekly collection (FOGO)	$8/household	Cost per household to deliver education campaigns and initiatives for a change in kerbside collection
Ongoing collection support – fortnightly collection (comingled recycling)	$8/household	Cost per household to deliver education campaigns and initiatives for a change in kerbside collection

4.2.4 Transport costs

Transporting recovered materials to be reprocessed will result in an increase in transport costs, measured through increased kilometres travelled from LGAs to the regional processing facilities. The transport costs for the collection routes have not been calculated. Transport modelling was not undertaken for this analysis therefore transport costs were calculated using standard national methodology. A summary of the annual transport costs is displayed in Table 14.

Table 14: Annual transport costs ($2023, real)

Component	Input	Assumption
Bulk transport cost by road	$0.147/tonne/km	Source: SLR
Cost for local transport (from PEF facility to cement kiln)	$0.45/tonne/km	Source: SLR
Kilometres travelled to Rockhampton MRF/EfW facility	From Biloela Transfer Station, Banana: 138.76 From Blackwater Landfill, Central Highlands: 194km From Benaraby Regional Landfill, Gladstone: 123km From Yeppoon Landfill, Livingstone: 51km	Assumed start location is existing landfill in each LGA and regional facilities are location proximate to Rockhampton MRF
Kilometres travelled to Gladstone PEF/RDF facility	From Blackwater Landfill, Central Highlands: 318km From Gracemere Landfill, Rockhampton: 123km From Yeppoon Landfill, Livingstone: 163km	Assumed start location is existing landfill in each LGA and regional facility is proximate to Gladstone landfill.

4.3 Summary of costs

A summary of the costs over the life of the project for each option is displayed in Table 15. The costs of the project were calculated over the lifetime of the project with two distinct periods:

- Construction period
- Operational period.

CAPEX is calculated as only occurring in the construction period. OPEX, transport costs, education, and bin collection costs are calculated as only occurring in the operational period.

Table 15: Summary of costs ($2023, millions)

Cost	Real	PV
Package 3		
CAPEX	5.70	4.65
Lifecycle costs	3.99	1.41
OPEX	54.10	19.14
Transport and bin costs	50.46	19.50
Total	**114.25**	**44.71**
Package 6		
CAPEX	41.95	33.72
Lifecycle costs	29.85	10.85

Cost	Real	PV
OPEX	153.37	52.23
Transport and bin costs	52.33	20.13
Total	**277.50**	**116.93**
Package 8		
CAPEX	351.95	181.67
Lifecycle costs	208.78	62.21
OPEX	530.42	141.67
Transport and bin costs	70.52	24.47
Total	**1,161.68**	**410.02**
Package 10		
CAPEX	56.95	40.16
Lifecycle costs	37.50	12.85
OPEX	207.37	64.76
Transport and bin costs	74.83	25.44
Total	**376.64**	**143.21**

5 Benefits

5.1 Overview of benefits

Table 16 provides an overview of the identified benefits and disbenefits in each category, and notes whether they can be monetised for inclusion in the CBA.

Table 16: Overview of benefits

Benefits/disbenefits	Description	Monetised
Benefits		
Reduction in waste to landfill	Value of airspace at landfill as a proxy for deferred investment in expanding landfill	Yes
Increased resource recovery and reuse	Value of beneficiated products (recyclables and FOGO)	Yes
Energy and environmental benefits	Value of carbon saved from redirecting FOGO waste to composting (rather than remaining in landfill) Value of carbon saved from redirecting residual waste to EfW (rather than remaining in landfill) Value of energy	Yes
Avoided cost of levy	Reduced waste to landfill will reduce to ongoing cost of the residual waste levy for Council	No
Reduction in environmental impacts (leachate, landfill, fires etc)	Reduced volumes of waste in landfill owing to higher resource recovery	No
Reduction in illegal dumping	Reduction in illegal dumping as residents have more options for resource recovery and disposal	No
Improved waste management practices	Provision of waste management education and additional waste management solutions resulting in improved household and industry practices	No
Increased downstream industry capacity and resulting economic activity in CQ	Manufacturing and processing activity in the region owing to the increase in feedstock available for local beneficiation	No
Better informed community	Resulting from waste management education	No
Increase in local skilled jobs	Increase in jobs in CQ across multiple industries	No
Improved value for money of waste management (environmental, social, economic)	More sustainable waste management will lead to improved long-term outcomes for Council and the community through reduced fees and better environmental outcomes	No
Development of local circular economies for recovered materials	Access to beneficiated materials provides opportunity for development of local circular economies	No
Ability to meet State and Federal targets	Increased diversion rates and use of secondary raw materials with reduced volumes of waste to landfill	No
Disbenefits		
Negative environmental externalities	Increase in transport emissions as a result of a transporting waste	Yes

Benefits/disbenefits	Description	Monetised
Impact to rate payers	Increase in rates for householders due to costs associated with package implementation. This is not monetised as an economic benefit, however, a high-level analysis has been undertaken in Section 6.3.	No

5.1.1 Monetisable benefits

Value of airspace at landfill

The implementation of the packages proposed in the RWRRMP will incentivise community and industry to improve waste management practices by providing additional solutions for resource recovery through Council and industry led services.

Within each package, there will be an opportunity for the community to increase resource recovery by utilising new household collection services and for industry to reduce waste through the provision of new waste processing facilities. This will reduce the volume of waste deposited at landfill, increasing the available airspace and potentially prolonging the life of the asset. To reflect the value of the saved landfill airspace to the economy, the value of the airspace has been calculated.

Assumptions

The estimated benefit of the value of airspace at landfill relies on a number of industry level benchmarks and assumptions, including:

- Waste volume projections across each LGA have been forecast by Arcadis
- The introduction of FOGO education and composting capability in CQ will incentivise the community in select LGAs to separate waste at the household level, using a new bin collection service that will reduce volumes of organic household waste going to landfill. The analysis assumes capture of Food and Garden Organics in the same FOGO stream rather than individual streams.
- The introduction of an expanded recycling collection service (where one does not exist already) coupled with waste education in CQ will incentivise the community to improve waste separation behaviour at the household level that will reduce volumes of recyclable materials going to landfill
- The development of an EfW facility or a PEF/RDF facility will utilise volumes of residual waste that are unable to be recycled, reducing the volumes of waste going to landfill however, landfill will still be required for residual wastes.
- The value of the benefit can be represented through the value of the gate fees at each landfill. Landfill gate fees typically cover the costs of operation, overheads, mobile plant and equipment, labour depreciation costs of roads and building and other fixed assets and profit[11]. It is assumed that the gate fees also account for future post-closure management, rehabilitation and long-term monitoring and replacement of the asset.

Table 17 lists the assumptions used to calculate the total landfill airspace benefit to Councils in CQ.

Table 17: Value of airspace benefit input assumptions

Input	Assumption	Source
Gate fees at landfill ($2023)	$190	As gate fees differ across material streams within each municipality, a general commercial rate was used across the region.
Waste volumes	Baseline current residual waste volume projections	Arcadis: CQ WMP Options Model v2.2

[11] MRA Consulting Group (2015). What is air worth? How to price a landfill. Accessed at https://mraconsulting.com.au/what-is-air-worth-appropriately-pricing-landfills/

Input	Assumption	Source
	Forecast residual waste volume projections based on intervention package implemented	Waste projections are based on QWDS data and Council validation and also consider projected population growth and capture rates of waste streams

Approach to monetise

Using these assumptions, the value of landfill airspace has been calculated for each relevant Package. The following equations were used to calculate the avoided cost at each landfill over the appraisal period:

$$Baseline\ residual\ waste\ volumes - projected\ landfill\ volumes\ with\ intervention - = waste\ volume\ diverted\ from\ landfill$$

$$Waste\ volume\ diverted\ from\ landfill * landfill\ gate\ fee = value\ of\ airspace\ saved$$

The results of these calculations for each LGA were summed to calculate the total benefit under each package.

Value of recovered and reprocessed products

Increased collection services and waste education in CQ is expected to result in better waste management practices and subsequent volumes of sorted materials that can be reprocessed for use. The implementation of reprocessing facilities, such as composting or glass/plastic/paper beneficiation plants are able to turn diverted waste volumes into secondary raw products that have value. As such, this benefit represents the avoided cost of making each product from raw materials.

Assumptions

The estimated benefit of the value of reprocessed products relies on a number of industry level benchmarks and assumptions, including:

- The increase in kerbside collection of organic and recyclable materials, as well as improved education regarding resource recovery in CQ will incentivise the community to separate waste and provide enough feedstock for use as secondary raw materials
- Industry will be incentivised to invest in the region and establish reprocessing operations, most likely in a larger LGA such as Rockhampton or Gladstone, close to the location of sorted feedstock
- The value of the benefit can be represented through the value (sale price) of the product after it has been reprocessed.

Input assumptions are presented in Table 18.

Table 18: Value of reprocessed product input assumptions

Input	Assumption	Source
Waste volumes	Forecast volume of materials diverted through improved kerbside collection Forecast residual waste projections based on Package implemented	Arcadis: CQ WMP Options Model v2.0 Waste projections are based on QWDS data and Council validation and also consider projected population growth and capture rates of waste streams
Product value	Compost: $0/t Plastic pellets: $350/t Paper: $160/t	Compost: Assumed compost value as requested by Council's for FOGO processing was $0 per tonne. A compost sale price of $30 and $120, depending on the quality of the compost was tested as a sensitivity

Input	Assumption	Source
		Glass: Department of Environment and Energy 2019[12] Plastic and paper: Department of Agriculture 2019[13]
Conversion factor	Compost: 0.5 Plastic, paper 0.8 Used to determine the loss in material volume after waste has been processed	Industry benchmarking

Approach to monetise

Using these assumptions, the value of landfill airspace has been calculated for each relevant Package. The following equation was used to calculate the avoided cost at each landfill over the appraisal period:

$$Projected\ waste\ volume\ for\ each\ stream * conversion\ factor * \$/tonne = value\ of\ product$$

Energy and environmental benefit

The delivery of an EfW facility to process residual waste that cannot be recovered has three primary benefit streams:

- Value of energy – electricity from EfW facility (Package 8) and fuel from PEF/RDF facility (Package 10).
- Value of carbon saved from redirecting FOGO to composting from landfill
- Value of carbon saved from redirecting waste to EfW from landfill.

Value of energy

EfW technology combusts waste at extremely high temperatures to generate steam which is then used to produce electricity – the process can also produce other usable industrial by-products. EfW facilities produce less carbon emissions per kilowatt hour (kWh) of electricity than many other plants and provide the opportunity to sell electricity generated at the facility. The value of electricity from the EfW facility in Package 8 has been monetised as a benefit.

PEF is a ready-to-use alternative fuel source, generated from select dry commercial, industrial, mixed construction and demolition materials. It is a practical and sustainable alternative to the use of fossil fuels in cement kilns. The value of PEF that can be sold to cement kilns has been monetised as a benefit for Package 10.

Value of carbon saved

Savings in the range of 200kg to 800kg carbon dioxide per tonne of waste could be realised if waste to energy replaces landfilling[14]. The potential carbon savings have been monetised by comparing the base case residual waste volumes and carbon emissions, with the resulting residual waste volumes and carbon emissions from intervention with the project options.

[12] Department of the Environment and Energy (2019). Assessment of Australian recycling infrastructure – Glass packaging. Accessed at https://www.agriculture.gov.au/sites/default/files/documents/assessment-australian-recycling-infrastructure-glass-packaging.pdf
[13] Department of Environment and Energy (2019). Recycling market situation: Summary review. Accessed at https://www.dcceew.gov.au/sites/default/files/documents/recycling-market-review-paper.pdf
14 The Role of Waste-to-Energy in the EU's Long-Term Greenhouse Gas Emissions Reduction Strategy. Accessed at https://www.vivis.de/wp-content/uploads/WM8/2018_wm_025-036_clerens

Assumptions

The estimated benefit of the value of avoided carbon emissions relies on a number of industry level benchmarks and assumptions, including:

- There are sufficient residual waste volumes for EfW treatment and electricity produced is able to be connected into the National Electricity Market or sold behind the metre
- The value of this benefit can be represented through the current price of an Australian Carbon Credit Unit (ACCU) given that the avoided carbon emissions could be sold as credits.

Input assumptions are presented in Table 19.

Table 19: Value of energy benefit input assumptions

Input	Assumption	Source
Waste volumes	Forecast residual waste projections based on Package implemented. Residual waste volumes for an EfW facility include MSW, C&I and C&D. Residual waste volumes for the PEF.RDF facility include C&I and C&D.	Arcadis: CQ WMP Options Model v2.0 Waste projections are based on QWDS data and Council validation and also consider projected population growth and capture rates of waste streams
Value of energy from EfW facility	Conversion factor = 621.92kWh/tonne Energy price = $0.195/kWh	Industry benchmarks[15] [16]
Value of PEF	Conversion factor = 50% i.e., volume of output is 50% of volume of feedstock PEF price = US$187/t	Desktop research based on ResourceCo facility tonnes of waste and output of PEF[17] Assumed PEF price is approximately 70% of coal price, reflecting ratio of calorific value. Coal price futures[18]
Value of CO_2-equivalent	FOGO landfill CO_2-e emissions factor: 1.85 FOGO compost CO_2-e emissions factors: CH_4: 0.021, N_2O: 0.025	Landfill emissions factor is the average of emissions factors for food waste and garden waste National Greenhouse Accounts Factors. 2021
Carbon savings EfW	Carbon savings per tonne if EfW replaces landfill = 600kg	The Role of Waste-to-Energy in the EU's long term greenhouse gas emissions reduction strategy[19]
Price of carbon	ACCU = $31.00/t of carbon	Clean Energy Regulator[20]

Approach to monetise

Using these assumptions, the value of avoided carbon emissions has been calculated for each relevant Package. The following equations were used to calculate the avoided cost at each landfill over the appraisal period:

[15] Global Syngas Technology Council. Waste to Energy Gasification. Accessed at https://globalsyngas.org/syngas-technology/syngas-production/waste-to-energy-gasification/
[16] Renewable and Sustainable Energy Reviews Journal (2019). An evaluation of the potential of waste to energy technologies for residual solid waste in New South Wales, Australia. Accessed at https://cdn.revolutionise.com.au/cups/bioenergy/files/4reyuetqtzsbcjh5.pdf
[17] Australian Waste and Recycling Expo. Process Engineered Fuel. Accessed at https://awre.com.au/recycling/processed-engineered-fuel/
[18] Trading Economics. Coal. https://tradingeconomics.com/commodity/coal
[19] The Role of Waste-to-Energy in the EU's long term greenhouse gas emissions reduction strategy. Accessed at https://www.vivis.de/wp-content/uploads/WM8/2018_wm_025-036_clerens
[20] Australian carbon credit units (ACCUs). Accessed at https://www.cleanenergyregulator.gov.au/Infohub/Markets/Pages/qcmr/september-quarter-2022/Australian-carbon-credit-units-(ACCUs).aspx

$$Volume\ of\ residual\ waste * EfW\ conversion\ factor = energy\ produced\ from\ residual\ waste$$

$$Energy\ produced * energy\ price = value\ of\ energy$$

$$Volume\ of\ residual\ waste\ *\ PEF\ conversion\ factor\ =\ volume\ of\ PEF\ produced$$

$$Volume\ of\ PEF\ produced\ *\ PEF\ price\ =\ value\ of\ PEF$$

$$Volume\ of\ residual\ waste * savings\ factor = tonnes\ of\ waste\ removed$$

$$Tonnes\ of\ waste\ removed * price\ of\ carbon = total\ carbon\ savings\ from\ transition\ to\ waste\ to\ energy$$

5.1.2 Monetisable disbenefits

Environmental externalities

Changes to the pattern and distance of travel by freight vehicles results in reduced urban amenity and increased costs to the environment by increasing the total distance travelled for waste transportation. Table 20 displays the assumptions used to calculate the environmental disbenefit.

Table 20: Environmental externalities input assumptions

Input	Assumption		Source
Environmental impacts	**Environmental impact ($2021)**	**$/1000 tkm**	*Australian Transport Assessment and Planning Guidelines PV5*, 2021[21]
	Air pollution	0.57	
	Climate change	3.53	
	Well-to-tank emissions	1.06	
	Noise	0.08	
	Soil and water	0.98	
	Nature and landscape	3.31	
	Urban effects	0	
	Biodiversity	2.86	
	Total	**$12.39/tkm**	
Waste volumes	Forecast volume of organics and recyclable materials diverted through improved kerbside collection and self-haul volumes		Arcadis: CQ WMP Options Model v2.0 Waste projections are based on QWDS data and Council validation and also consider projected population growth and capture rates of waste streams
Kilometres travelled to Rockhampton MRF/EfW/PEF facility	Refer to Section 4.2.4		Refer to Section 4.2.4

[21] Australian Transport Assessment and Planning Guidelines (2021). PV5 Environmental parameter values. Accessed at https://www.atap.gov.au/sites/default/files/documents/pv5-multi-modal-update.pdf

Approach to monetise

Using these assumptions, the value of transport emissions has been calculated for each package. The following equations were used to calculate the annual transport emissions over the appraisal period:

$$Volumes\ of\ waste * kilometres\ traveled * \$tkm = \ environmental\ impact$$

5.1.3 Non-monetisable benefits

New upstream and downstream economic activity attracted to the region

Development of new waste sorting and processing infrastructure in CQ will provide economic stimulus to the regions where infrastructure is developed, as well as Queensland more broadly. Increasing resource recovery services available in CQ will require increased inputs throughout the supply chain, which may encourage businesses to establish in CQ to be closer to the market. New upstream and downstream industrial activity in CQ will increase the resilience of the region through increased diversity of services and will decrease reliance on suppliers based elsewhere. This will improve efficiency for business and industry within CQ, potentially reduce logistics costs and further stimulate job growth in CQ.

Increased Gross Regional Product (GRP)

The whole of the CQ is expected to benefit from improving waste management and the development of new waste industries due to increased GRP. GRP is a measurement of the total final value of goods produced in a region. Central Queensland is a major contributor to the state and national economy, generating $17 billion in Gross Regional Product in 2019. The investment in resource recovery infrastructure and associated downstream industry activity is expected to support an increase in GRP, through stimulating the demand for resource recovery services and encouraging private investment in the region.

An increase in resource recovery services may provide better offerings for businesses and greater diversity in waste management options. This may increase the attractiveness of CQ to private investors, however, the impact on the cost of resource recovery may be a deterrent for some investors.

Increased jobs

Investment in resource recovery infrastructure across CQ is expected to create direct jobs as well as indirect jobs in upstream and downstream industries during construction and operations. Industries that will be positively impacted include:

- Waste management: there may be an increase in jobs across the waste industry in waste management and resource recovery services, compliance and enforcement, data analysis and monitoring, waste collection, infrastructure operations and maintenance across the public and private sector.
- Materials production/manufacturing: increased volumes of secondary raw materials may lead to an increase in demand for recycled materials and inputs in the supply chain from businesses that are seeking to increase sustainability of their operations. The input materials can be sourced locally from newly established and expanded businesses within CQ, requiring an increase in production and manufacturing jobs in the region to cater for the increased demand of such goods.
- Logistics: indirectly, the project will increase jobs in transport and logistics companies as waste services and transportation requirements are expanded across CQ.

Meeting Queensland resource recovery targets

Most LGAs within Central Queensland have set targets to work towards a circular economy and reduce waste disposal in landfills. The Central Queensland recovery rate is reported in the Queensland Waste and Resource Recovery Infrastructure Report as approximately 39% for all waste streams, which is lower than the state average of 45%. To reach the State target, upgrades to infrastructure, policy and initiatives are required at both an individual Council and regional level. Currently, the region has no MRF due to the Rockhampton facility fire in 2020 and there are significant barriers for other LGAs to collect and transport waste. Organics processing in the region is also limited to mulching at Council landfills. However, without a fundamental shift in policy or investment in infrastructure, State and Federal targets will not be met.

6 CBA results

This section consolidates the costs and benefits to present the headline BCR and economic NPV.

6.1 Summary of costs and benefits

Table 21 summarises the total discounted incremental costs and benefits for the Project, based on the estimation of project benefits and costs relative to the base case. Incremental costs are dominated by capital expenditures. The incremental benefits are dominated by the value of landfill airspace.

Table 21: Summary of costs and benefits ($2023, millions, discounted at 7%)

Expenditure item	Package 3	Package 6	Package 8	Package 10
Costs				
CAPEX	4.65	33.72	181.67	40.16
Lifecycle costs	1.41	10.85	62.21	12.85
OPEX	19.14	52.23	141.67	64.76
Transport and collection costs	19.50	20.13	24.47	25.44
Total costs	**44.71**	**116.93**	**410.02**	**143.21**
Benefits				
Value of airspace at landfill	5.94	17.35	91.72	71.28
Value of compost	0.00	0.00	0.00	0.00
Value of carbon savings (FOGO)	7.57	7.57	7.57	7.57
Value of beneficiated products	0.00	8.72	8.84	8.53
Value of energy	0.00	0.00	7.39	5.38
Value of carbon savings (EfW/PEF)	0.00	0.00	7.39	5.38
Environmental disbenefit	0.00	-0.04	-0.40	-0.49
Total Benefits	13.52	33.60	122.51	97.66
NPV	**-31.20**	**-83.33**	**-287.51**	**-45.55**
BCR	**0.30**	**0.29**	**0.30**	**0.68**

Figure 2 displays the resulting residual waste from each package, compared to the residual waste under a business-as-usual scenario. The increasing waste volumes are a result of increasing population growth in the region.

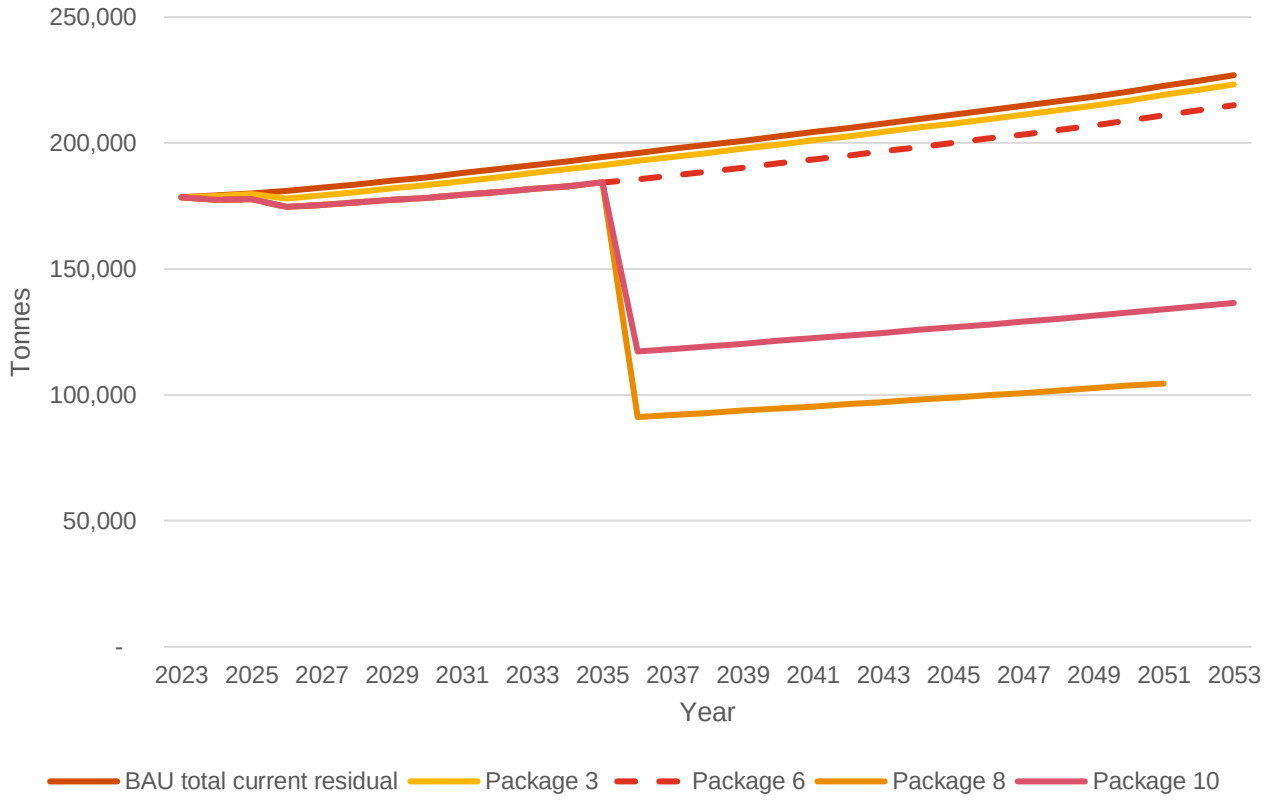

Figure 2: Residual waste from package implementation

The economic analysis results indicate that Package 10 is the preferred option, owing to more even ratio of costs to benefits relative to other options. While Package 8 results in more resources diverted out of landfill (airspace available), the costs of constructing and operating an EfW facility outweighs the benefits, even though they are the highest among all packages.

While the economic analysis results result in negative NPVs and BCRs lower than one, this does not mean the project is not economically viable. The economic analysis has been undertaken from a regional perspective, assuming that all Councils are involved in each component where viable. However, as discussed in Section 3.3, there is scope for Councils to 'opt-out' of some components of the packages. This would reduce capital costs, costs for transfer/bulking infrastructure, collection and transport costs as well as operating costs where they are dependent on throughput.

It is recommended that further analysis is undertaken by Councils with detailed cost estimates of infrastructure as this is a key driver of economic viability.

6.1.1 No beneficiation scenario

It is likely the local beneficiation will be undertaken by the private sector and as such, a scenario assessment was undertaken to exclude the costs and benefits of local beneficiation, to understand the effect that this component has on the economic results.

Noting beneficiation is not included in Package 3 in the core scenario, the headline economic results excluding beneficiation are presented in Table 22.

Table 22: No beneficiation scenario results ($2023, PV)

Expenditure item	Package 3	Package 6	Package 8	Package 10
Total costs	44.71	88.39	381.36	114.67
Total benefits	13.52	24.89	113.67	89.13
NPV	-31.20	-63.51	-267.69	-25.54
BCR	0.30	0.28	0.30	0.78

6.2 Sensitivity analysis

This section presents a range of sensitivity and scenario analyses applied to the default economic analysis results. Several analyses have been undertaken to assess the responsiveness of the economic modelling results with respect to changes to key parameters and assumptions.

The analysis in this section is focused on specific alternative scenarios for key assumptions, reflecting different outcomes for Project performance or impact. Table 23 outlines the results from the sensitivity testing undertaken.

Table 23: Sensitivity analysis ($2023, millions)

Scenario		Package 3	Package 6	Package 8	Package 10
Core	**NPV**	**-31.20**	**-83.33**	**-287.51**	**-45.55**
	BCR	**0.30**	**0.29**	**0.30**	**0.68**
4% discount rate	NPV	-43.29	-109.34	-402.62	-37.26
	BCR	0.32	0.32	0.35	0.82
10% discount rate	NPV	-23.79	-66.82	-212.30	-46.46
	BCR	0.28	0.26	0.26	0.56
20% increase in CAPEX	NPV	-32.41	-92.24	-336.29	-56.15
	BCR	0.29	0.27	0.27	0.63
20% decrease in CAPEX	NPV	-29.98	-74.42	-238.73	-34.95
	BCR	0.31	0.31	0.34	0.74
20% increase in OPEX	NPV	-35.02	-88.88	-310.95	-53.60
	BCR	0.28	0.27	0.28	0.65
20% decrease in OPEX	NPV	-27.37	-77.78	-264.07	-37.49
	BCR	0.33	0.30	0.32	0.72
20% increase in transport costs	NPV	-31.20	-83.42	-288.47	-46.70
	BCR	0.30	0.29	0.30	0.68
20% increase in bin collection costs	NPV	-31.20	-83.23	-286.55	-44.39
	BCR	0.30	0.29	0.30	0.69
Compost sale price increased to $30	NPV	-29.16	-81.30	-285.48	-43.52
	BCR	0.35	0.30	0.30	0.70
Compost sale price increased to $120	NPV	-23.07	-75.20	-279.38	-37.42
	BCR	0.48	0.36	0.32	0.74

6.3 Effect on households

To understand the impacts on individual stakeholders such as Queensland Government, Local Government or the private sector, a detailed financial and commercial analysis should be undertaken. A financial and commercial assessment would assess the financial viability of the proposed options packages from the viewpoint of the owner of the infrastructure or initiative, such as Councils or the State. It would consider only those cashflows which directly impact the owner. An economic and financial assessment examine different measures of project viability, and neither should be considered in isolation.

For the purpose of this analysis, a high-level assessment of the effect that each package would have on households at a regional level (i.e., not individual Councils) was undertaken using:

- Estimated costs over the appraisal period excluding beneficiation costs (construction + 30 years of operation)[22]
- The expected reduction in levy payment (for each LGA) due to a reduction in residual waste going to landfill based on the package implemented
  - This was calculated based on each LGAs resulting tonnes of residual waste post package implementation, times the annual levy
  - This analysis also took into account the reduction in annual payments from 1 July 2023, as per Table 24, noting that these payments continue to cover the full levy amount (100%) for LGAs in Central Queensland except Rockhampton and Gladstone over the appraisal period.
- The number of households within the coverage area.

Table 24: Annual payments percentage from 1 July 2023[23]

Financial Year	Gladstone and Rockhampton	All other CQROC LGAs
2022-23	105%	105%
2023-24	95%	100%
2024-25	85%	100%
2025-26	70%	100%
2026-27	60%	100%
2027-28	50%	100%
2028-29	40%	100%
2029-30	30%	100%
2030-31	20%	100%

Table 25 presents the approximate cost and benefit to households in the region over the life of the analysis as well as an approximate annual cost.

Table 25: Cost to households ($PV, 2023)

	Package 3	Package 6	Package 8	Package 10
Total costs over appraisal period ($millions)	44.71	88.39	381.36	114.67
Total levy benefit over appraisal period ($millions)	2.63	6.26	32.51	24.98
Annual cost per household ($/hh)	26.03	51.46	222.01	66.76

[22] Note that the Operating Costs for the EfW and PER/RDF under Packages 8 and 10 do not start operations till FY36 and therefore only 15 years of costs are captured in the appraisal period.

[23] Queensland Government. Waste levy charges from 1 July 2022. https://www.qld.gov.au/environment/management/waste/recovery/disposal-levy/about/from-1-july-2022

	Package 3	Package 6	Package 8	Package 10
Annual levy reduction per household ($/hh)	1.53	3.65	18.92	14.54
Approximate net annual cost per household ($/hh)	**24.50**	**47.81**	**203.09**	**52.21**

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Appendix C:

Waste Flow Modelling Methodology & Assumptions

C1 Modelling Methodology

The following works have been undertaken:

Step 1 - Data Request

- Prepared and issued formal data requests to each Local Government Area (LGA)

Step 2 - Review of Information

- Review of available information including:
  - Suitability for use / data quality
  - Data type (arisings, infrastructure, materials/service, and cost factors).
- Completion of data gap analysis
- Review of future policy and legislative requirements

Step 3 – Stakeholder Engagement

- Attended initial project inception meeting with the CQ RWRRMP Working Group
- Developed baseline status and forecasting for inclusion in CQ RWRRMP Interim Report
- Undertook Options Assessment and Multi Criteria Analysis (MCA) Workshop with key LGA stakeholders to discuss findings of CQ Interim Report.
- Additional follow up sessions with relevant LGAs and Department of Environment and Science (DES) to validate data / address identified data gaps provided to inform waste flow forecasting.

Step 4 - Modelling

- Develop forecast scenarios to analyse variation of generation rates, recovery rates, processing, and landfill demand scenarios for different waste streams
- Develop predictive scenarios based on population change within the region

C2 Data Sources

The following State-wide primary data sets reviewed during the development of this model include:

- Queensland Waste Data Survey (QWDS) – Waste Arisings
- Queensland Waste Resource Recovery Infrastructure Report (QWRRIR) – Waste Infrastructure
- Recycling and Waste Collection Options Tool (RAWCOT) – Waste Materials/Service

In addition, the following CQ region specific data sets were reviewed such as local waste audits / independent studies not captured under the above as summarised below:

- Council responses to the DES Annual Waste Data Survey
- Council data provided for the Queensland Waste and Resource Recovery Infrastructure Report (2019)
- Council waste management strategy, operational Planning, and reporting documents
- Council infrastructure data including remaining airspace
- Council waste site and facility statistics
- Australian Bureau of Statistics government population and householder forecasts
- Studies, business cases and other documentation prepared at a council or regional scale to inform the development of new or optimised services for collection or post-collection
- Workshops, interviews and discussion with regional working groups, councils, mayors, CEOs, councillors, economic development, waste management.

A full list of data sources used is presented in **Table C1** below.

Table C1 Data sources

Title / Dataset	Date	Provided by	Summary
Master facility Register Fixed	31/08/2019	Arcadis	Data base of facility details
2019 Operator Site_Updated LH	18/19	Arcadis	Good infrastructure stocktake for landfills and transfer stations for each LGA
LG Extraction	18/19	Arcadis	Extraction of responses from QWRRIR surveys
CQROC Request_LGA Annual Survey_2014-2020	2014 - 2020	DES	Annual LGA survey for all CQROC Councils from 2014-2020
CQROC Request_LGA Annual Survey_2021	2021	DES	Annual LGA survey for all CQROC Councils for 2021
BSC Waste Reduction & Recycling Plan Final	2015-2018	Banana Shire Council	Information on waste transfer stations what they accept / tonnages. Info on number of kerbside collection services. Info on Landfills / waste acceptance / future life
Project Brief - WM & RR Business Case (3)	2021	Gladstone Regional Council	Plan to develop a waste management & resource recovery business case and implementation Plan

Title / Dataset	Date	Provided by	Summary
Waste Management and Resource Recovery Strategy Technical Report 2019	Nov-19	Gladstone Regional Council	2017/18 data on waste generation, waste services and infrastructure, key issues and **opportunities**, collaboration opportunities between industry and other LGAs
Waste_Management_Strategy Summary Report 2019	2019	Gladstone Regional Council	Waste Strategy - **summary** of challenges and opportunities, priorities, and actions
Project Brief - Waste Plan V3 (1)	2022	Gladstone Regional Council	Project brief for Gladstone Region Waste Service and Asset Growth Plan
Item 5 - Waste Collection and Service	2022	Gladstone Regional Council	Service data
RE Message to Working Group Members - Regional Waste Management Plan	2022	Gladstone Regional Council	Inpuit tonnages at council landfills and transfer stations, costs for site operation, cleansing and disposal, cost breakdown per facility
Item 7 - Current Parcel Services SummaryJul	2022	Gladstone Regional Council	Number of service types per area
Fees_and_Charges_2022_23_Waste_ Management	2022/23	Gladstone Regional Council	Waste charges for 2022/23
Item 9 - Details of current domestic waste contracts	2022/23	Gladstone Regional Council	Lift rates and disposal costs ($/t)
RE Message to Working Group Members - Regional Waste Management Plan 2	2022	Gladstone Regional Council	ExPlanation from forecasting analyst at GRC
Item 16 - Multi -Unit Dwellings	2022	Gladstone Regional Council	MUD's services (number and frequency)
RE Message to Working Group Members - Regional Waste Management Plan 4	2022	Gladstone Regional Council	Email summary of engagement data and reports
620.31106-Central Queensland RFI-Gladstone	2022	Gladstone Regional Council	Summary of RFI response
2022 Waste Education Plan	2022	Rockhampton Regional Council	outlines RRWRs education priorities for the calendar year 2022
6.-2223-FeesCharge-RRWR-Waste-and-Recycling	2022	Rockhampton Regional Council	waste and recycling fees
620.31106-Central Queensland RFI, RRC Response, 26.08.22	10-Aug-22	Rockhampton Regional Council	RFI answers from LGAQ - not much data
Collection Services Option Analysis FINAL	7/5/2020	Rockhampton Regional Council	Collection Services Option Analysis model data
FOGO Trial - Mid-trial Survey Responses @ 02 Aug 22	8/2/2022	Rockhampton Regional Council	Mid-trial Survey Responses fogo trial
FOGO Trial - Pre-trial Survey Responses	pre-08/22	Rockhampton Regional Council	Pre-trial Survey Responses fogo trial
Multi-Year Kerbside Audit Analysis V2.0	12/6/2021		Multi-Year Kerbside Audit Analysis
RE Message to Working Group Members - Regional Waste Management Plan	8/17/2022	Rockhampton Regional Council	EMAIL - NO DATA - DATA IN ATTACHMENT - SEE 034 TAB
RRC Waste Stream Data	2022?	RRC	great generation data

Title / Dataset	Date	Provided by	Summary
RRC-Regional-Waste-Strategy-2020-2030-Final-Email	7/12/1905	RRC	strategy doco - no data
Waste Strategy Survey_Responses_Report_FINAL Nov-2019	11/17/2019	RRC	Draft RRC Waste Strategy 2020-2030 Survey
AppendixData_RRC_2018	2018	RRC	waste compo data and generation rates
Field Results Spreadsheet - RRC Copy	Aug-19	RRC	generation & composition data
AppendixData_RRC_KerbsideAssessment_Jul20	Jul-20	RRC	Kerbside Waste Stream Assessment
AppendixData_RRC_Nov21	Dec-21	RRC	Kerbside Waste Stream Assessment
LSC- 620.31106-Central Queensland RFI	2022	Livingstone Shire Council	Response to RFI

C3 Model Assumptions

Assumptions

Regional waste projections have been developed (see Figure 2) based on the data sources and assumptions summarised below:

- Medium population projection applied
- Per capita generation rates (tonnes per capita) calculated from historical population and waste data
- Two-year historical average per capita rate applied to all waste streams and all councils.
- Historical waste quantities and generation rates are prone to inter-yearly fluctuations due to administrative issues including reporting changes, or underlying changes to consumption.
- Economic and social factors influence what residents and businesses buy, use, consume and dispose of, which is particularly relevant considering COVID-19 induced restrictions.
- Variations are especially prevalent with C&I and C&D waste as these streams are dependent on a range of external market forces and can be price sensitive.
- The Queensland Waste and Resource Recovery Infrastructure Report (QWRRIR) outlined trends in waste generation rates and their relationship with GDP to determine if an adjustment factor might be applied. However, no conclusive adjustment factor was determined due to data quality concerns and inconsistency in waste tonnage data reporting back to 2010-2011.
- At a national scale, the National Waste Data Report 2020,5 reported a 20% reduction in per capita generation of waste for MSW and C&I over a 13-year period, equating to an annual decrease of approximately 2.5%. However, analysis of regional waste generation rates does not support this.

Regional waste projections have been developed based on the assumptions summarised below:

Table C2 Model Assumptions

Title	Input	Description
Population Scenario	Implied Compound Annual Growth Rate (CAGR) of 1.2% for 2021-2031 2021 to 2041 Medium population projection has been applied	CAGR and Medium population scenario applied based on existing QLD State government forecasts: Projected Populations - sourced from QLD Government Statistician's Office (2019) *The State of Queensland, Queensland Treasury, 2022. Projected-dwellings-series-local-government-area-qld-2016-2041.xlsx* accessed at: https://www.qgso.qld.gov.au/statistics/theme/population/population-projections/regions Historical Population - sourced from Queensland Government Statistician's Office (2022), *The State of Queensland, Queensland Treasury, 2022. Estimated-resident-population-lga-qld-2001-2021pr.csv* accessed at: https://www.qgso.qld.gov.au/statistics/theme/population/population-estimates/regions
Generation per capita	Assumed kerbside yield (kg/capita): Banana - 185 Central Highlands – 217 Gladstone – 311 Livingstone – 267 Rockhampton – 310 Woorabinda – 0	Two-year historical average per capita rate applied to all waste streams and all councils. Per capita generation rates (tonnes per capita) calculated from historical population and waste data A two-year average generation rate has been selected to accommodate the drop in C&D waste observed in the 2020-2021 financial year, as this drop is believed to be attributed to COVID and therefore considered unlikely to continue.

Title	Input	Description
Composition Assignment	Kerbside compositions used for: - Banana - 185 - Central Highlands – 217 - Gladstone – 311 - Livingstone – 267 - Rockhampton – 310 - Woorabinda – 0? - Self-haul composition	A series of generic compositions taken from the Recycling and Waste Collection Options Tool (RAWCOT) were used to estimate the relative proportions of materials in the kerbside residual waste stream. The recycling and organics collections had additional material reported through the Queensland Waste Data Survey which was used to inform the wider materials make-up.
Recycling Bin	80% Default bin coverage	Default bin coverage assumption based on Council of Mayors Southeast Queensland (COMSEQ) SEQ Waste Management Plan, Final Report 2021.
Organic Bin Assumptions	100% proportion of food organics can go in Food Organic and Garden Organic (FOGO). 0% proportion of food organics can go in GO 100% proportion of garden organics can go in FOGO 100% of garden organics can go in GO. 80% Default Organics bin coverage 14% Additional GO from service introduction (based on yield per person). 5% Loss of self-haul GO due to FOGO service introduction (best guess estimate / nothing reported).	Organic bin assumptions based on COMSEQ SEQ Waste Management Plan, Final Report 2021. Capture rates based on existing services and review across NSW from Analysis of NSW Food and Garden Bin Audit Data, RAWTEC (2018) FO: High (50%), Med (35%) & Low (25%) GO: High (95%), Med (85%) & Low (75%)

Appendix D:

Implementation Cost Estimate

Table AD-1 Indicative Cost Estimate (costs in millions)

Item	2024	2025	2026	2027	2028	2029	2030	2031	Total to FY31
Regional Implementation									
Project Manager (RWG)	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	**1.44**
Administrative & Legal	0.10	-	-	-	-	-	-	-	**0.10**
Develop detailed implementation Plan	0.05	-	-	-	-	-	-	-	**0.05**
Review RWWP	-	-	-	-	0.10	-	-	-	**0.10**
Meetings (Council FTE requirement)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	**0.39**
Council contribution to actions	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	**0.22**
Sub Total – Plan Implementation	**0.43**	**0.25**	**0.25**	**0.25**	**0.35**	**0.25**	**0.25**	**0.25**	**2.30**
Regional Education Strategy									
Education Strategy (and updates)	0.05	-	0.02	-	0.02	-	0.02	0.00	**0.10**
FOGO implementation, GRC/RRC only	Captured within organic implementation costs below								-
Kerbside Education & Other	Captured within material recycling & recovery costs below								-
Sub-Total – Regional Education	**0.05**	**0.00**	**0.02**	**0.00**	**0.02**	**0.00**	**0.02**	**0.00**	**0.10**
Regional Organics Solution									
FOGO Implementation, GRC only									
Administration, business cases, PM	0.20	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.85
FOGO education costs (new service GRC)	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.08
One off investment (bins) (GRC)	-	-	1.43	-	-	-	-	-	1.43
Collection costs (new, GRC)	-	-	0.55	0.58	0.60	0.61	0.62	0.63	3.59
Processing costs (new, GRC)	-	-	0.64	0.65	0.67	0.69	0.70	0.72	4.08
Sub-Total – New FOGO Service, GRC	**0.34**	**0.34**	**2.83**	**1.44**	**1.48**	**1.51**	**1.53**	**1.56**	**11.03**
FOGO Implementation, RRC only									
Administration, business cases, PM	0.20	0.20	0.08	0.08	0.08	0.08	0.08	0.08	0.85
FOGO education costs (new service RRC)	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	2.08
One off investment (bins) (RRC)	-	-	2.20	-	-	-	-	-	2.20
Collection costs (new, RRC)	-	-	0.91	0.93	0.95	0.97	0.99	1.00	5.75
Processing costs (new, RRC)	-	-	0.93	0.95	0.98	1.00	1.03	1.05	5.94
Sub-Total – New FOGO Service, RRC	**0.46**	**0.46**	**4.38**	**2.22**	**2.26**	**2.31**	**2.35**	**2.39**	**16.82**
Organics Programs									
Community composting	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.80
Roll out of compost bin program	-	0.21	-	-	-	-	-	0.21	0.43
Material flow analysis - organics	0.01	0.02	-	-	-	-	0.02	-	0.05
Sub-Total – Organics Programs	**0.11**	**0.33**	**0.10**	**0.10**	**0.10**	**0.10**	**0.12**	**0.31**	**1.28**
TOTAL (Regional Organics Solution)	**0.91**	**1.13**	**7.30**	**3.76**	**3.84**	**3.91**	**4.01**	**4.26**	**29.13**
Material recovery & recycling solution									
Education Implementation (kerbside + other)	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	5.44
Education Plan (Woorabinda)	-	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.17

Item	2024	2025	2026	2027	2028	2029	2030	2031	Total to FY31
Small scale infrastructure improvements	-	1.25	1.25	1.25	1.25	1.25	1.25		7.50
Community circular economy programs	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.40
Household Hazardous Waste CRCs	-	-	0.20	0.20	0.20	0.20	0.20	-	1.00
New regional scale MRF	0.50	17.50	-	-	-	-	-	-	18.00
Waste audit program	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.64
TOTAL (MRR Solution)	**1.31**	**12.11**	**9.78**	**2.28**	**2.28**	**2.28**	**2.28**	**0.83**	**33.15**
Residual Waste									
Develop regional residual waste solution & business case	-	0.05	0.30	0.30	0.30	0.02	0.02	0.01	1.00
Progress & implement R&D into problematic wastes & disaster wastes	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.80
TOTAL (Residual Solution)	**0.10**	**0.15**	**0.40**	**0.40**	**0.40**	**0.12**	**0.12**	**0.11**	**1.80**
OVERALL TOTAL – IMPLEMENTATION COST FOR RWRRMP TO FY30-31	**2.79**	**13.64**	**17.75**	**6.70**	**6.89**	**6.57**	**6.67**	**5.46**	**66.47**

All costs presented in Million $ based at 2023 rates, BSC-Banana Shire Council, CHRC-Central Highlands Regional Council, GRC-Gladstone Regional Council, LSC-Livingstone Shire Council, RRC-Rockhampton Regional Council, WASC-Woorabinda Aboriginal Shire Council

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