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Assessment of Australian paper & paperboard recycling infrastructure and 2018-19 exports, including to China

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About IndustryEdge

IndustryEdge is Australia's leading trade data, market analysis and intelligence firm in the fibre resources, wood products and pulp & paper sectors.

Established in 1991, the firm publishes independent monthly market analysis for forestry and wood products (Wood Market Edge) and pulp and paper products (Pulp & Paper Edge). *IndustryEdge* also publishes a range of annual reviews, multi-client guides, research reports and associated publications in paper, paper products, pulp, recovered fibre and similar sectors.

As a data focussed analytical business, *IndustryEdge* also supplies a wide range of datasets to clients, on a monthly basis, many of which form the basis for its own analysis activities and consulting assignments.

IndustryEdge undertakes a diverse range of consulting assignments each year, from fibre supply analysis (plantations, recovered paper, pulp etc), through wood processing and wood product market analysis focussed on Australia, into pulp and paper manufacture and bio-processing and its global and local markets, sustainability reporting and a range of investment and business advisory and support activities.

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Qualifications and Disclaimers

The data used in preparing the report was collated and analysed by *IndustryEdge* from sources at its disposal, with due care and attention to detail. The data was up to date at the time the analysis was prepared, but *IndustryEdge* cannot warrant the accuracy of information from data or information from external sources.

We note that the recovered paper export data detailed in this analysis may be different to some other datasets addressing the same materials and timeframes. This is most likely due to changes in the ABS datasets over time, the different times at which data extraction occurred and potentially, different materials definitions.

The data was extracted by *IndustryEdge* in September 2019, from original data supplied by the Australian Bureau of Statistics.

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Recovered paper in context

Each year, Australia recovers a significant proportion of its substantial fibre consumption, in the form of paper and paperboard products. Whether industrially, commercially or domestically, Australians have embraced the recovery and recycling process, especially where it applies to fibre.

While the larger portion of that recovered material is used domestically, mainly for production of recycled corrugated packaging, exports are an important feature of the industry, its supply chain and economics. That the majority of Australia's exports of recovered paper go to China is not an accident.

History demonstrates that China's industrialisation in the 1990s and 2000s and its expansion of production of packaging materials to ship its goods across the globe, coincides with the rise in recovery and exports of fibre materials from Australia and other countries.

In short, demand from China was instrumental, alongside the desire of the Australian population and leadership to improve resource recovery outcomes, to the rise in recovery rates over the last two decades.

Recovered paper is manufactured primarily from biological material for which there are established and well understood recycling processes and outcomes. That too has supported very large volumes of material being collected and recycled, either domestically or in export markets.

Over a relatively short time, under a variety of pressures, the product standards required for supplying recovered paper to China (initially) and other countries (subsequently) have become more refined. Contaminants, prohibitions on certain other materials in recovered paper and general compliance with 'grade' or 'specification' have tightened to the point where export markets are diminished and significantly less recovered paper is being exported.

The Australian Government announced in August 2019 that it proposed to prohibit exports of recovered paper (and other materials) from a date to be determined. This report is prepared with that history and context in mind.

The report 's commentary and analysis assumes export prohibitions will apply to all recovered paper, and does not assume any collateral regulatory controls. This is for ease of analysis and may not be the ultimate design of the prohibitions.



Consumption of paper and paperboard in Australia

Australia's consumption of paper and paperboard totalled 3,095.6 kt in 2018-19. At an aggregate level, paper and paperboard consumption was similar to prior years and within expectations.

The chart below shows consumption, by major grade for the decade up to and including 2018-19.



Australian Apparent Consumption of Paper & Paperboard by Main Grade: 2009 – 2019 (kt)

Source: ABS & IndustryEdge

The four main grades of paper and paperboard and their production and trade details for 2018-19 are shown in the table below.



Consumption, Production and Trade of Paper & Paperboard by Main Grade: 2018-19 (kt)

Grade	Production	Exports	Local Sales	Imports	Consumption
Newsprint	319.0	133.6	185.4	22.5	207.9
Printing & Communication	441.0	69.6	371.4	572.6	944.0
Tissue	210.0	16.6	193.4	121.2	314.6
Packaging & Industrial	2,221.8	908.9	1312.9	316.2	1629.1
Total	3,191.8	1,128.7	2,063.1	1,032.5	3,095.6

Source: ABS & IndustryEdge

It should be noted that the apparent consumption chart and table above do not include either production or imports of:

- Pre-converted fibre packaging (122.2 kt in 2018-19)
- Moulded fibre products (eg. egg cartons)
- Pre-printed material (books, newspapers and magazines) and stationery (import data only records value, not quantity or volume)
- Converted tissue products (import data only records value, not quantity or volume)
- Fibre packaging imported with goods (est. 1,100 kt per annum)

In aggregate therefore, the volume of paper and paperboard assumed for this purpose to have been consumed in Australia in 2018-19 is **4,318 kt**.

Brief descriptions of each of the main grades, their end-use markets and recycling outcomes are detailed in **Appendix One**.



Recycling of fibre in Australia

Recovered fibre (both pre and post-consumer) is used extensively in the production of paper and paperboard in Australia, as is the case in most countries. Recovered fibre is used because it is widely available and is usually a cheaper form of fibre than virgin fibre pulp.

In Australia, recycling of recovered fibre has the added advantage of being a local fibre supply, reducing imports of pulp and decreasing the cost variations associated with currency movements and global pulp price movements.

In 2018-19, Australia's total use of fibre for the manufacture of paper and paperboard was 3,479 kt. Of this, 44.8% or 1,559 kt was supplied by recycled fibre. This proportion has declined from 55.3% a decade ago in 2008-09.

The structural decline in the use of recovered paper (as a proportion of the total) in Australia has been gradual, but continuous. It arises for several reasons that include more intense international competition for all fibre resources, the declining average and marginal quality of recovered paper and increased demand for high quality and high strength virgin fibre packaging materials.



The Australian Fibre Furnish – Consumption of Virgin Pulp by Main Grade & Utilisation of Recovered Paper: 2009 – 2019 (ktpa)

Source: ABS & IndustryEdge



On an export parity basis, the 1,559 kt of recovered paper used domestically in 2018-19 was valued at approximately AUD336.4 million on a Free-On-Board basis. The locally used volume was deployed on ten paper machines (primary processing facilities), at eight facilities, operated by four companies¹ and in four states².

The tables below set out the major recovered paper collectors, processors and reprocessors in Australia. Listings are alphabetical.

Collectors & Processors of Recovered Paper	Primary Locations
Australian Paper	Maryvale – Vic*
Australian Paper Recovery (APR)	Truganina – Vic, Hallam - Vic
Cellmark	Mona Vale - NSW
Cleanaway	Albury – NSW, Darwin – NT, Derwent Park – Tas#, Perth - WA
Norske Skog Australasia	Albury – NSW*
Northern Adelaide Waste Management Authority (NAWMA)	Edinburgh - SA
Orora	Botany – NSW*
Polytrade	Grafton – NSW, Rydalmere – NSW,
Southern Metropolitan Regional Council	Canning Vale – WA
Veolia	Spreyton – Tas,
Visy Recycling	Smithfield – NSW, Carrara – Qld, Murrarie – Qld, Gibson Island – Qld*, Wingfield – SA, Springvale – Vic, Heidelberg – Vic, Coolaroo – Vic*

* Also re-processing facility

formerly SKM

There are only a small number of re-processors of fibre in Australia. Some of the largest processors are also among the largest collectors and processors and some also have a role in recovered paper and paperboard supply to other re-processors and in exporting.

¹ Australian Paper, Norske Skog, Orora and Visy Industries

² New South Wales, Queensland, Tasmania and Victoria



Re-processors of Recovered Paper	Products	Locations
Australian Paper	Recycled office papers and packaging papers	Maryvale – Vic
Fibre Cycle	Pet care products eg. kitty litter	Lonsdale – SA, Toowoomba – Qld, Helensvale – Qld
Huhtamaki	Moulded fibre products eg. egg cartons	Preston – Vic
Norske Skog Australasia	Recycled newsprint	Albury – NSW
Orora	Recycled packaging papers	Botany – NSW
Visy	Recycled packaging papers	Coolaroo – Vic, Reservoir, Vic, Smithfield – NSW, Tumut – NSW, Gibson Island – Qld



Recycled products and markets

Recycled paper and paperboard products remain ubiquitous in the global economy, primarily as packaging and industrial paper grades. In the very significant majority of cases, recycled paper and paperboard are recycled back into other grades of paper and board.

However, as set out below, by volume, there is one significant product manufactured from recovered fibre – corrugated cartons.

Although extensively recycled, it deteriorates over time and each 'fibre' can only be recycled a limited number of times.

Paperboard for corrugated cartons (and other packaging & industrial paper grades) By far the most significant product manufactured from recycled paper and paperboard is corrugated cartons. Approximately half of all corrugated cartons are manufactured from recycled material, most of which were previously corrugated cartons, typically considered to be recycled up to seven times.

The grades of paper and paperboard recycled into corrugated cartons are Unbleached Kraft and to a much lesser extent the Other grade (see below for definitions). In 2018-19, it is estimated that approximately 1,475 kt of recovered paper was used to manufacture packaging and industrial paper and paperboard in Australia.

From this, 449 kt of recycled corrugated carton paperboard was exported and an estimated 888 kt of recovered paperboard was used to manufacture corrugated cartons used in Australia and as inputs to the production of other packaging and industrial paper grades (eg. Plasterboard liners, Recycled sacks and bags).

In total, consumption of corrugated carton materials over the decade has been growing 2.6% per annum. The drivers for faster consumption growth are a mix of growing food transportation (including exports) and rising e-commerce deliveries.

The two grades of paperboard used to manufacture corrugated cartons are corrugating medium and multi-ply liner. In 2018-19, their combined consumption was 808 kt including a small quantity of imports (<90 kt). It should be noted that some Kraftliner products contain up to 15% of recovered paperboard and the



consumption includes use in some other forms of fibre packaging.



Australian Corrugated Carton Materials Consumption by Paperboard Type: 2009 – 2019 (kt)

Source: ABS, IndustryEdge research and company reports

Newsprint

Consumption of Newsprint is declining very rapidly and will not recover. Shown in the chart below consumption of Newsprint has fallen an average 11.0% per annum over the last decade.

Some grades of newsprint include a proportion of recovered newsprint (mechanical) and a small proportion of other recovered fibre, as a cheaper fibre source than virgin fibre. This was once a substantial component of newsprint, but is now diminished, just as consumption of the product itself has declined. It is estimated, based on survey work undertaken and reported by *IndustryEdge* for NewsMediaWorks, that in 2018-19, approximately 20 kt of recovered paper and paperboard was used in the manufacture of newsprint.





Australian Newsprint Apparent Consumption: 2009 – 2019 (kt)

Source: ABS, IndustryEdge research and company reports

Recycled office papers

A small proportion of Australia's office papers – especially copy paper – are manufactured from recycled Bleached Kraft grade recovered paper. Some has a proportion of recovered paper and some are 100% recycled.

The specific market for recycled grades of office paper is very difficult to assess, but it has been sufficiently robust for Australian Paper to invest in a De-Inked Pulp production facility at its Maryvale Mill in Victoria, to manufacture recovered fibre pulp to make recycled office paper grades. In 2018-19, the relatively new facility received an estimated 55 kt of recovered paper.

Alternative recycling in Australia

A small number of growing alternative recycling outcomes exist in Australia.

These activities are:

- Moulded fibre production ~ egg cartons, fruit trays etc ~ est. 12 kt
- Pet care ~ kitty litter etc ~ est. 25 kt



• Compost and soil stabilizer ~ est. 10 kt

In total, in 2018-19, it is estimated that 47 kt of recovered paper was deployed to these alternative outcomes. Anecdotally at least, this is an end use experiencing growth. The compost and soil stabiliser market is likely to be larger than defined, with some landfill operators reportedly diverting paper and similar material into their composting activities.

An unknown proportion of material described as going to landfill (from different points in the supply chain) may be deployed in production of energy in Energy-from-Waste (EfW) facilities.

Exports

Exports of recovered paper are products in their own right, supporting a large and sophisticated supply-chain that provides products – recovered paper – to the international market.

In 2018-19, Australia's recovered paper exports totalled 1,105.6 kt, a fall of 16.0% on the prior year.

At export, as defined earlier there are four 'products' or at least, grades of recovered paper:

- **Unbleached Kraft** (shown in blue) is entirely recovered Packaging & Industrial paper grades, where there is no bleached content. This grade is dominated by corrugated boxes and is often known as Old Corrugated Containers (OCC).
- **Bleached Chemical** (shown in orange) is almost entirely bleached office and printing papers, made from chemical pulps.
- **Mechanical** (shown in green) includes Newsprint and most forms of catalogues and some magazines, where they are manufactured from pulp made by mechanical processes
- **Other** (shown in red) is also known as 'mixed' or 'unsorted' recovered paper. It includes the significant majority of recovered paper sourced from co-mingled kerbside collections that pass through MRFs.

Exports are set out in the chart below, for the decade to 2018-19 and in the subsequent table, in detail, for 2018-19.





Australian Exports of Recovered Paper by Grade: 2009 – 2019 (ktpa)

Recovered Paper Grade	2017-18 (kt)	2018-19 (kt)	% Change
Unbleached Kraft	816.5	657.4	-19.5%
Bleached Chemical	73.4	26.2	-64.3%
Mechanical	113.1	51.4	-54.6%
Other	313.5	370.6	18.2%
Total	1,316.5	1,105.6	-16.0%

Source: ABS

The chart below displays recovered paper exports by country over the last decade.





Australian Exports of Recovered Paper by Country: 2009 – 2019 (ktpa)

It is important to specifically examine exports to the main recipient country: China.

Over the decade, Australia's total recovered paper exports to China peaked at 1,144.5 kt in 2012-13. Since then, exports to China have declined, falling to 537.5 kt in 2018-19.

Source: ABS







Source: ABS

The chart shows exports to China, by Grade. The table below shows that experience on a relative basis.

2010-1 <i>9</i> (Kt)	Exports to China 2018-19
417.3	63.5
1.7	6.4
18.5	36.1
95.7	25.8
533.2	100.0
	2018-19 (kt) 417.3 1.7 18.5 95.7 533.2

Source: ABS



Recovery of paper & paperboard in Australia

The output of the modelling and analysis for this report indicates that Australia's domestic paper and paperboard producers received **1,559 kt** of recovered paper in 2018-19.³

This does not include the **47.0** kt of recovered paper used in other applications, including production of pet litter, moulded fibre products and compost, nor does it include the unknown volumes received by paper & paperboard mills from unspecifed sources (local drop-offs, internal transfers etc) or any volumes of material delivered to paper mills before being transferred to landfill.

The ABS reported recovered paper exports totalling **1,105.6** kt in 2018-19.

The paper and paperboard inputs to each of the major recovered paper grades provides relatively clear indication of some of their sources. The following table sets out the main sources by input type, estimates them proportionally and details the volume of material recovered in 2018-19 from these sources.

	Municipal Solid Waste		Commer	Total	
Recovered Paper Grade	Est. %	kt	Est. %	kt	kt
Mechanical	55%	84.7	45%	69.3	154.1
Bleached Chemical	25%	283.2	75%	283.2	566.4
Unbleached Kraft	25%	489.0	75%	1,467.0	1,956.0
Total		856.9		1,819.5	2,676.4

Source: ABS & IndustryEdge

Note: The 'Other' ['Mixed'/'Unsorted'] grade of recovered paper is derived almost entirely from the Municipal Solid Waste stream and is made up of the three main grades set out above, but is, as the name suggests, largely the unsorted portion from the Municipal Solid Waste stream.

There is a degree of ambiguity in the definitions of grades of recovered paper, particularly at this aggregated level, which are primarily used as export designations. There are more granular and precise commercial sub-grades within each of these

 $^{^3}$ This is consistent with other modelling conducted by IndustryEdge, for other purposes, and varies by <0.3% in aggregate



grades. As a result of the ambiguity, it is possible for material to be exported as one grade, when another would have been more appropriate. This may have contributed to some of the challenges experienced in having exported material accepted by the buyer.

Descriptions of each of the main grades of recovered paper, and the products that are typically found within them, are detailed in **Appendix Two**.



Recovery and recycling infrastructure and supply chain

Australia operates extensive infrastructure for the recovery and recycling of fibre (along with other materials). From an industry perspective, this infrastructure constitutes a supply-chain that sustains substantial domestic economic activity and delivers significant export income.

This section of the report has been prepared in light of the proposed prohibition on the export of recyclables.

In the event that the proposed prohibition on exports of recyclables proceeds, there will be several implications, both direct and indirect.

It is noted that on current export volumes, between 1,106 kt (2018-19) and 1,523 kt (the peak in 2012-13) of recovered paper will no longer be exported if the proposed prohibition proceeds. In 2018-19, the value of those exports was AUD239 million, on a free-on-board basis.⁴

The table sets out recovered paper exports, by grade for 2017-18 and 2018-19. The table includes the average export price (AUDFob/t) and the value of exports for 2018-19.

	2017-18 (kt)	2018-19 (kt)	% Change	Ave. Price (AUDFob/t)	AUDM*
Unbleached Kraft	816.5	657.4	-19.5%	208.50	137.1
Bleached Chemical	73.4	26.2	-64.3%	269.97	7.1
Mechanical	113.1	51.4	-54.6%	362.45	18.6
Other	313.5	370.6	18.2%	204.52	75.8
Total / Weighted Average	1,316.5	1,105.6	-16.0%	215.78	238.6

Source: ABS * Million Australian dollars

The price and value of Australia's recovered paper exports is important. Like other commodities, exports are impacted by a range of external factors, not least of which is demand, and the drivers of changing demand. The other significant external factor

⁴ ABS, Australian Harmonised Export Commodity Classification (AHECC), Chapter 47



is currency exchange rates. When the Australian dollar is trading lower to the US dollar (in which almost all transactions are completed), buyers pay less US dollars per tonne. Conversely, they pay more US dollars when the Australian dollar exchanges at a higher rate. The relative strength of the US dollar over the last two years might therefore have been anticipated to improve demand for Australian supply, and thus, have sustained exports.

That this did not occur underscores that in the current context, demand factors are outweighing price factors. Recovered paper markets are currently a decidedly 'buyer's market', in which supply is significantly larger than demand. The effect has been to suppress prices in US dollars.



The chart below sets out recovered paper exports over the last decade.

Source: ABS

Supply-chain economics and costs

In the event of the prohibition proceeding, as a minimum, this export income would not be earned, now or into the future. Export income defrays the cost of collection, sorting and handling of all recovered paper, including the very significant volumes



used locally (1,559 kt in 2018-19).

The economics of recovery and recycling work, under most scenarios, because of scale. This is especially the case where the commodity is relatively low in value. Though it may not universally be the case, the removal of export income associated with recovered paper will increase the net cost of recovery and thereby, increase the cost of recycling and as a result, the cost of the recycled products, unless that export income is replaced.

It might be considered obvious, but if there is no revenue stream associated with recovery of materials, less of that material will be recovered. Domestic paper and paperboard mills cannot use more recovered paper, currently.

As a result, it is likely that on a net basis, recovered paper that was previously exported would no longer be collected.

It can be expected that there would be some realignment of the supply-chain in this situation, with some volumes previously exported making their way to domestic reprocessing facilities, in exchange for other volumes ceasing to be collected. This would create implications for recovered paper collections in particular areas, regions and States.

Essentially, local reprocessors would go only as far as they needed, to collect the quantity and quality of recovered fibre they need to sustain their operations.

State and territory impacts

The implications of the proposed prohibition on exports for each State and Territory is set out below.

As the chart below shows, Victoria dominates exports. This is because most material originating from Tasmania and South Australia is exported via the Port of Melbourne. This is a commercially derived strategy to maximize the quality of resource and optimize its domestic and export utilization. If the material remained in the originating states, it could only be exported, and often only in sub-optimal volumes.

Re-exports refers to material that is *imported* to Australia and immediately *re-exported*. For recovered paper, this occurs where small volumes are shipped to Australia, mainly from New Zealand and Pacific Island nations, before being aggregated with larger volumes and exported in a single volume.





Australian Exports of Recovered Paper by State: 2009 – 2019 (ktpa)

Australia's recovered paper exports by State, for 2018-19 are detailed, by grade in the table below.

State	Unbleached Kraft	Bleached Chemical	Mechanical	Other (Unsorted)
NSW	81.9	6.4	16.6	75.1
Vic	322.4	5.5	11.9	139.6
Qld	122.2	5.0	7.0	44.6
WA	86.4	3.7	15.6	80.6
SA	37.7	5.4	0.2	30.0
Tas	4.5	_	_	_

Australian Recovered Paper Exports by State by Grade: 2018-19 (kt)

Source: ABS



NT	2.3	-	_	0.9
Total	657.4	26.2	51.3	370.6

Source: ABS

In the absence of export opportunities (or other local markets that do not currently exist), it can be expected that recycling collections in **Western Australia** and the **Northern Territory** would cease entirely.

In **South Australia**, **northern Tasmania** and the northern and inland regions of **Queensland**, collections could be expected to be curtailed to specific regions and collections of specific grades of recovered paper.

For South Australia, this is because there is no local reprocessing and volumes transferred to Victoria would reduce to only those specifically required for reprocessing in Victoria. For Queensland and Tasmania, local reprocessing is limited and for significant parts of those states, collections are too far from those reprocessing facilities.

In **south-eastern Queensland**, **New South Wales** and **Victoria**, the situation would be a little different. These are the regions where re-processing is most significant. However, in the absence of export competition for the material required in each state, reprocessors will narrow their focus to obtaining the quality and quantity of material they require. In these states, the motivation for economically marginal collections would cease.

Overall, there should be little doubt that it is Municipal Solid Waste (MSW) collections that will be under pressure.

It should be noted that by sheer volume, the entirety of Australia's domestic consumption of recovered paper in 2018-19 (1,559 kt) was able to be supplied by Commercial & Industrial (C&I) collections (1,820 kt).

Additionally, and by contrast, MSW collections accounted for a calculated 856.9 kt of collections in 2018-19 and an estimated 599.9 kt of exports, including nearly all of the 370.6 kt of the 'Other' or mixed export designation.

It follows therefore that the export prohibitions will cause a significant proportion of recycling focused MSW collections to cease, where the MSW collections that continued would be those in closest proximity to domestic reprocessing facilities.



Collection

The majority of Municipal Solid Waste (MSW) is collected in dedicated trucks that compress material collected at kerbside, delivering it to MRFs. The volume from this source has been increasing, but the quality of the material – from a paper and paperboard perspective is diminishing.

Under the pressure of commercial contracts, it is widely reported that collectors are compressing co-mingled loads more than ever before, causing paper and paperboard to become both more difficult to sort and increasingly contaminated, especially by glass fines. With respect to fibre at least, this particular contaminant issue plays a role in the import restrictions and quality specifications imposed by recipient countries.

With no economic driver to collect MSW for recycling, the current recycling collection infrastructure could be deployed to collecting material for delivery to landfill.

The role of MRFs and Single-Stream recovery infrastructure

Australia's fixed recovery infrastructure for paper and paperboard has two main types:

- Materials Recovery Facilities (MRFs) and
- 'Single-stream' facilities that receive only paper and paperboard

This is supplemented by small quantities of direct mill sales, some of which come from social direct deliveries from close to paper mills, internal transfers and similar transactions, the volumes of which are difficult to capture.

Under a scenario in which there are no exports of recovered paper, and a substantial decline in domestic demand for fibre recovered from the MSW stream, it might follow that for fibre at least, MRFs would no longer be required. In part, this appears to be correct.

However, there are structural reasons why this is not universally the case. The primary reason is that the major re-processor of paper and paperboard (Visy Industries) also operates significant MRFs and needs fibre and also other resources (plastics, glass and other materials).



Beyond the major re-processor, the situation appears to apply to other MRFs.

Fibre is understood to constitute around half (by weight) of the material received into MRFs. If MRFs were no longer required for recovery of fibre, the economics of MRF operations would necessarily change.

Australia is already experiencing disaggregation from MRFs receiving all materials. In conjunction with a growing number of municipalities and supported by Sustainability Victoria, Australian Paper Recovery now operates a 'glass-free' MRF, in Truganina, an industrial suburb to the west of Melbourne. The driver of the glass-free designation is to ensure that the collected fibre is of sufficient quality to meet domestic and export requirements. Remove fibre from that facility under this scenario and the MRF no longer has a sustainable economic rationale.

Single-stream facilities would be largely unaffected by an export prohibition under this scenario. Though doubtless some of the dynamics under which they operate would change.

Appendix Three describes Materials Recovery Facilities (MRFs) and Single-Stream Recovery facilities.

Paper & paperboard mills

In the event of a prohibition on exports of recovered materials, paper and paperboard mills in Australia would receive recovered paper derived almost entirely from Commercial & Industrial (C&I) collections, as set out above.

While at one level this would be an advantage (the quality of the fibre would be expected to be improved, on average), there are other implications.

To supply all recovered fibre from the C&I stream, C&I collections would need to continue across the country. C&I collections of 1,820 kt to supply 1,559 kt (86% capacity utilization) make all C&I collections important. Some are however far distant from domestic reprocessing opportunities.

The best example is that collections in Western Australia are further from reprocessing in the eastern states than they are from Indonesia. The cost of shipping C&I collected recovered fibre from Western Australia is prohibitive and would increase the average delivered fibre cost to domestic paper mills.

Paper and paperboard are globally traded commodities and are highly cost sensitive.



The consequence is that increased marginal fibre supply costs will not outweigh any improvements in average fibre quality that derives from C&I collections.

Consequently, some MRFs in close proximity to major reprocessing facilities are likely to remain in operation. These will more likely be centred around capital cities, on the eastern seaboard (south east Queensland, New South Wales and Victoria). Under that scenario, some Single-stream facilities would come under pressure. They would inevitably be those operating at distance from the main re-processors.

Grades of recovered paper

The grades of paper and paperboard are different to one another, have different end-use applications and are manufactured by different processes. The same applies for the recovered paper grades. They are different, and the different products often found within them can also have different properties, and thus have different values.

In aggregate, in a 'solid state' environment, (where the applied variable is an end of recovered paper exports) of the 1,106 kt exported in 2018-19, it is *estimated* that 1,030 kt would be added to existing landfill volumes. This is based on at least 810 kt (440 kt Unbleached Kraft and 370 kt Other) being commuted directly to landfill, and an estimated minimum 220 kt MSW derived supply that would be displaced by previously exported Unbleached Kraft supply.

Details are displayed below, by grade:

- **Mechanical** grade recovered paper supplies will continue to decline into virtual irrelevance, driven lower by continually falling demand for printed news:
 - Domestic consumption of mechanical grades for production of moulded fibre, Newsprint (blended with virgin fibre) and pet care products would increase;
 - Available volumes (51.4 kt in 2018-19) would be expected to be commuted from export to domestic reprocessing;
- **Bleached chemical** recovered paper supplies are declining more slowly than mechanical supplies, but exports were already dwindling due to some domestic competition and the declining quality of clean, sorted recovered material:
 - The small quantity of export material is sorted, cleaned and derived almost entirely from the C&I stream and is mainly pre-consumer. It is suitable for reprocessing in Australia, into recycled office papers (for which the current market is saturated) and possibly into recycled



'whitetop' liners;

- Available volumes (26.2 kt in 2018-19) would be expected to be commuted from export to domestic reprocessing and to landfill;
- **Unbleached chemical** recovered paper supplies would be in significant surplus, on an immediate and continuing basis:
 - Domestic reprocessors would absorb better quality material, displacing lower quality Unbleached Kraft and 'Other' (mixed or unsorted) supply collected through the MSW stream;
 - This would account for less than 60 kt per annum (MSW supply replacement) and an uncertain volume of displacement of existing supply;
 - Available volumes (657.4 kt in 2018-19) would be expected to be commuted from export to domestic reprocessing (est. +/- 30% or c.220 kt per annum) and landfill (est. +/- 70% or 440 kt per annum);
- **Other (mixed or unsorted)** recovered paper supplies would be in complete, immediate and continuous surplus:
 - Available volumes (370.6 kt in 2018-19) would be expected to be commuted from export to landfill;
 - Additionally, the significant proportion of the estimated 220.7 kt of MSW supply delivered to domestic reprocessors would be displaced by previously exported C&I supply and would also be commuted to landfill.

Analysis and details are supplied below.

The table below sets out the estimated volumes of paper and paperboard recovered by recovered paper grade or specific material, and by type in 2018-19.



Recovered Paper / Specific Material Grade	Types of paper & paperboard products	kt
Mechanical	Newspapers, Magazines, Catalogues, Directories, Brochures	154.1
Bleached Chemical	Office paper, Printing papers, Magazines, Envelopes and Stationery, Folding Boxes and other packaging ⁵	566.4
Unbleached Kraft	Corrugated Containers, Industrial Sacks, Folding Boxes and other packaging	1,956.0
Total		2,676.4

Source: IndustryEdge

It is notable that volumes of recovered paper and paperboard exported as 'Other' are distributed into the 'material specific' grades, from which they are derived. That is, all fibre products will be manufactured from fibre pulped using **Mechanical** means, or **Chemical** (including **Kraft**) means and then either being **Bleached** or remaining **Unbleached**.

It is only at export that the 'Other' designation is deployed. It may consist of any or all of the other 'grades' or specific materials, in mixed, variable and uncertain proportions. The 'Other' designation is therefore not helpful in understanding the types of fibre that are available in the Australian economy, and they have been allocated on the basis of the material specificity and 'pre-export' basis.

The table below sets out the collections of each grade of recovered paper, by source, for 2018-19.

Recovered Paper Grade	% Derived from MSW collections	kt	% Derived from C&I collections	kt
Mechanical	55%	84.7	45%	69.3
Bleached Chemical	50%	283.2	50%	283.2
Unbleached Kraft	25%	489.0	75%	1,467.0
Total		856.9		1,819.5

⁵ The Bleached Chemical grade may also include a range of bleached packaging grades, including some folding boxes, bags, sacks and other items, including some liquid packaging board products



The source of recovered paper is important because as the table below shows, 70.0% of MSW collections were exported in 2018-19. The result being that only 30.0% of that volume was delivered to domestic reprocessors, compared with 73.5% of the C&I stream.

	MSW		C	Total	
	kt	%	kt	%	kt
Export	599.8	70.0%	471.1	25.9%	1,071.0
Mill	220.7	25.8%	1,337.9	73.5%	1,558.6
Alternative	36.4	4.2%	10.5	0.6%	46.9
Total	856.9		1,819.5		2,676.4

If there is a distinction (other than source itself) between the MSW and C&I supply, it is that the C&I stream is more likely to be derived from a single-source (as distinct from single stream processing facilities) or to be sorted. The consequence is that single-source supply is preferred.

Of the total 1,559 kt of recovered paper delivered to domestic reprocessors in 2018-19, nearly 86% was derived from C&I sources, as the table below demonstrates. It also shows that 74.2% (1,157.0 kt) of the total volume delivered to domestic reprocessors was Unbleached Kraft, the vast majority of which was derived from C&I sources.

kt	MSW	C&I	Total	Proportion
Mechanical	8.2	46.4	54.7	3.5%
Bleached Chemical	155.8	191.2	346.9	22.3%
Unbleached Kraft	56.7	1,100.3	1,157.0	74.2%
Total	220.7	1,337.9	1,558.6	
Proportion	14.2%	85.8%		

It must be noted that the amount of material derived from each of the MSW and C&I streams is in a state of flux, as the market and supply-chain for recovered paper continues to adjust and adapt to the altered dynamics.



Further assessment and analysis

In the event that the proposed prohibition on recovered paper exports proceeds, it will be necessary for the specific supply-chain costs and implications (including the opportunities) to be modelled and described in financial and commercial terms.

Additionally, it would be helpful in the assessment of options, for a cost-curve outlining the cost per tonne and market limits the various recovered paper reprocessing options. This would be beneficial for Government, the supply chain and potential investors.

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Appendix One - Description of Main Grades of Paper & Paperboard

Newsprint

Although generally a Printing & Communication paper, Newsprint has traditionally been treated separately because of its once substantial volumes and distinct supply chain. Newsprint is manufactured from pulp which has been produced using mechanical pulping techniques, rather than chemical pulping techniques.

Post-consumer Newsprint is extensively recovered and recycled into Newsprint and Packaging & Industrial paper and paperboard, as well as insulation, soil stabilizer, moulded fibre products such as egg cartons and pet-care products such as kitty litter.

Recovery is generally through co-mingled kerbside collections, with the significant majority of supply passing through MRFs, supplemented by specific collections ('newspaper drives') that may bypass MRFs and be returned to the Newsprint manufacturers or direct to Packaging & Industrial paper manufacturers.

Printing & Communication

Printing & Communication papers refer to those grades of paper used in printed applications (other than Newsprint). This is an extensive range of products including directories, catalogues and inserts, magazines, brochures, forms, envelopes posters, stationery, books and more, including copy paper. While consumption is in decline, this is still a substantial grade.

The majority of recovery is through co-mingled kerbside collections, passing through MRFs.

Printing & Communication papers are made from two virgin fibre inputs – chemical pulp and mechanical pulp. Recovered material is, in part, segregated between the Bleached Chemical and Mechanical grades, as well as the 'Other' grade.

Post-consumer recovery volumes are used in recycled office-products (including copy paper), as recycled content for tissue production and in some 'white recycled' packaging grades.

Tissue

Dominated by toilet paper, the Tissue grade includes facial tissues and hand towels primarily. There is no post-consumer recovery or recycling.

Packaging & Industrial

Representing the largest volume of consumption, Packaging & Industrial paper and paperboard grades are used to manufacture bags (retail), sacks (industrial), wrapping papers and folding cartons such as cereal and pharmaceutical boxes, but is dominated by use in manufacture of corrugated cartons, almost entirely manufactured from fibre that was originally chemically pulped.

Corrugated cartons can be manufactured from virgin fibre pulp or recycled fibre pulp, and often from a mix of the two. Recovery and post-consumer recycling of Packaging & Industrial grades of paper and paperboard is extensive and is generally deployed back into the manufacture of corrugated cartons.



Appendix One – Description of Main Grades of Paper & Paperboard

Traditionally, the substantial volume of post-consumer recovery has been through Commercial & Industrial collections, due to the business-to-business nature of the use of packaging. Although this remains substantial, the rise of e-commerce and home deliveries has resulted in increased collections arising through co-mingled kerbside collections and its passage through MRFs.



Recovered paper types, grades and sources

Globally, recovered paper types are defined – at the primary level – by the type of pulp from which they are manufactured, and within that, whether they are bleached. This typology is used because the different pulp types have different applications.

Types and Grades of Recovered Paper

The table below sets out the types and grades of recovered paper. The 'Recovered Paper Grades' are international trade grades. Within each, there are a considerable number of specific grades, for which specifications and prices are different. Although not definitive and certainly no longer up to date, reference to the *Australian Recovered Paper Specifications*⁶ may be of benefit.

Types (Pulp type)	Recovered Paper Grades (inc. for Export)*	Paper & Board Inputs	
Chemical	Bleached Chemical (may include some Packaging & Industrial paper & paperboard)	Office paper	
		Printing papers	
		Magazines (some)	
		Envelopes & stationery	
	Unbleached Kraft (may include some bleached content material)	Corrugated containers	
		Industrial sacks	
		Folding boxes (some)	
Mechanical		Newsprint	
	Mechanical	Catalogues	
		Magazines (some)	
Mixed		All	
	Other/Unsorted	Mixed packaging (eg. aseptic liquid packaging board)	

Source: IndustryEdge

⁶ Australian Council of Recycling, Australian Recovered Paper Specifications, (retrieved 24 May 2018), <u>http://www.acor.org.au/uploads/2/1/5/4/21549240/paperspecs_v3.pdf</u>



* At export, the formal description of each of the grades is:

HS code	Description
470710	Paper or paperboard; waste and scrap, of unbleached kraft paper or paperboard or corrugated paper or paperboard
470720	Paper or paperboard; waste and scrap, paper or paperboard made mainly of bleached chemical pulp, not coloured in the mass
470730	Paper or paperboard; waste and scrap, paper or paperboard made mainly of mechanical pulp (e.g. newspapers, journals and similar printed matter)
470790	Paper or paperboard; waste and scrap, of paper or paperboard n.e.c. ⁷ in heading no. 4707 and of unsorted waste and scrap

A working definition and the material composition of each of the grades is:

- **Unbleached Kraft** is entirely recovered Packaging & Industrial paper grades, where there is no bleached content. This grade is dominated by corrugated boxes and is often known as Old Corrugated Containers (OCC).
- **Bleached Chemical** is almost entirely bleached office and printing papers, made from chemical pulps.
- **Mechanical** includes Newsprint and most forms of catalogues and some magazines, where they are manufactured from pulp made by mechanical processes
- **Other** is also known as 'mixed' or 'unsorted' recovered paper. It includes the significant majority of recovered paper sourced from co-mingled kerbside collections that pass through MRFs.

The **'Mechanical'** grade of recovered paper consists largely of Newspapers, Catalogues and Magazines that use paper produced by mechanical pulping processes.

Recovered material is estimated to be derived primarily from Municipal Solid Waste collections (55%), supported by the pre-consumer material from printers and publishers, as well as 'returns' of unsold publications, which are derived from the Commercial & Industrial stream (45%).

The **'Bleached Chemical'** grade recovered paper consists of white printing and communication papers manufactured from chemical (mainly Kraft) pulping processes.

It is estimated that 75% of this grade is derived from the Commercial & Industrial stream and the remainder from the Municipal Solid Waste stream. The latter stream has been growing its share of this grade, as printing has been migrating from commercial activity to household and small-business activity, driven by the advent of digital technologies. However, the disaggregation of this material to the

⁷ Not Elsewhere Classified



household level makes it less likely to be collected in a form suitable for recycling.

Commercial collections occur at office buildings and for large organisations, including government departments and agencies. Importantly, this supply includes material collected pre-consumer, from processing facilities that are dominated by commercial printers and secondary manufacturers such as envelope and label manufacturers.

For **'Unbleached Kraft'** recovered paper, the situation is effectively reversed, with the significant majority of the recovery occurring through Commercial & Industrial processes, representing the more business-tobusiness nature of much of these collections. The grade consists of packaging and industrial grades of paper and paperboard, dominated by corrugated cartons and often already containing significant proportions of recovered paper and board. This grade may also include other unbleached paper and board products, including sack-kraft and some grades of cartonboard or folding box board.

The Commercial & Industrial stream supplies an estimated 75% of this grade's exports, with the remainder (<25%) supplied by the Municipal stream and a very small proportion (<1%) is estimated to be derived from the Construction & Demolition stream, largely from packaging of products installed in construction.

It should be noted that the Commercial & Industrial source stream is also the predominant supply for Australia's containerboard manufacturers, whose emphasis is to extract the required quality of material for their own use, prior to exports occurring. The implication is that material exported to China (and other destinations) includes a larger proportion of lower quality material.

Municipal collections include a significant volume of material derived from small-businesses, as well as household level material.

The **'Other'** grade of recovered paper defined earlier is also known as **'Mixed'** or **'Unsorted'**. It should be noted that it is generally considered an export designation, but that does not preclude its domestic utilization. It is almost entirely derived from Municipal Solid Waste collections and may consist of any and all grades of paper and paperboard.

Because it is mixed and unsorted, this grade is prone to very significant variations in quality. At least 95% of the export volume of this grade is sourced from Municipal collections.

A small, but important, proportion of Other exports is specific, high quality material, that has been collated for specific markets. Most of this material is collected from Commercial and Industrial streams and sources (eg. production blanks and offcuts) and from post-consumer schemes (eg. container deposit schemes). Prominent examples are mainly consumer-packaging products, most notably aseptic liquid



packaging board products arising from production over-runs and flavoured-milk cartons arising from container deposit schemes.

This specific material is significant because:

- In the current market context, it continues to be exportable ~ the means of its collection and handling (either uncontaminated through a pre-consumer stream or cleaned through a container deposit scheme) ensures it falls within specifications for those able to reprocess the material;
- Reported export prices are higher than for most other high-quality recovered paper products ~ they have tended to push the average price of the Other grade of recovered paper higher; and
- It provides guidance about the types of methods required to deliver export grade recovered paper, outside of the three main designations (Unbleached kraft, Bleached kraft and Mechanical).



Appendix Three – Description of MRFs and Single-Stream Facilities

MRFs & Single-stream Facilities

MRFs

MRFs in Australia vary from reasonably sophisticated to basic sorting facilities. The successful have invested considerable capital to ensure their equipment is up to date.

MRFs in Australia receive material in loose form, from MSW collections. They also have the capacity to accept Commercial and Industrial recyclables such as cardboard, paper, cores, plastic, glass, aluminium, and in some cases steel.

The loose co-mingled material sourced from MSW collections is 'dumped' on the floor of the MRF and is then pushed by a mechanical loader on to a conveyor in mixed form where it is transferred into a revolving cylinder called a trommel.

The trommel has various size openings that allow the heavier materials to fall through and are recovered at that point or transferred to a secondary sort facility. It is where most of the glass components of the mixed material is separated.

The paper steam is then usually sent over either a bounce conveyor or a shaker screen that separates the heavier and larger pieces of cardboard.

Magnets installed over moving conveyor belts remove the steel and tin containers while eddy current separators are used to remove aluminium cans and other nonferrous metals.

Plastics can be identified by type and separated with the use of optical sorters.

Usually the remaining paper stream is conveyed past a sort station where foreign materials are removed by workers standing on either side of the conveyor. This is a manual process and the proportion of contaminants able to be physically removed depends largely on the speed of the conveyor, the extent of the contamination and the number of employees on the belt.

Contaminants are dropped in to various segregated holding bays where that are either sent to landfill or in some cases, if they have value they can be recycled.

Some dedicated MRFs, usually in regional areas, undertake a 'positive sort', involving those on the sort conveyor manually picking the nominated material such as newsprint or a similar commodity that has a higher value. This process is very labour intensive and is only viable if the labour cost and conveyor belt speed allows for the material to be picked off in sufficient qualities.

The paper and paperboard streams are conveyed direct to a baler, where the material is pressed in to bales that typically weigh one tonne, and are stored onsite or loaded direct into containers should the



Appendix Three – Description of MRFs and Single-Stream Facilities

product be going to export. Baled paper and cardboard can be loaded onto local transport, should there be a domestic re-processing facility within reasonable access.

MRFs in major city locations are all capable of loading to export with container loading ramps and docks and certified weighbridges.

Major Issues for MRF's

- Contamination biggest problem
- Unable to sort to the new China specifications of <0.5% contaminants
- Volumes from kerbside collections are increasing
- High cost of capital investment to install modern high technology
- Retro fitting sort lines is difficult and expensive
- Fluctuating prices for commodities processed.
- Uncertainties over ongoing outlets for materials recovered.

Single-stream facilities

Single-stream recovery facilities – known to some as Non-MRFs – receive only one material. They are a significant presence in the paper and paperboard sector, receiving and processing paper and paperboard to the exclusion (generally) of other materials. Their existence underscores the specific importance of recovered paper to the manufacture of paper and paperboard in Australia and globally.

The single-stream collectors can be considered as two distinct groups – the industrial, and the small or social level.

At the **industrial** level, the facilities often include weighbridges and balers, but do not usually have sorting lines. Most target Unbleached Kraft recovered paper, but some focus specifically on the other grades. Collection techniques include contractual relationships with major aggregators such as shopping centres and large users of paper and paperboard.

It should be noted this dedication does not mean they will refuse other paper and paperboard material (including drop-offs), but they will ensure that it is received sorted and there is no cross-contamination.

Even at the industrial level it is difficult to assess exactly which facilities are dedicated to single-stream collections. However, the following companies are known to operate these non-MRFs in each of the indicated States.



Appendix Three – Description of MRFs and Single-Stream Facilities

State	Operator
Victoria	Cleanaway, One Paper, Australian Paper (on site at its Maryvale
	Mill), Australian Paper Recovery
NSW	Cleanaway, Remondis, Cellmark, Norske Skog (on site at its Albury
	mill), Orora (on site at its Botany Mill)
Queensland	Cleanaway
Tasmania	SKM, Veolia
SA	Cleanaway, Orora, Scout Recycling
WA	Cleanaway, Remondis, SMRC

Nearly all of the major recovery facility operators have drop-off options for pre-sorted material, many of which are not located at their MRFs, and the material from which is rarely re-directed to the sorting system.

Many of these 'satellite' facilities receive only small quantities of material, some linked to Container Deposit Schemes as is the case for Scout Recycling in South Australia. However, the material they receive has a specific focus and value, sufficient to sustain their operations and recover and recycle material effectively.

At the other end of the industrial collections, larger facilities receive volumes in sufficient quantity to supply major reprocessors. The best example is Orora's own operation at its Botany paperboard mill. It receives only recovered paper and paperboard, and within that, only the Unbleached Kraft grade.

At the small or social level, there is a wide range of organisations that collect specific grades of paper and paperboard – mainly newsprint – for transfer to the re-processors. Some mills allow for local and community drop-offs, the Cycling Club in Albury works directly with Norske Skog for instance and Scout groups (as distinct from the commercialized Scout Recycling in SA) are renowned for their 'newspaper drives'. It is estimated that in 2018-19, these forms of collection delivered as much as 10 kt of paper and paperboard to specific end-users, including those deploying recovered newsprint to alternative applications like the production of pet-care products (kitty litter) and similar.