APRIL 11, 2024

Biosolids Production and End Use Survey – Australia 2022/23

For the Australia & New Zealand Biosolids Partnership

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improving our environment

STATEMENT OF LIMITATION

This submission has been prepared solely for the Australia & New Zealand Biosolids Partnership. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

QUALITY ASSURANCE STATEMENT	
Client:	Australia & New Zealand Biosolids Partnership
Project Name:	ANZBP 2023 biosolids survey
PSD Job Number:	J309
Document File Reference:	d:\jobs\j309 ANZBP 2023 biosolids survey\report\j309 Biosolids Production in Australia 2023
Project Manager:	Catherine Vero
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Reviewed By:	Catherine Vero
Approved for Issue:	Catherine Vero
Document Status:	Final
Date of Issue	11 April 2024

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

Abbreviation	Full Name
ANZBP	Australia New Zealand Biosolids Partnership
ATAD	Autothermal thermophilic aerobic digestion
DS	Dry solids
EP	Equivalent persons
PFAS	Per and polyfluoroalkyl Substances
WWTP	Wastewater treatment plant

GLOSSARY

Term	Definition
Dry solids (DS)	Mass of material after drying to 0% water content.
Equivalent persons (EP)	A measure of the total biological oxygen load to the plant in terms of the number of person equivalents (60 mg cBOD5/person/day)
Pie diagram percentage values	Values have been rounded to one decimal place so may not sum to 100% Where a figure is quoted of 0.0% this is <0.0% e.g. 0.08%

1 INTRODUCTION

In 2010, the Australian & New Zealand Biosolids Partnership (ANZBP) commissioned a national survey to identify the main features of biosolids management across Australia and New Zealand. The survey was repeated a further 6 times including this survey in 2023. This report pertains to Australia only and collates survey results for the 2022/23 financial year.

Surveys to 2019, inclusive, catalogued and reported the following primary parameters:

- Biosolids production;
- Biosolids end use;
- Biosolids stabilisation grade;
- Biosolids contamination grade; (added in 2013)
- Biosolids main stabilisation process;
- Biosolids dewatering process.

In 2021 additional data was collected to both update the survey in line with current and predicted trends and to obtain data that is anticipated to be useful to ANZBP members and government departments. These data are:

- Biosolids secondary stabilisation processes;
- End use management and branding;
- Stockpile volumes;
- Transportation of biosolids to end use site;
- Emerging contaminant management;
- Renewable energy production.

In 2023 participants were asked to comment on industry risks and opportunities.

The results of this survey are presented on a national and state basis. Some discussion is also provided on significant changes since 2010.

2 METHOD

The approach used to determine the biosolids production in Australia was to survey, as a minimum, all plants servicing over 30,000 people. The ANZBP identified that this criterion would capture around about 80% of Australia's population. In the course of the survey many water utilities provided information on plants smaller than this threshold and where they did, the data was included. This year, a total of 401 sites were included in the analysis. Data from 368 sites was provided and for a further 17 sites data from 2021 was used and for 16 sites data from 2019 was used in the survey analysis.

All classifications are made on the basis of dry tonnes of production unless otherwise stated.

Biosolids from lagoon based systems are only reported if biosolids were removed and beneficially used in that year. Otherwise the mass reported from that system is zero.

3 CLASSIFICATIONS

To enable relatively simple analysis and presentation of the data, each area of information, such as end use, is classified into broad groupings. These groupings are discussed below.

3.1 PRODUCTION

Total biosolids production is presented in terms of dry tonnes of biosolids. Data on % dry solids by state is also presented.

3.2 END USE

The following classifications were used for end use:

- Agriculture: for biosolids applied to land for its fertiliser value without value added processing;
- Landscaping: for biosolids used for landscaping or other horticultural use. Note this end use category changed in 2021 from "Landscaping (compost)", as composting is classified as a stabilisation process not an end use;
- Forestry: for biosolids applied to plantation forests to aid tree growth;
- Landfill: for biosolids disposed to landfill;
- Ocean discharge: for biosolids discharged to the ocean;
- Stockpile: for biosolids stored, pending future planning, processing or use;
- Land rehabilitation/restoration or quarry rehabilitation: for biosolids applied to land, such as mine sites for rehabilitation of the land. This category was expanded in 2021;
- Other: any other uses;
- Unspecified: for sites for which no data was provided by the utility or for which the end use could not be identified.

The following uses can be classified as being 'beneficial' uses: agriculture, landscaping, forestry, and land rehabilitation/restoration and quarry rehabilitation.

3.3 STABILISATION GRADE

Due to the different standards and naming conventions used for Stabilisation Grades across Australia, a standardised grading schema was applied, Table 3-1. Stabilisation grade was classified on the basis of an A, B or Unstabilised grading. Some biosolids were not graded by the utility and are marked as NG (not graded) in the survey results.

Table 3-1: Stabilisation grading

Classification	NSW	Vic	SA	Qld	Tas	WA	NZ
A	A	T1, T2	A	A	A	P1, P2	A
B	B	T3	B	B	B	P3	B
Unstabilised	C	Unstabilised	Unstabilised		Unclassified	P4	Unstabilised

3.4 CONTAMINANT GRADE

Due to the different standards and naming conventions used for Contaminant Grades across Australia, a standardised grading schema was applied (see Table 3-2). Contamination grade was classified on the basis of A, B, C or Restricted/ Unsuitable for Use. Some biosolids were not graded by the utility and are marked as NG (not graded) in the survey results.

The purpose of this comparison is to allow both long term tracking of biosolids quality changes and offer some comparison between states. The comparison between gradings is not direct and should this report does not represent that they are. Gradings across jurisdictions are different and the reader should refer to state guidelines to compare individual contaminant grades.

Changes made for this survey are South Australian biosolids grade C removed and grade B classified as equivalent to standardised grade C in alignment with the 2020 guidelines from those jurisdictions. Victorian and Western Australian classifications remain as C2 equivalent to standardised grade B.

Table 3-2: Contaminant grading

Classification	NSW	Vic	SA	Qld	Tas	WA	NZ
A	A	C1	A	A	A	C1	A
B	B	C2		B		C2	B
C	C		B	C	B		
Restricted or Unsuitable for use	D, E	Unsuitable for use	Unsuitable for use		Unsuitable for use	Unsuitable for use	Unsuitable for use

3.5 STABILISATION PROCESS

Classification of stabilisation process was made on the basis of the main stabilisation process following the main liquid sewage treatment process. The following stabilisation process categories were used, new categories have been added as indicated:

- Aerobic digestion
- Agitated air drying
- Air drying
- Anaerobic digestion
  - Acid phase digestion
  - Standard mesophilic anaerobic digestion
  - Thermophilic phase anaerobic digestion (TPAD)
- Thermal hydrolysis with pre-treatment with anaerobic digestion
- Autothermal thermophilic aerobic digestion (ATAD)
- Composting
- Extended aeration (new in 2021)
- Incineration
- Lagoon storage (used for biosolids stored in liquid form)
- Lime stabilisation
- Long term storage (of dewatered biosolids)
- Sludge drying beds and drying lagoons
- Thermal drying
- Solar drying (new in 2021)
- Pyrolysis and gasification (new in 2021)
- None
- Other
- Unspecified (used where no data were provided)

This list is also used to collect data on any secondary processing steps with the addition of "No further processing". An example of how this is if a site has aerobic digestion followed by a composting process (on or off site) the main process is aerobic digestion and the secondary process is composting.

3.6 DEWATERING PROCESS

Classification of the dewatering process was made on the basis of the following categories:

- Belt filter press
- Conventional centrifuge
- Drying bed or lagoons
- Screw press
- None
- Other

- Unspecified (used where no data were provided)

3.7 BIOSOLIDS MANAGEMENT

Classification of biosolids management is based on the following series of questions. Results are reported on a dry tonne basis or by number of water authorities as relevant. These questions are:

1. Is your biosolids analysed regularly for PFAS or other emerging contaminants that are not yet regulated?
2. Do you produce renewable energy from your biosolids (e.g. from biogas produced during sludge digestion)?
    a. Biogas is used to provide heat and electricity for onsite use;
    b. Biogas is used to provide heat for onsite use and electricity is exported to the grid;
    c. Biogas is used to provide heat for onsite use; no electricity is produced;
    d. No renewable energy is produced from biosolids processing;
    e. Yes.
3. If yes to Q2, provide energy production (GWh/ year)
4. For final biosolids which are removed or disposed of, does the producer:
    a. Give biosolids away with costs covered by recipient;
    b. Receive payment for biosolids;
    c. Give biosolids away;
    d. Pay for removal from site for end use/disposal;
    e. Not applicable/unspecified;
    f. Other.
5. Risk management related to biosolids end use:
    a. The biosolids end-use program and risks are managed by a 3rd party;
    b. The biosolids end-use program and risks are managed by a 3rd party, and audited in-house;
    c. The biosolids end-use program and risks are managed in-house;
    d. Not applicable;
    e. Not specified.
6. How far are biosolids typically transported for end use?
    a. 1 - 50 km
    b. 51 - 150 km
    c. 151 - 400 km
    d. More than 400 km
    e. No transport
    f. Not specified (used where no data were provided)

7. Relating to historic biosolids stockpiles
    a. Do you have historic biosolids stockpiles?
    b. Please estimate how many dry tonnes of biosolids you have stockpiled.
    c. What quantity of biosolids did you add or subtract from your stockpiles in this financial year?
8. What statement best agrees with your organisation's risk management approach for emerging contaminants:
    a. No risk management approach to emerging contaminants;
    b. Monitoring only;
    c. High-level risk assessment;
    d. Detailed formal risk assessment;
    e. Not applicable/unspecified.
9. Has the utility or a third party branded the biosolids is the biosolids:
    a. Sold by a third party but unbranded;
    b. Sold by a third party with a brand name;
    c. Sold by utility/council but unbranded;
    d. Sold by utility/council with a brand name.

3.8 INDUSTRY RISKS AND OPPORTUNITIES

This year participants were asked to share what they viewed as the most pressing risks and opportunities for the industry in 2022/2023. Data was collected without prompts but with restrictions of two responses over 100 characters per utility. The data was classified into groups based on responses. Results are reported on a count basis.

Not all participants responded however based on the data received, common responses were grouped into categories so the qualitative data could be presented quantitatively.

Each category is described in the results section to capture the details of each response and how it relates to the category it is assigned to. Other important risks that were reported but didn't fit into one single category are included in a miscellaneous category.

4 RESULTS

4.1 PRODUCTION

The total biosolids production of Australia identified in the current survey is 372,000 tonnes per year of dry solids, representing about a 6% increase from the 2021 survey. The previous survey results are shown in Table 4-1.

Table 4-1: Annual biosolids production in Australia 2022/23

Year	Tonnes dry solids	Reported % dry solids
2010	300,000	25%
2013	333,000	24%
2015	310,000	21%
2017	327,000	18%
2019	371,000	16%
2021	349,000	25%
2023	372,000	23%

Average solids content of dewatered biosolids is around 23% (weighted average) and this equates to around 1.6 million tonnes of biosolids in dewatered form (also called wet biosolids) used in 2022/23.

Biosolids production by state over time is shown in Figure 4-1.

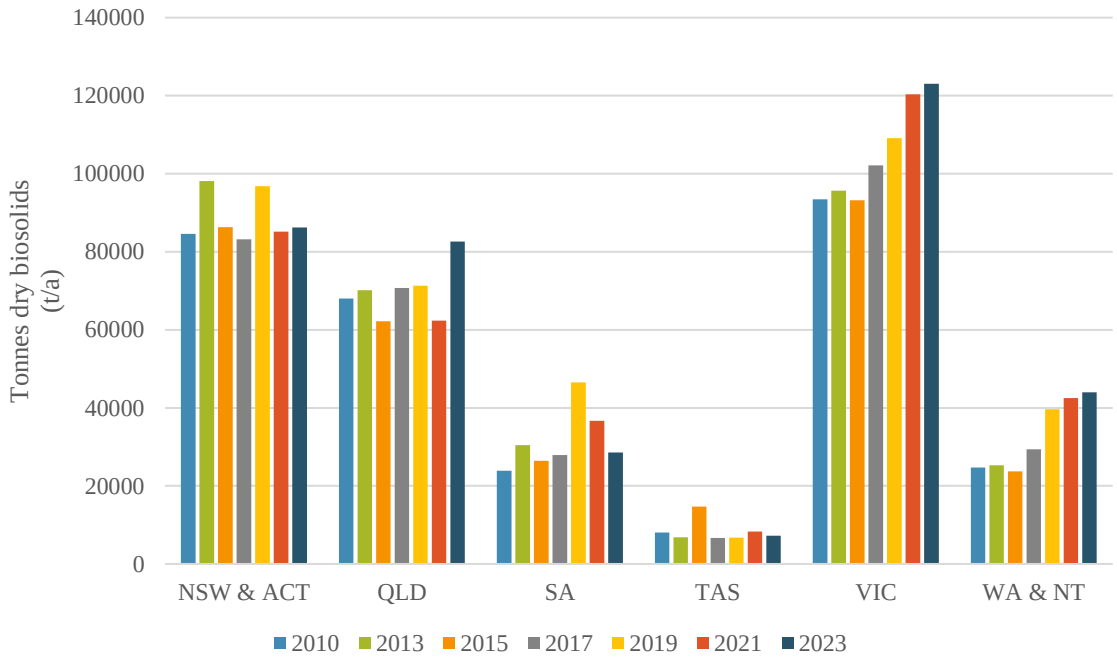

Figure 4-1: Biosolids total production, by state over time

Due to different stabilisation and drying processes between states, the dry solids content at end use can be significantly different. The average dry solids content by state is shown below.

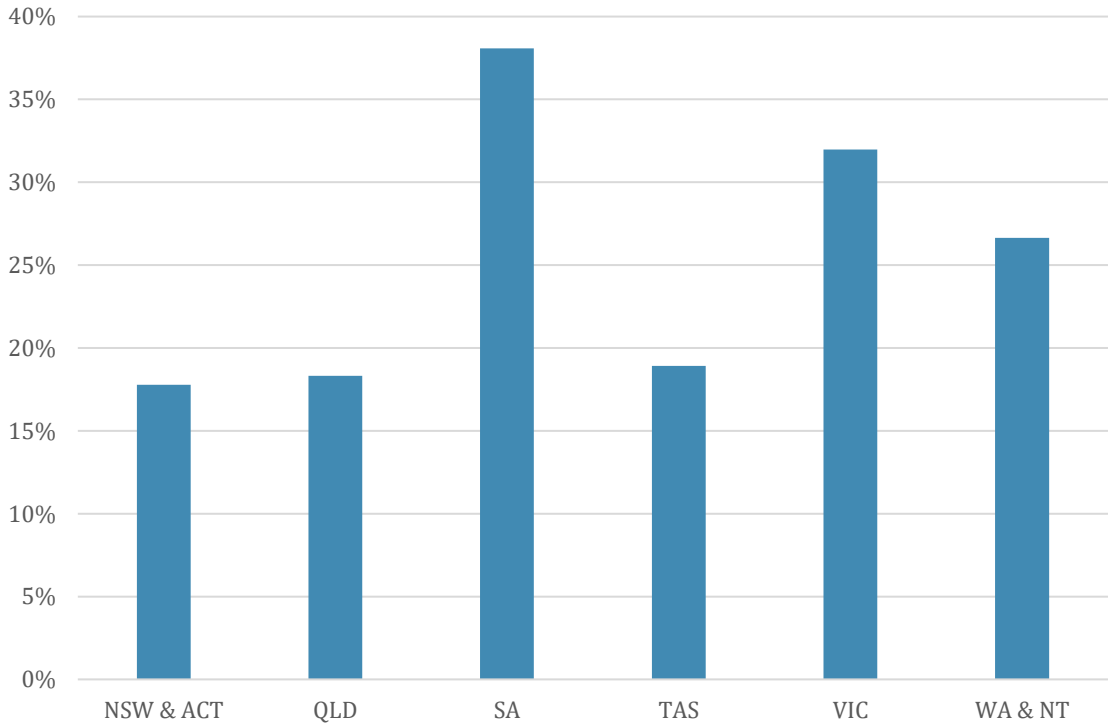

Figure 4-2: Weighted average biosolids dry solids content by state, 2023

4.2 END USE

Biosolids end use nationally and for each state is presented in Figure 4-3 to Figure 4-4 following. Figure 4-4 shows how biosolids end use has changed since the first biosolids production and end use survey in 2010. Nearly 85% of biosolids is beneficially used, similar to 83% in 2021 but down from 91% in 2019.

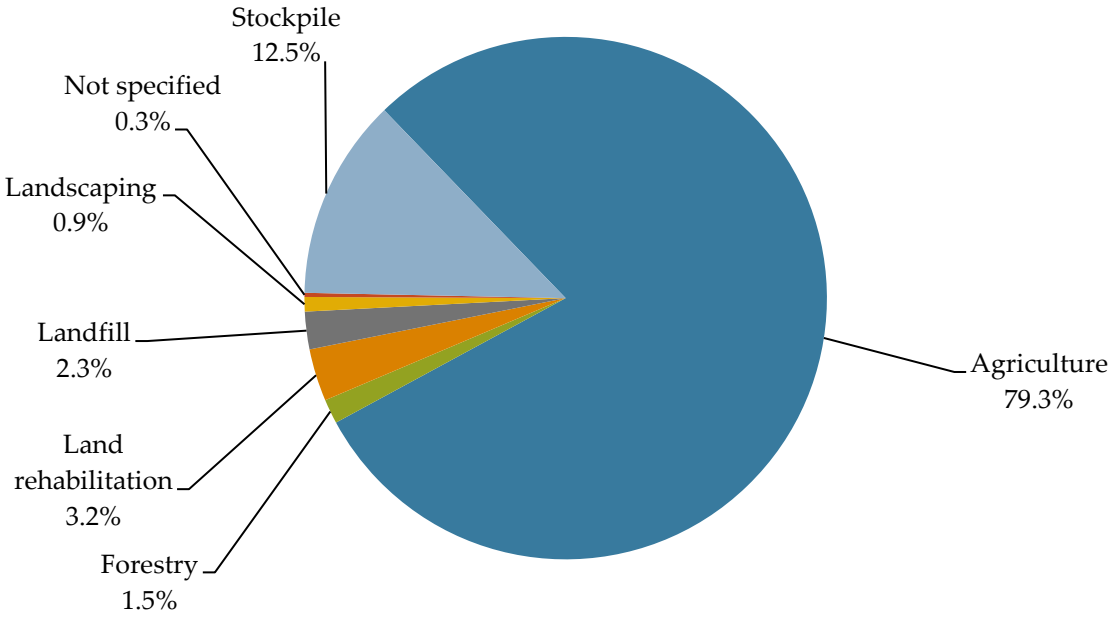

Figure 4-3: Biosolids end use (dry mass basis), Australia 2023

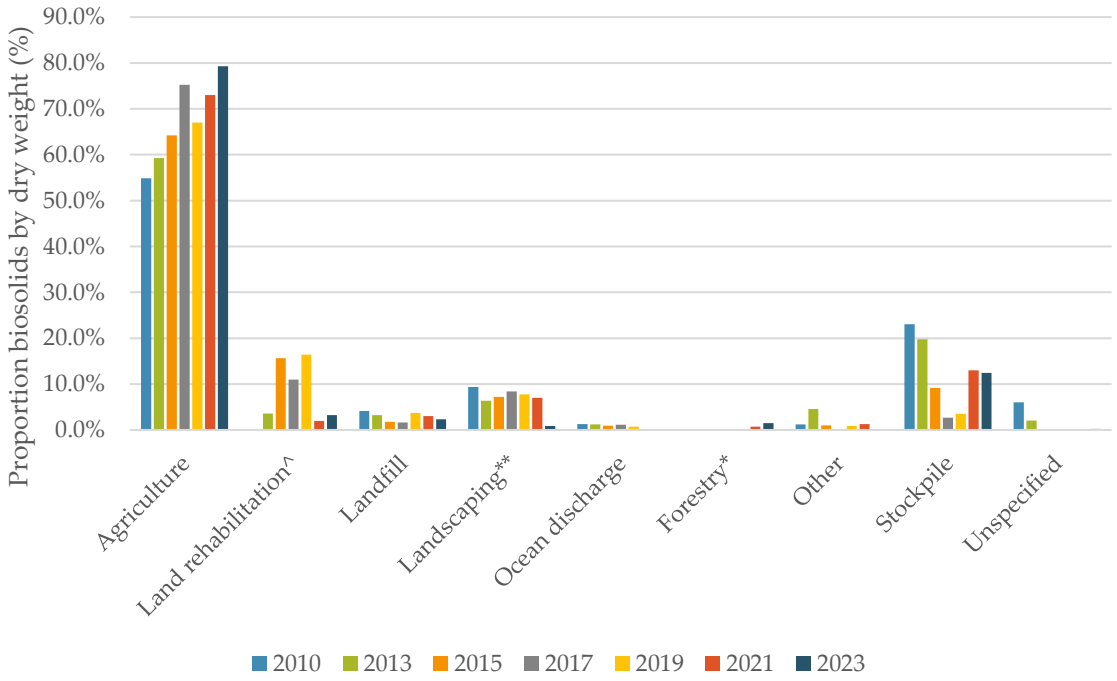

Figure 4-4 Biosolids end use (dry mass basis), Australia 2010 to 2023

^ Includes landform restoration or quarry rehabilitation (bulk fill), * Included as 'Other' 2010 to 2019

** 'Landscaping' changed from 'Landscaping (compost)' in 2021

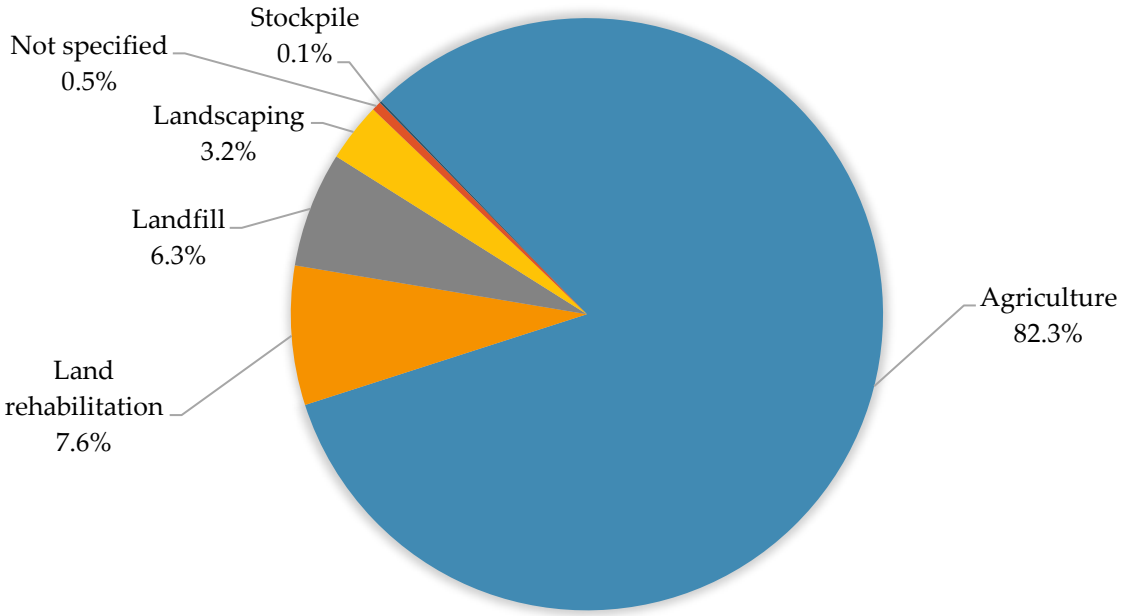

Figure 4-5: Biosolids end use (dry mass basis) NSW and ACT 2023

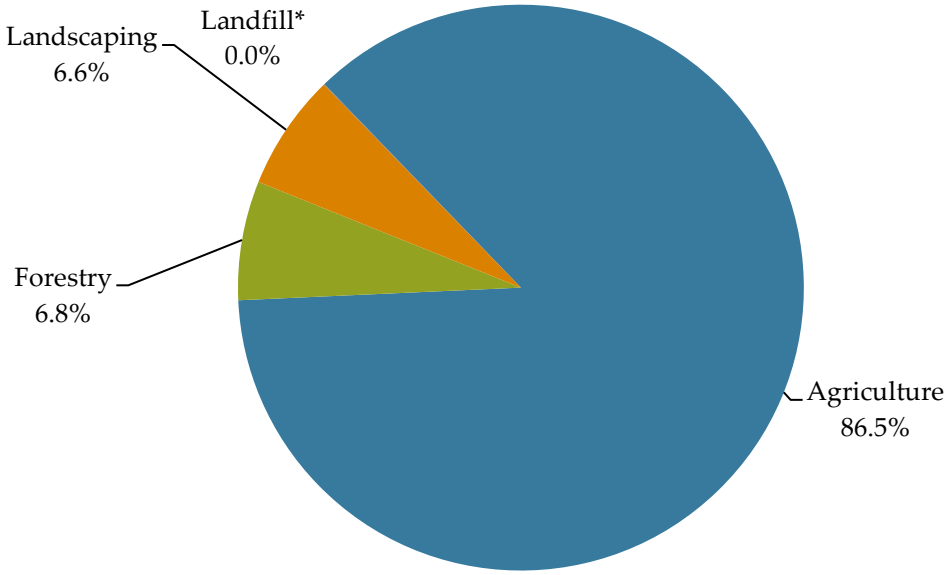

Figure 4-6: Biosolids end use (dry mass basis) Queensland 2023

* Note that values of 0.0% denote data less than 0.1%. This has been included in figures despite not showing any value, as 1 decimal place does not capture values <0.1%.

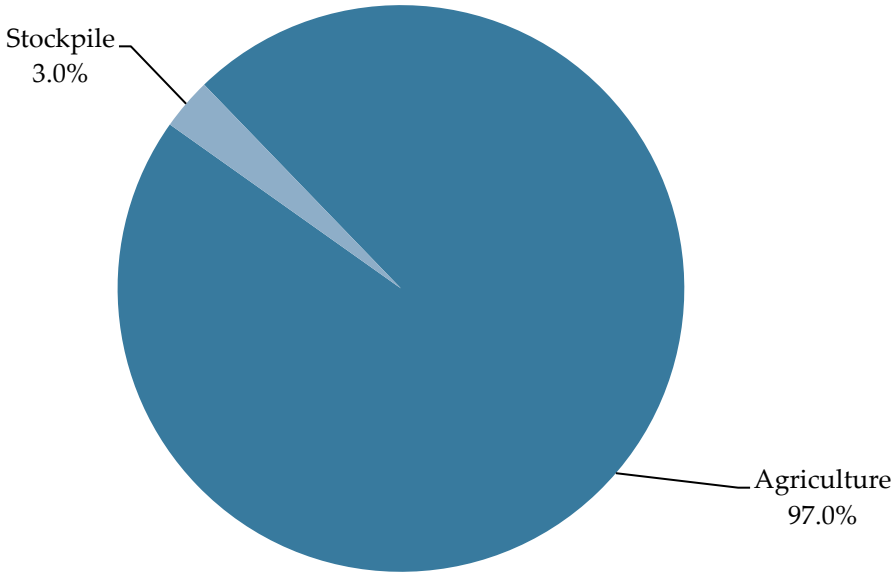

Figure 4-7: Biosolids end use (dry mass basis) South Australia 2023

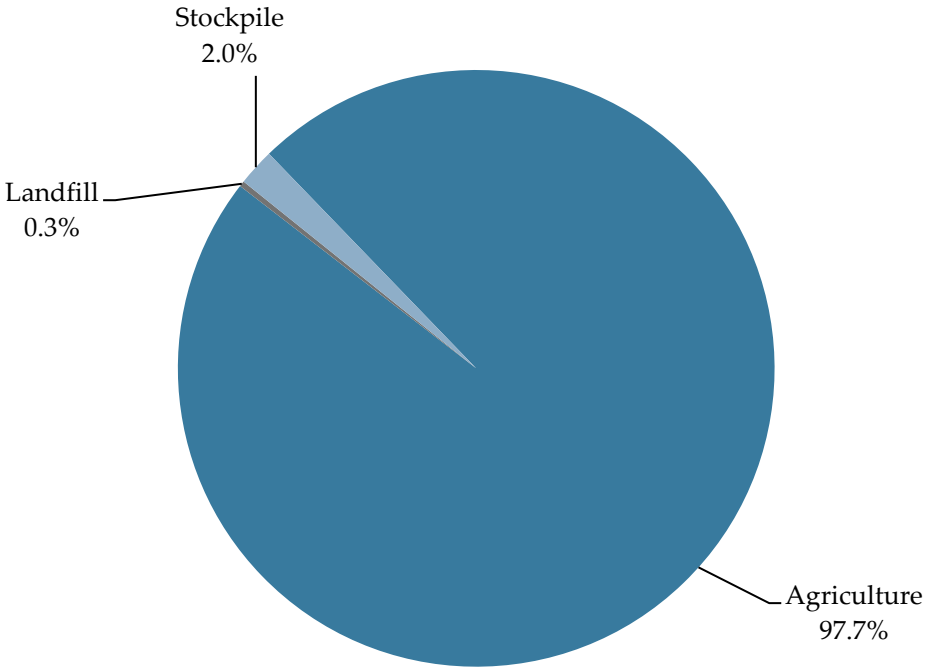

Figure 4-8: Biosolids end use (dry mass basis), Tasmania 2023

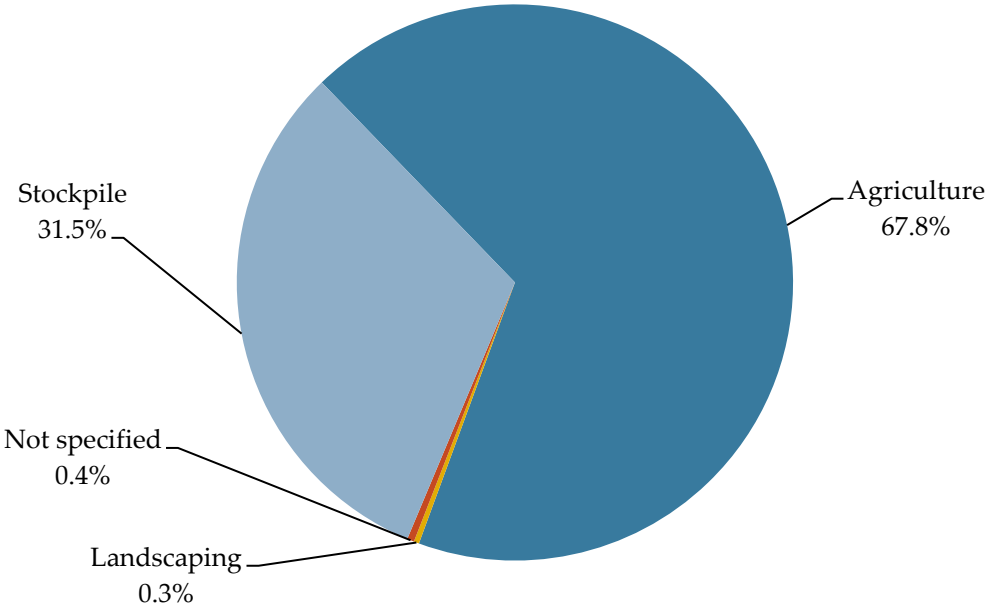

Figure 4-9: Biosolids end use (dry mass basis), Victoria 2023

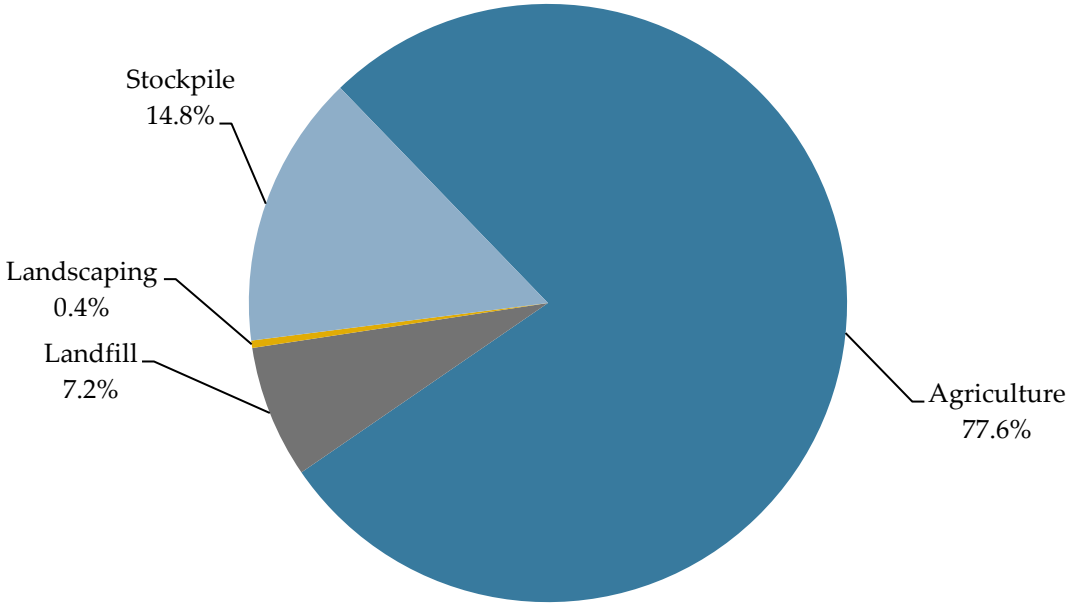

Figure 4-10: Biosolids end use (dry mass basis), WA and NT 2023

4.3 STABILISATION GRADE

Biosolids stabilisation grade nationally and for each state is presented in Figure 4-1 to Figure 4-18

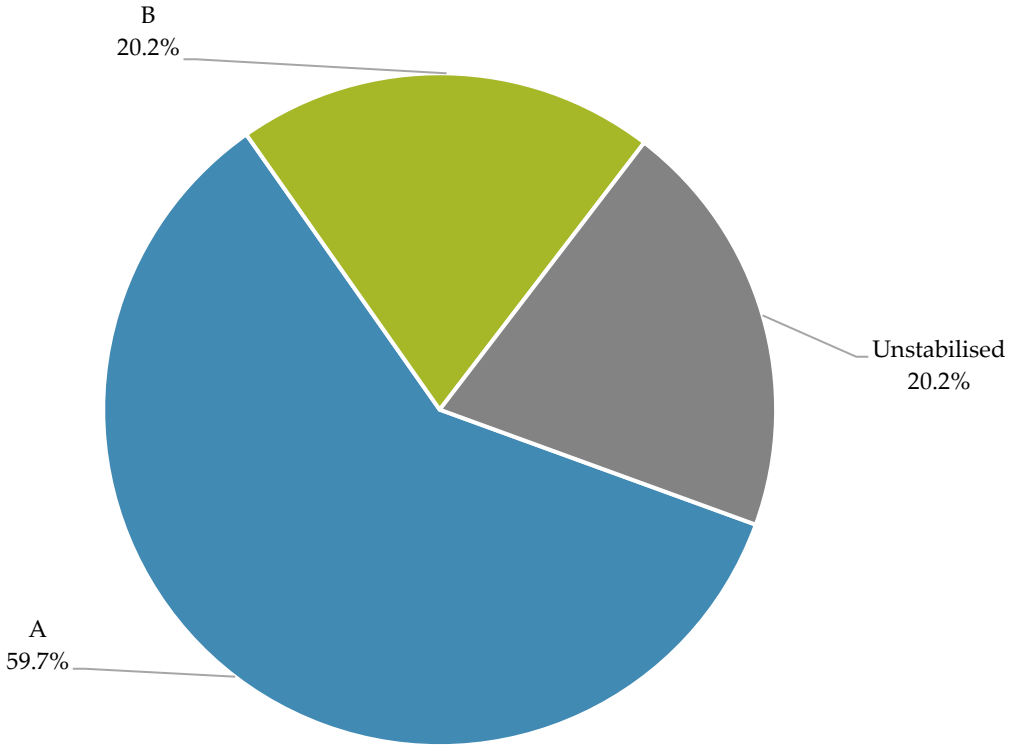

Figure 4-18 following. Biosolids classified as unstabilised have dropped from 6% to 1.8% since the 2021 survey. As in 2021 stabilisation A and stabilisation B biosolids remain about equally split. Figure 4-12 shows how stabilisation grade has changed since the first biosolids production and end use survey in 2010.

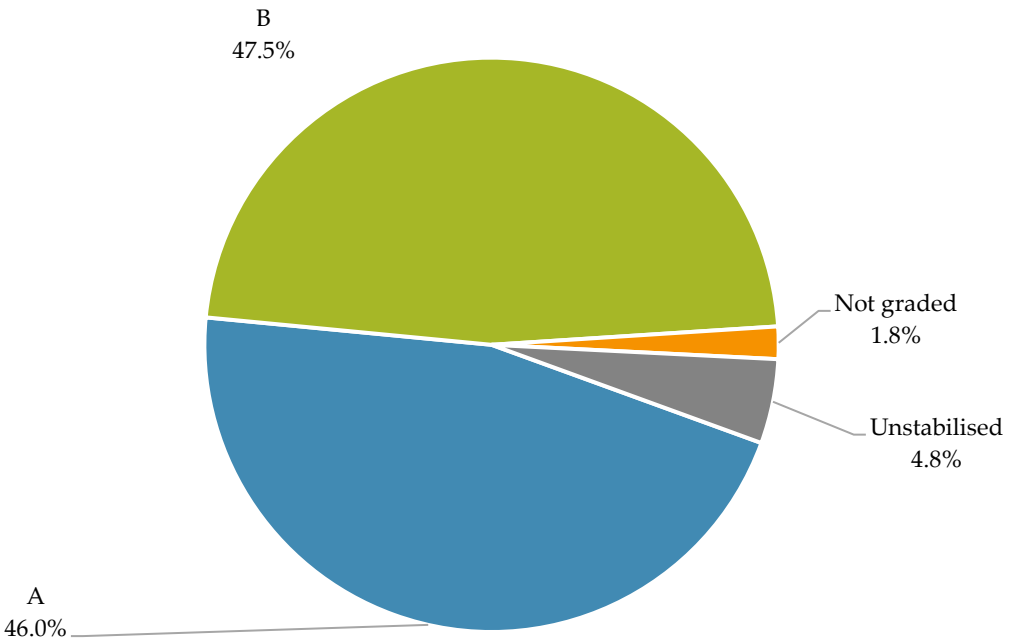

Figure 4-11: Stabilisation grade (dry mass basis), Australia 2023

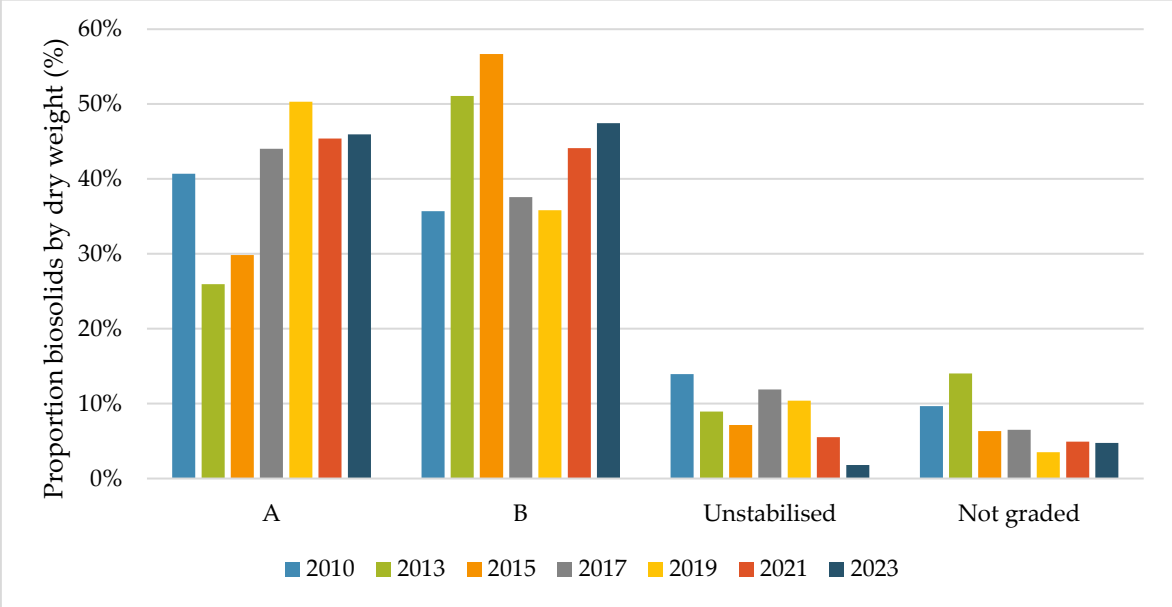

Figure 4-12: Stabilisation grade (dry mass basis), Australia 2010 to 2023

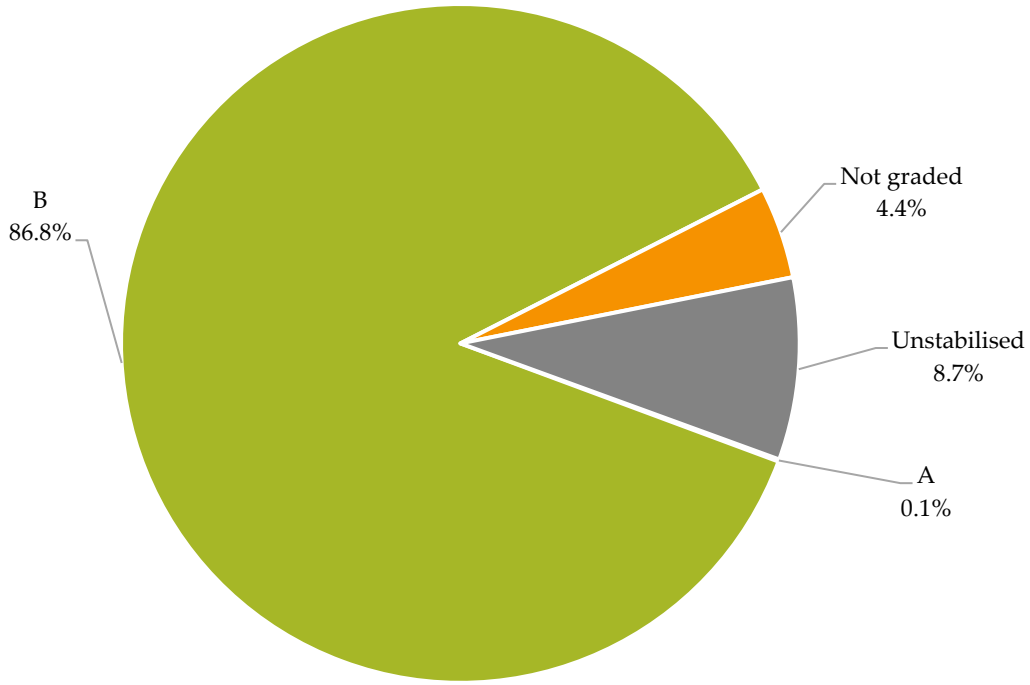

Figure 4-13: Stabilisation grade (dry mass basis), NSW and ACT 2023

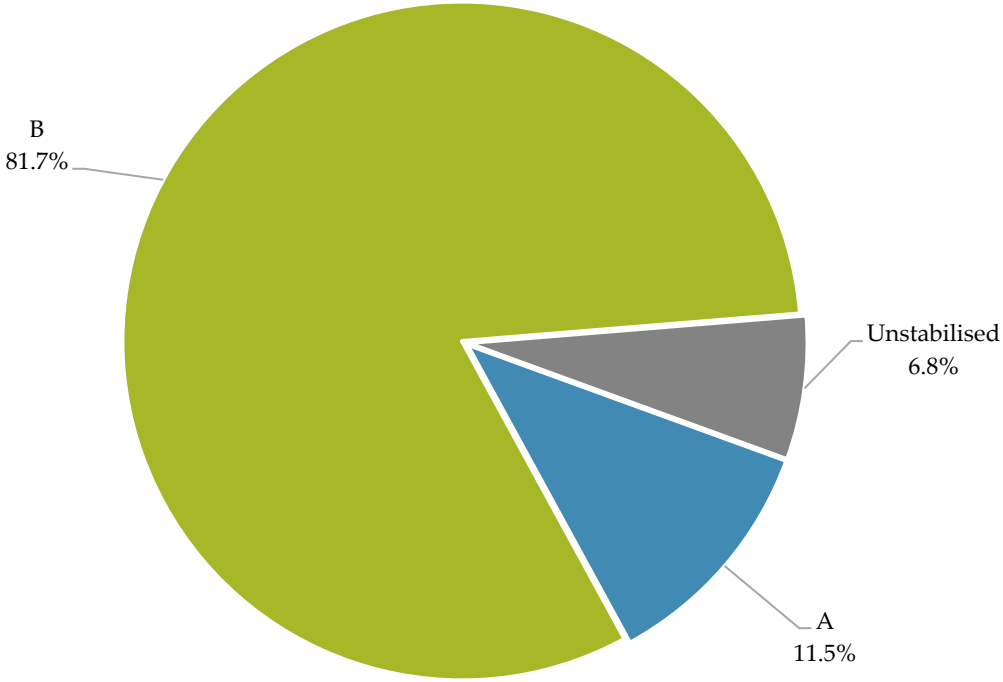

Figure 4-14: Stabilisation grade (dry mass basis), Queensland 2023

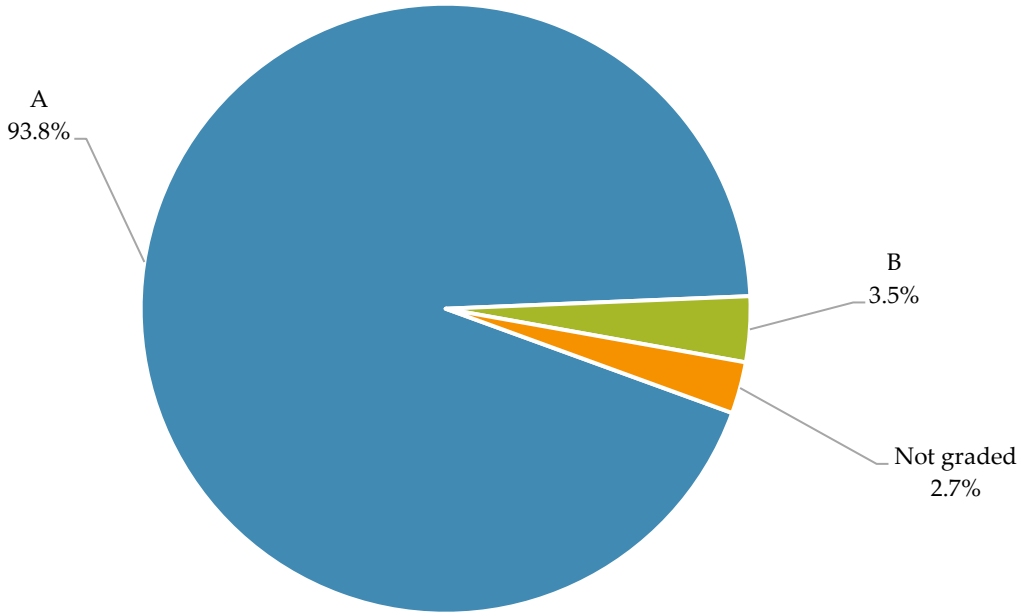

Figure 4-15: Stabilisation grade (dry mass basis), South Australia 2023

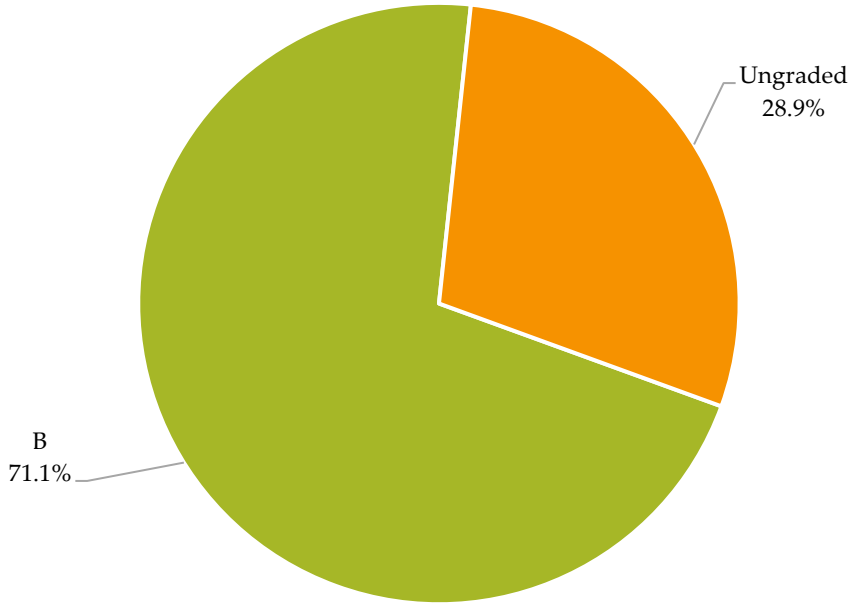

Figure 4-16: Stabilisation grade (dry mass basis), Tasmania 2023

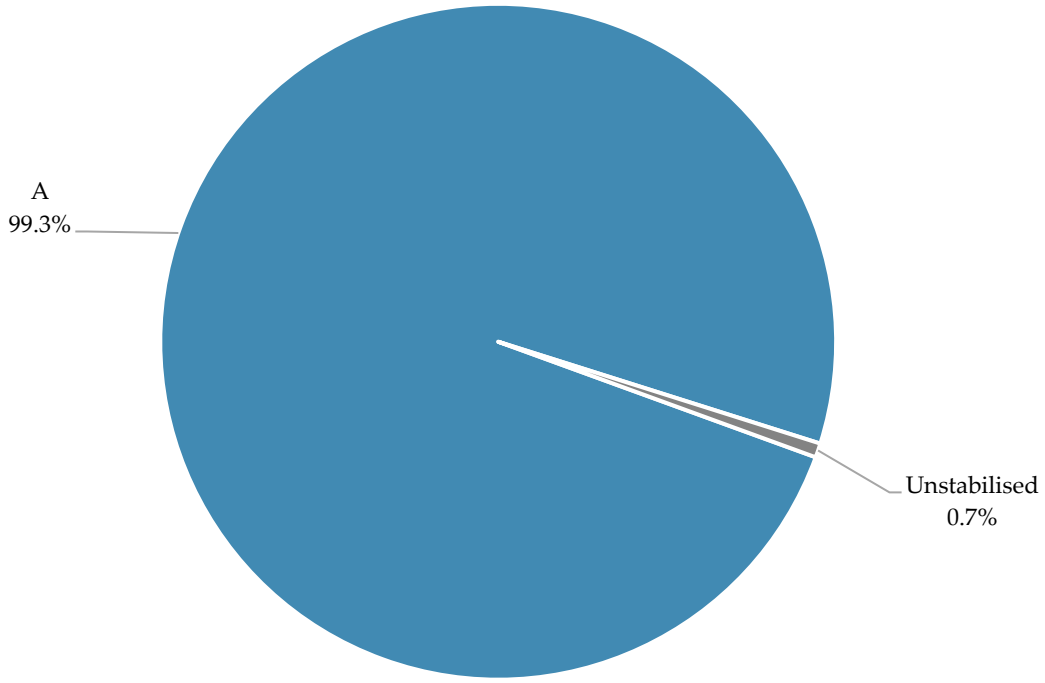

Figure 4-17: Stabilisation grade (dry mass basis), Victoria 2023

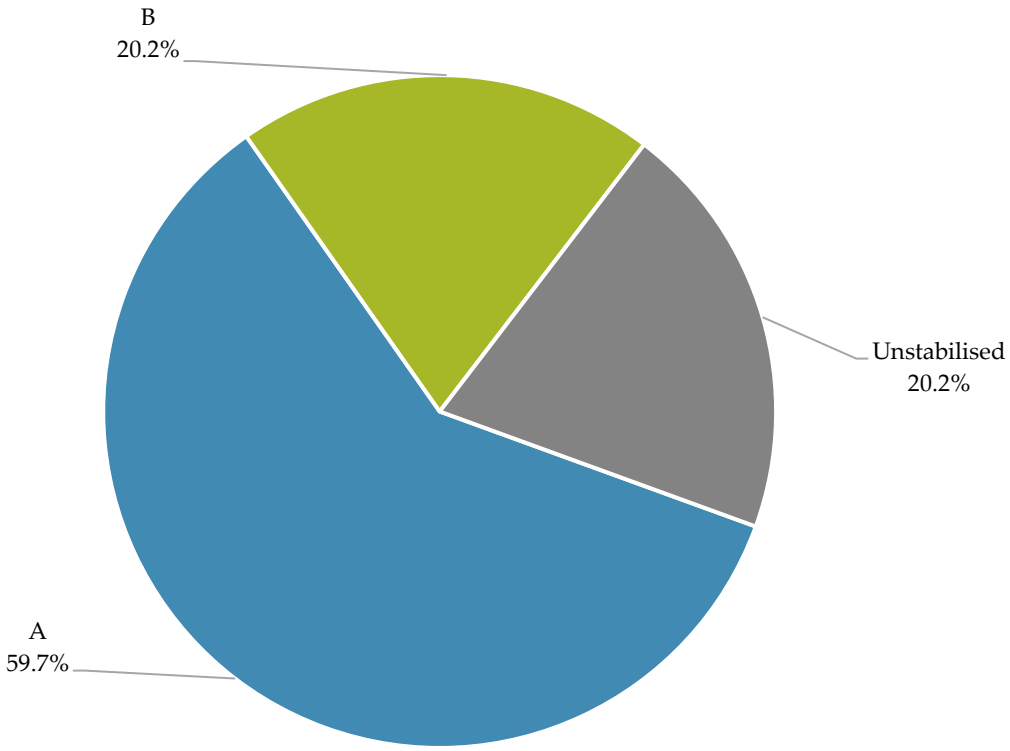

Figure 4-18: Stabilisation grade (dry mass basis), WA and NT 2023

4.4 CONTAMINANT GRADE

Biosolids contaminant grade nationally and for each state is presented in Figure 4-19 to Figure 4-26 following. Figure 4-20 shows how contaminant grade has changed since the first biosolids production and end use survey in 2010.

Biosolids classified as unspecified/not graded have dropped from 6% to 2.6% since the 2021 survey.

There have been small shifts in contaminant grade across most states but Queensland has seen a significant shift from contaminant grade B to C, contributing significantly to the drop from 57% to 44% of biosolids classified as contaminant grade B and the commensurate rise in biosolids grade C from 33% to 48%.

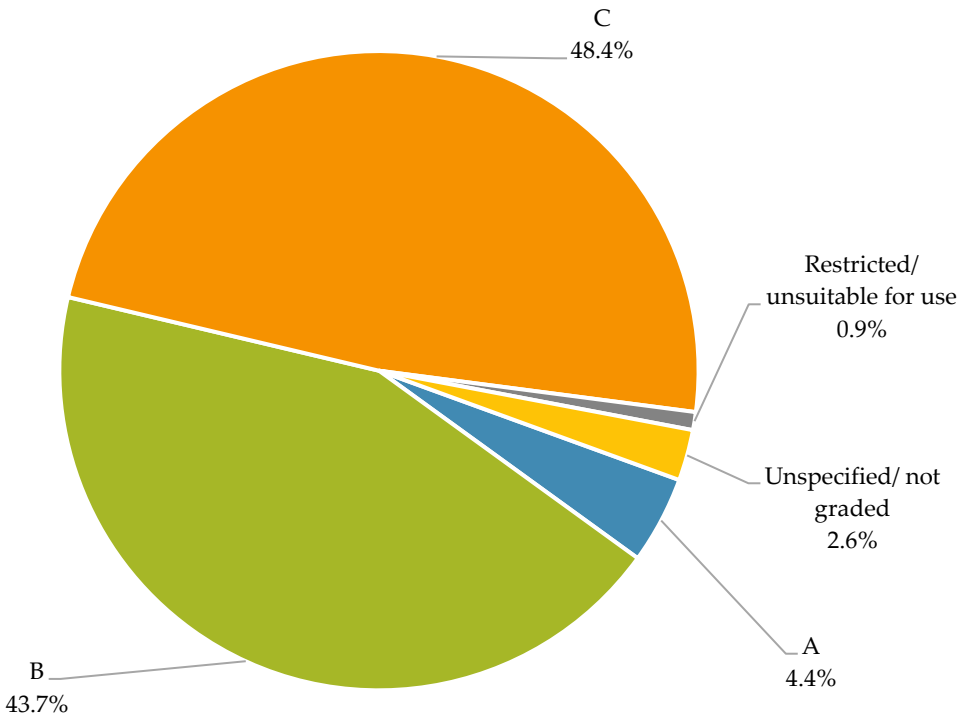

Figure 4-19: Contaminant grade (dry mass basis), Australia 2023

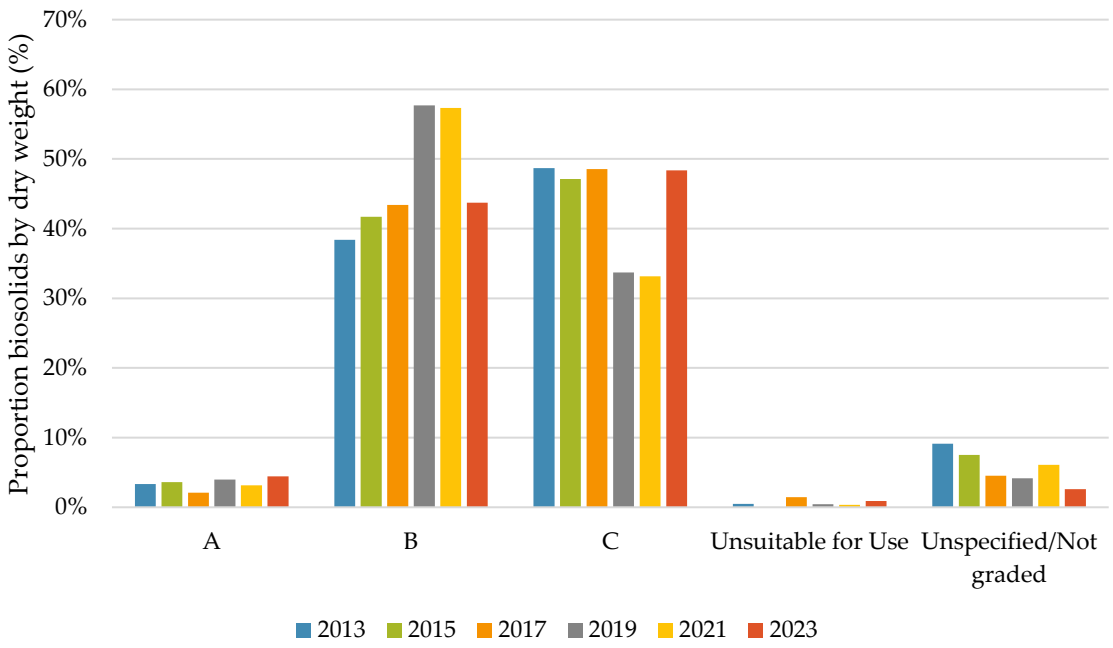

Figure 4-20: Contaminant grade (dry mass basis) over time, Australia 2010 to 2023

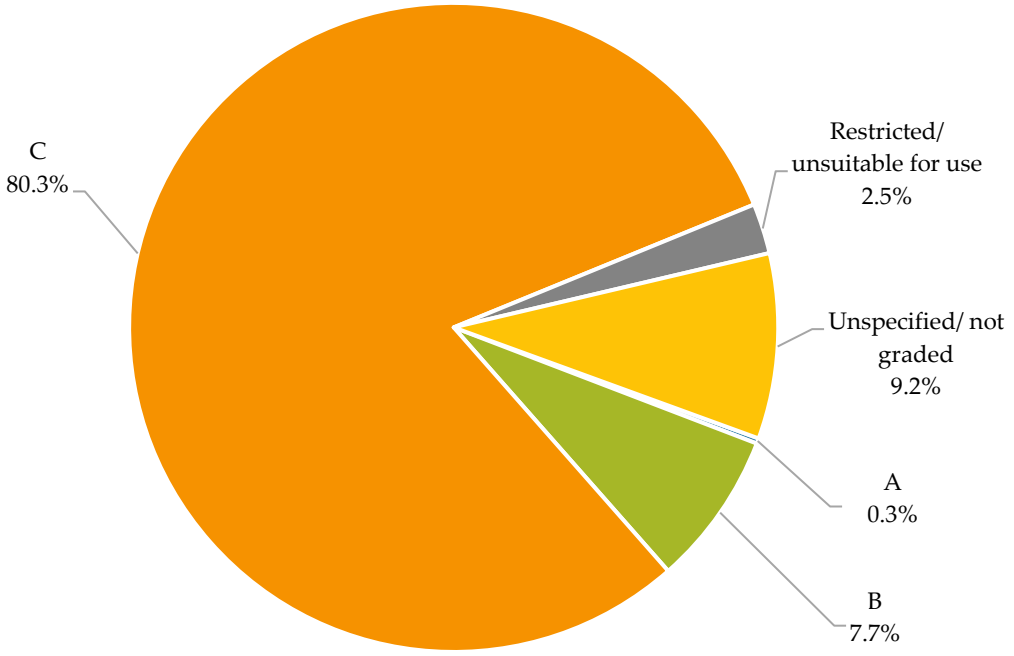

Figure 4-21: Contaminant grade (dry mass basis), NSW and ACT 2023

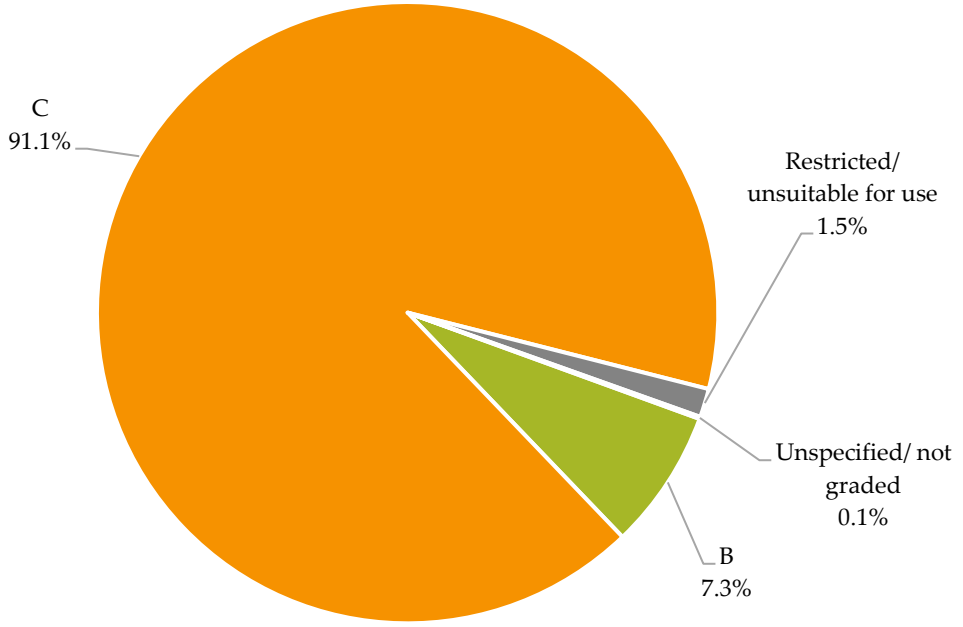

Figure 4-22: Contaminant grade (dry mass basis), Queensland 2023

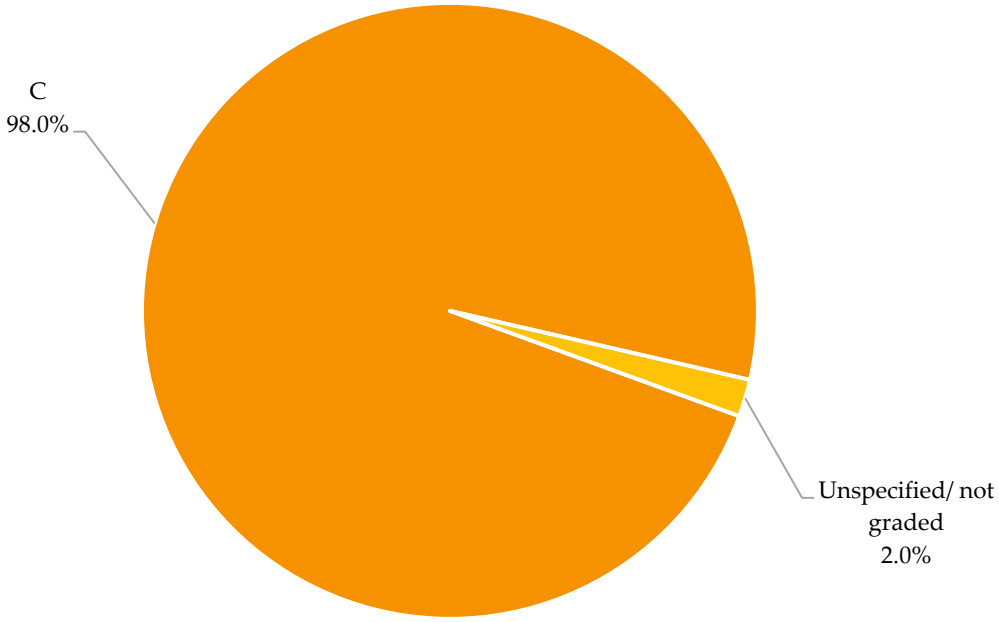

Figure 4-23: Contaminant grade (dry mass basis), South Australia 2023

Note that actual grade according to South Australian guidelines is B, C is with normalised grading.

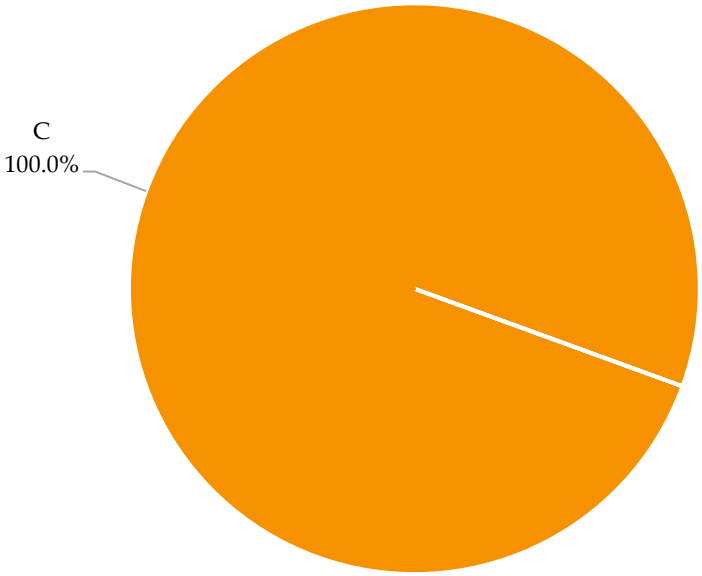

Figure 4-24: Contaminant grade (dry mass basis), Tasmania 2023

Note that actual grade according to Tasmanian guidelines is B, C is with normalised grading.

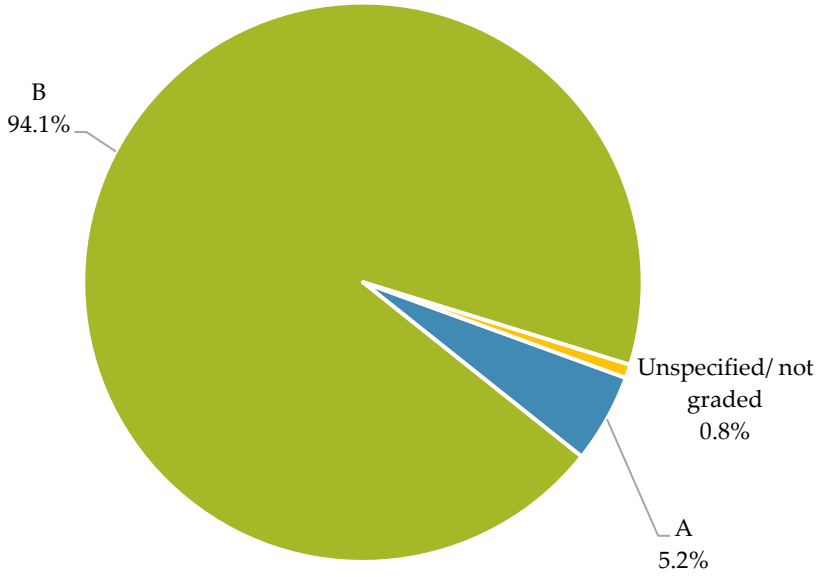

Figure 4-25: Contaminant grade (dry mass basis), Victoria 2023

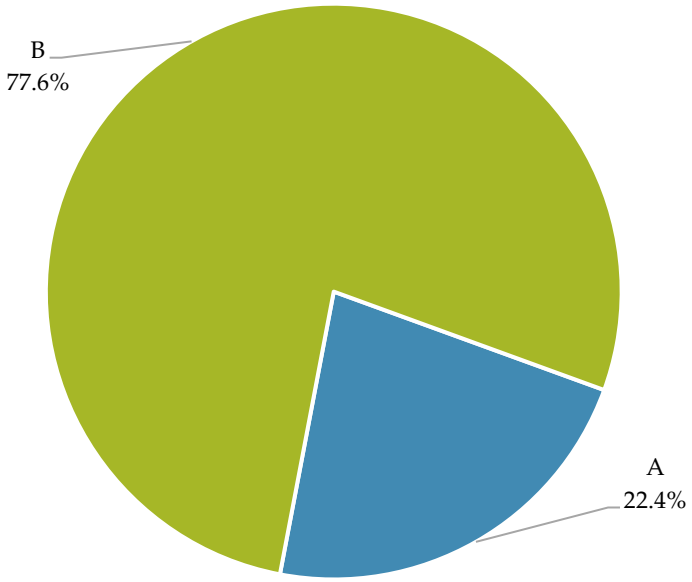

Figure 4-26: Contaminant grade (dry mass basis), WA and NT 2023

4.5 STABILISATION PROCESS

Information was collected on main and secondary stabilisation processes. This information nationally and for each state is presented in Figure 4-27 to Figure 4-33 following.

Anaerobic digestion has previously been the main stabilisation method for over 50% of biosolids produced and sludge drying beds and drying lagoons a small part. The change this year is due to a significant producer reclassifying their treatment process from anaerobic digestion to sludge drying beds.

Anaerobic digestion includes different types of anaerobic digestion such as the most common mesophilic process as well as TPAD (thermally phased anaerobic digestion) and acid phase digestion.

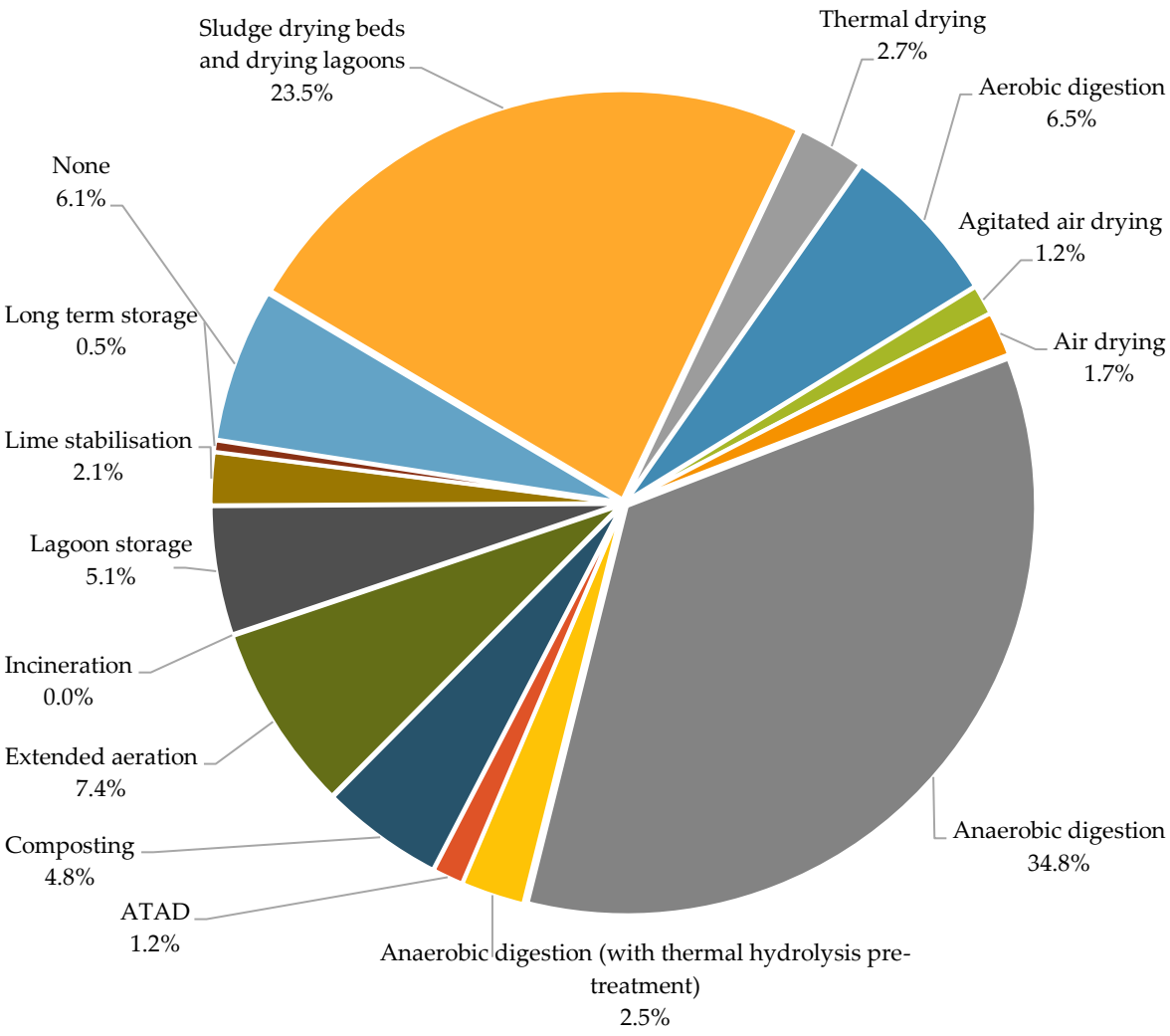

Figure 4-27: Main stabilisation process (dry mass basis), Australia 2023

* Note for this report that values of 0.0% denote data less than 0.1%. This has been included in figures despite not showing any value, as 1 decimal place does not capture values <0.1%.

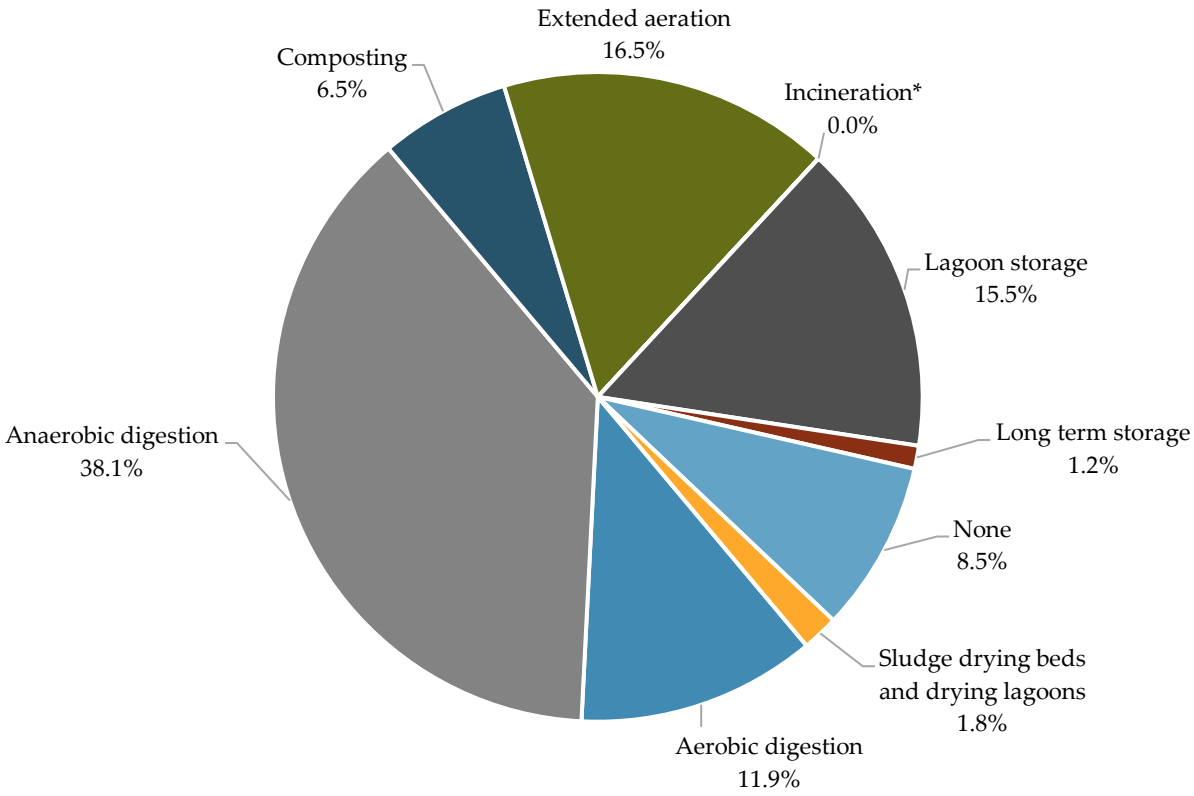

Figure 4-28: Main stabilisation process (dry mass basis), NSW and ACT 2023

* Note for this report that values of 0.0% denote data less than 0.1%. This has been included in figures despite not showing any value, as 1 decimal place does not capture values <0.1%.

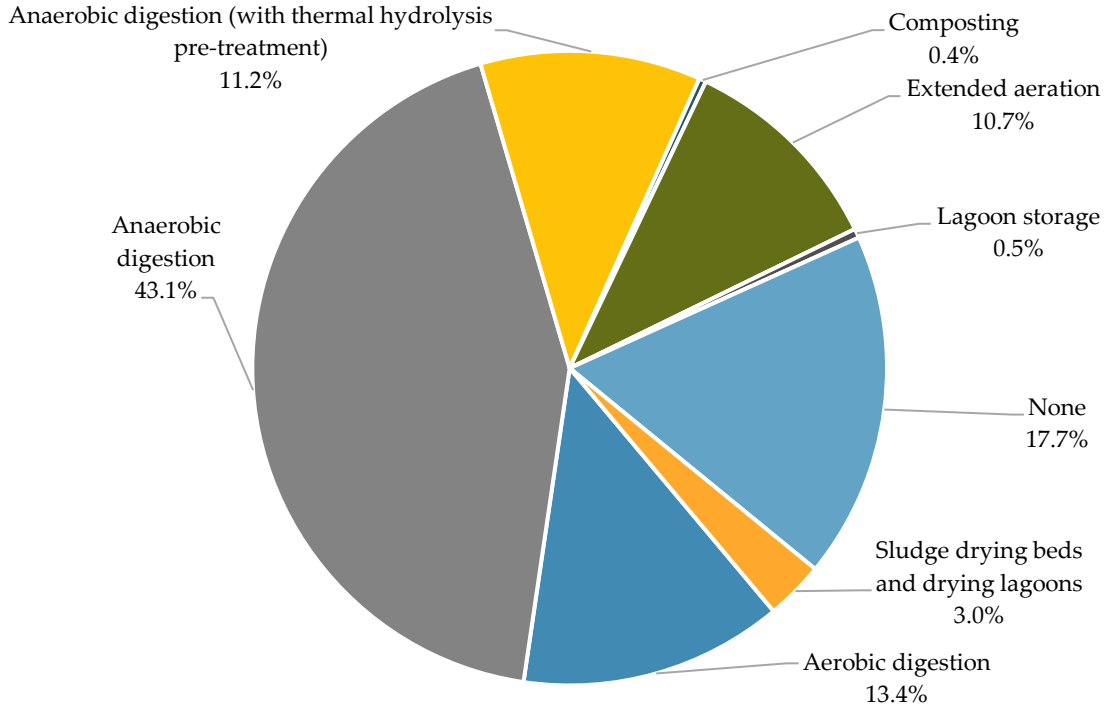

Figure 4-29: Main stabilisation process (dry mass basis), Queensland 2023

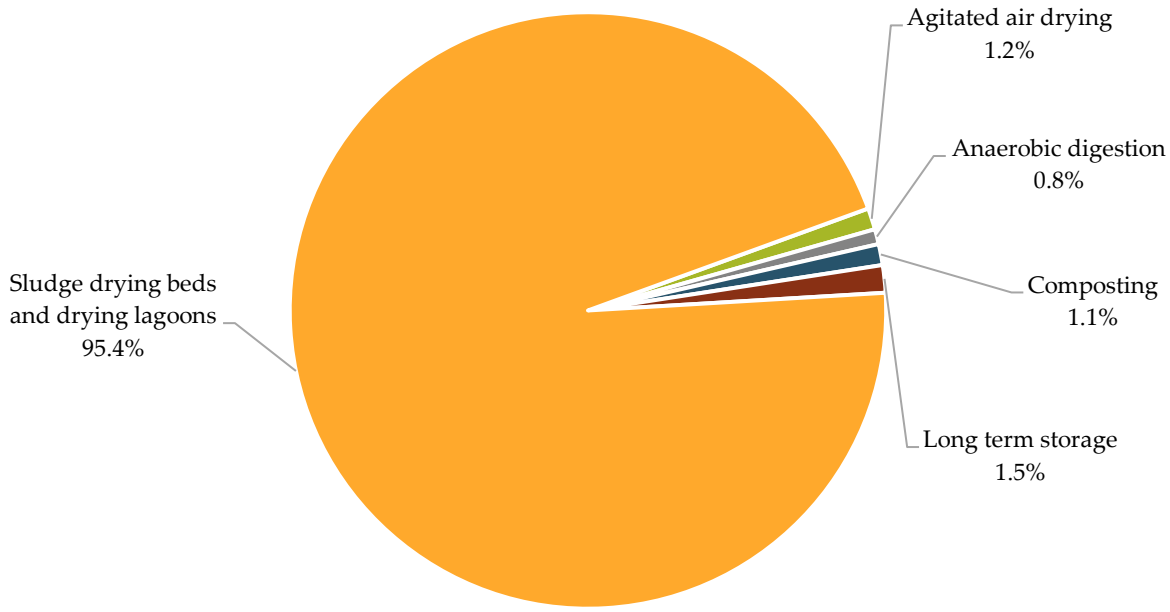

Figure 4-30: Main stabilisation process (dry mass basis), South Australia 2023

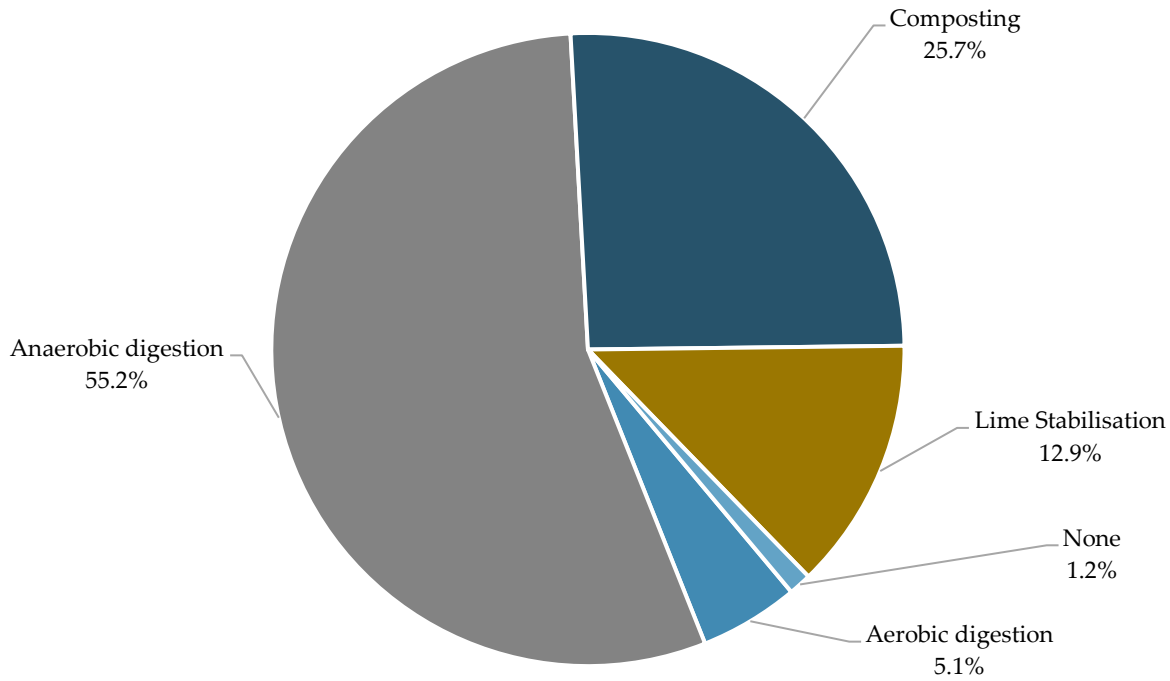

Figure 4-31: Main stabilisation process (dry mass basis), Tasmania 2023

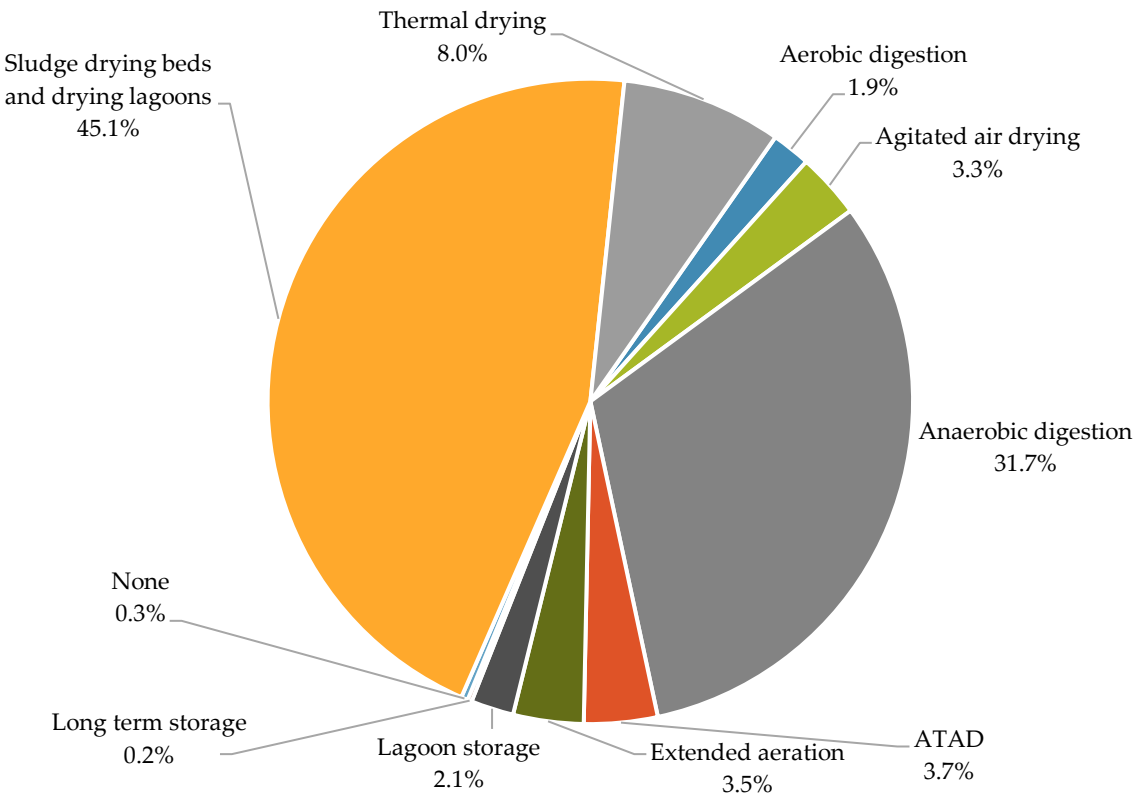

Figure 4-32: Main stabilisation process (dry mass basis), Victoria 2023

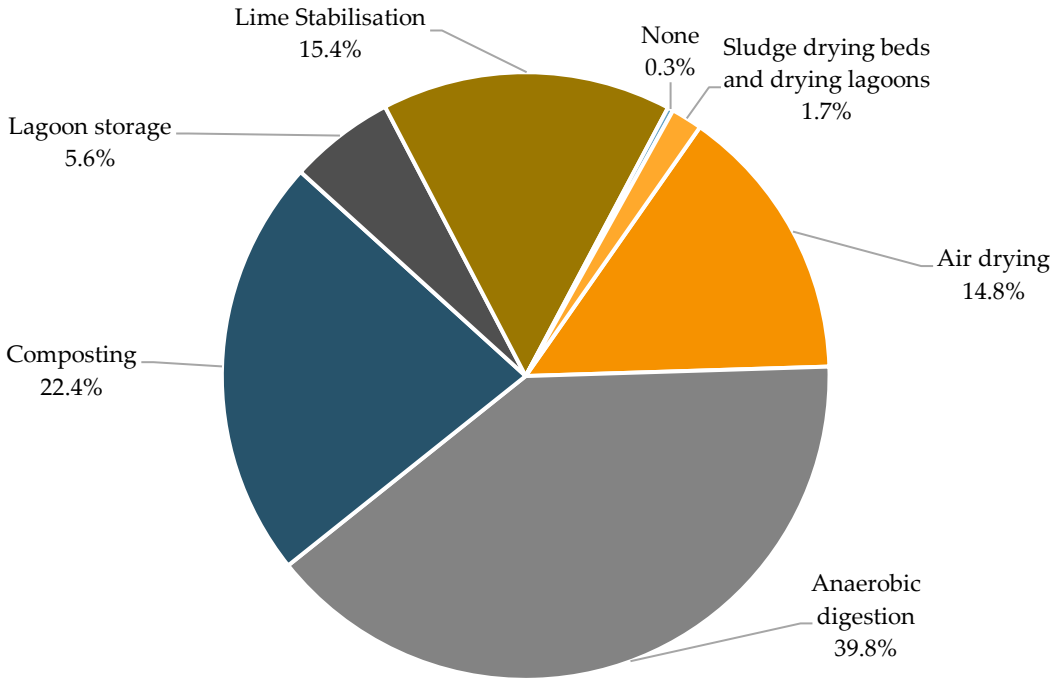

Figure 4-33: Main stabilisation process (dry mass basis), WA and NT 2023

Additional data was requested from 2021 regarding any secondary stabilisation carried out. Figure 4-34 to Figure 4-40 show this data for 2022/23.

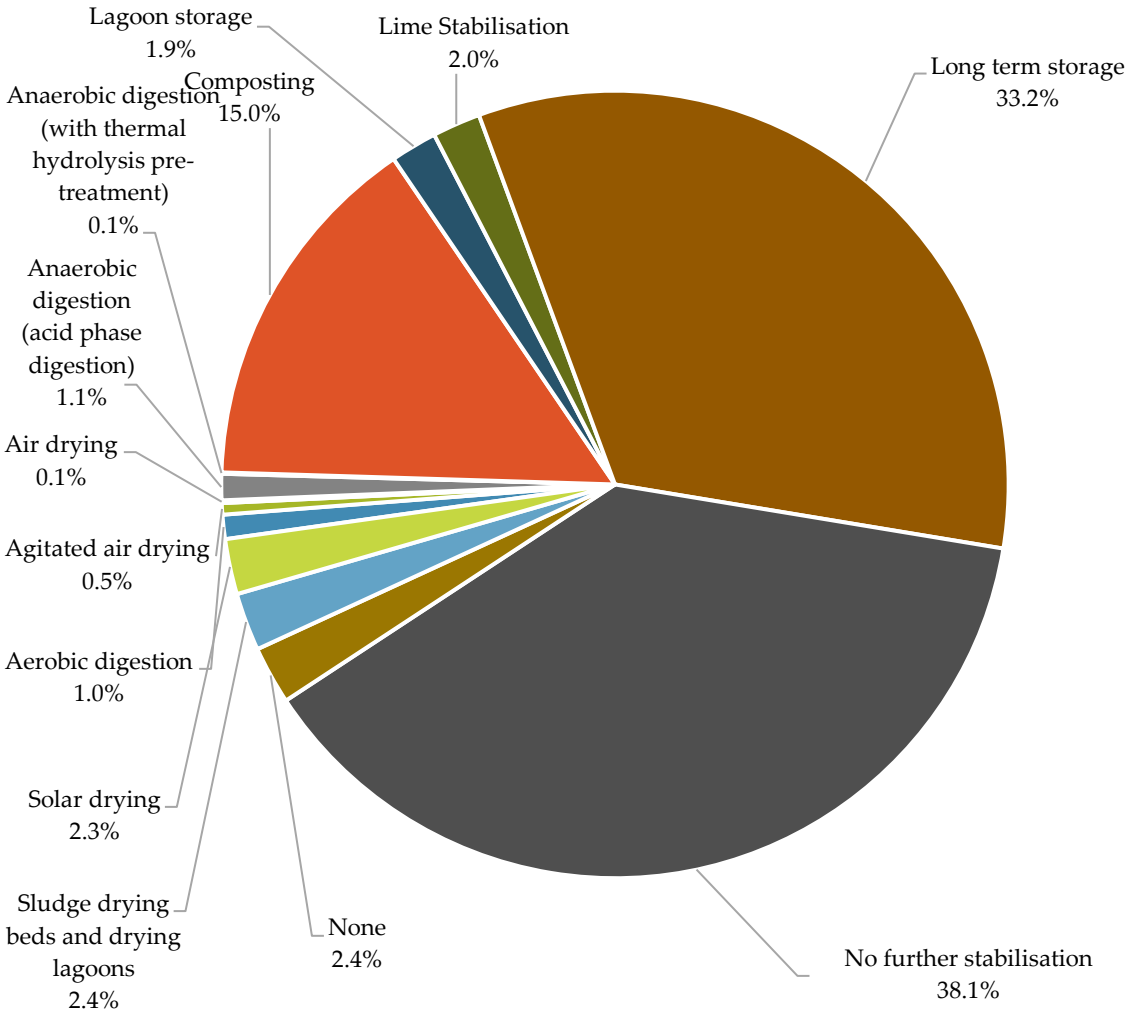

Figure 4-34: Secondary stabilisation process 2023 (dry mass basis), Australia 2023

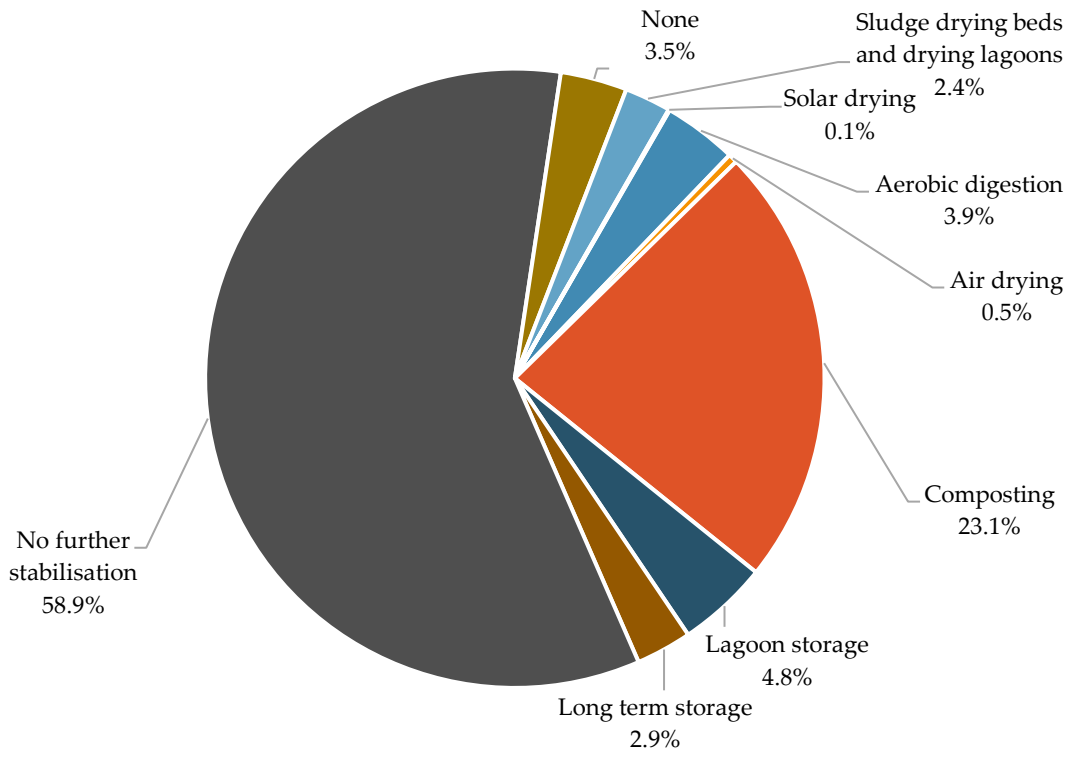

Figure 4-35: Secondary stabilisation process (dry mass basis), NSW and ACT 2023

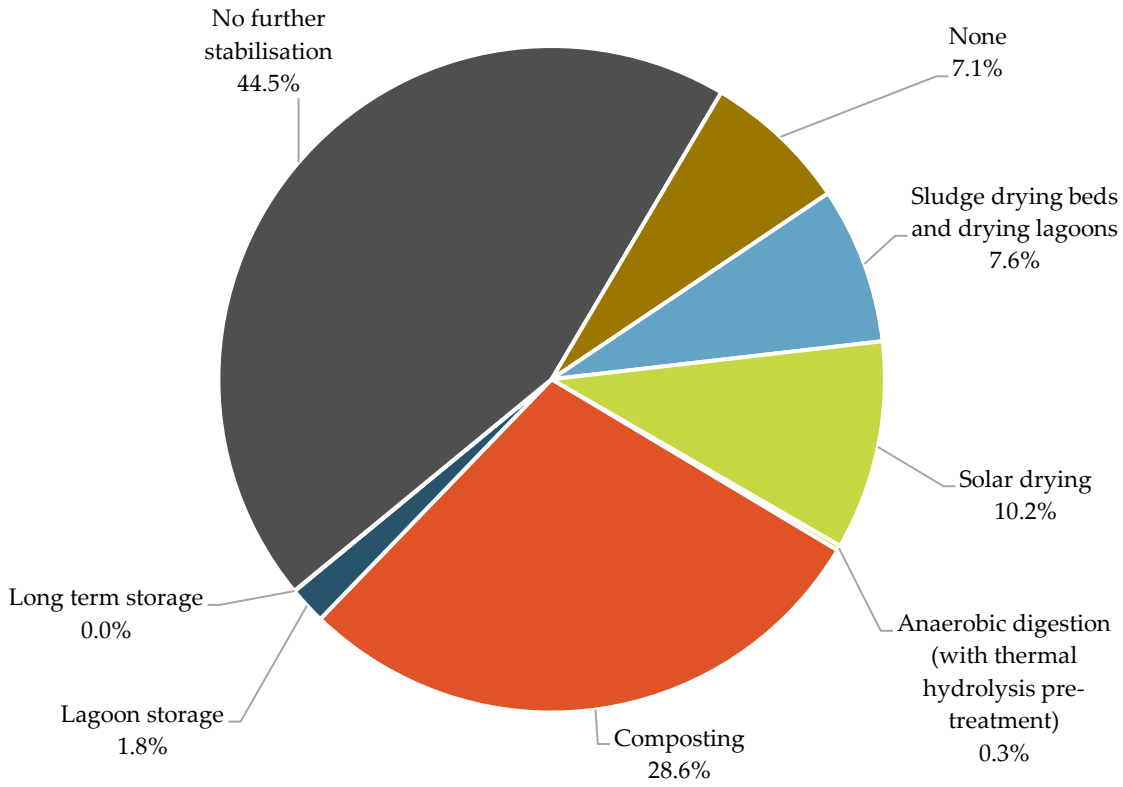

Figure 4-36: Secondary stabilisation process (dry mass basis), Queensland 2023

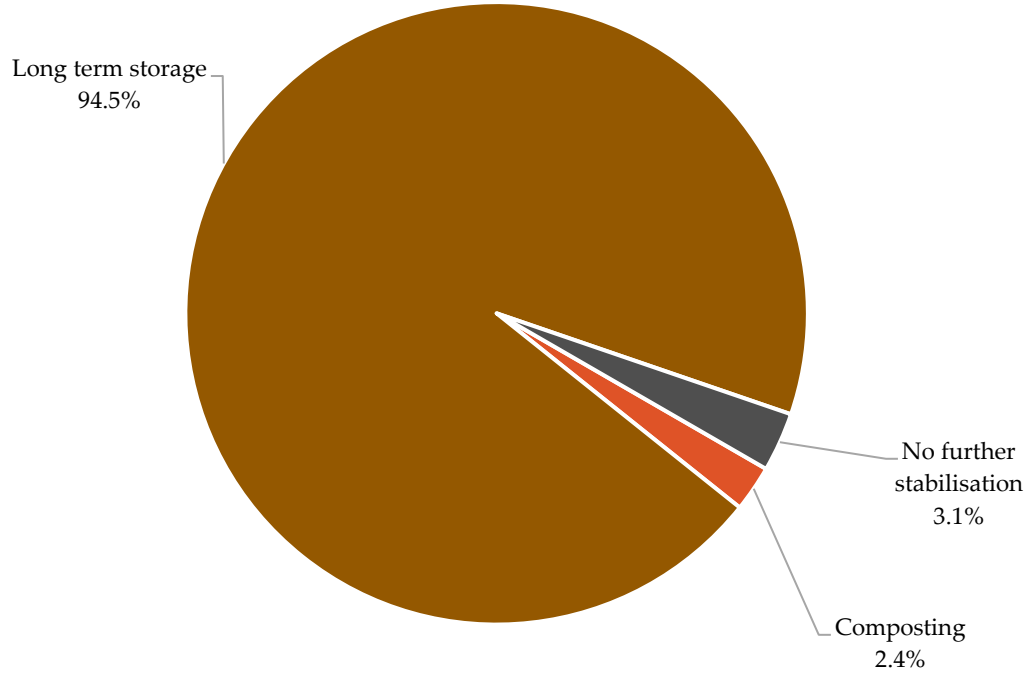

Figure 4-37: Secondary stabilisation process (dry mass basis), South Australia 2023

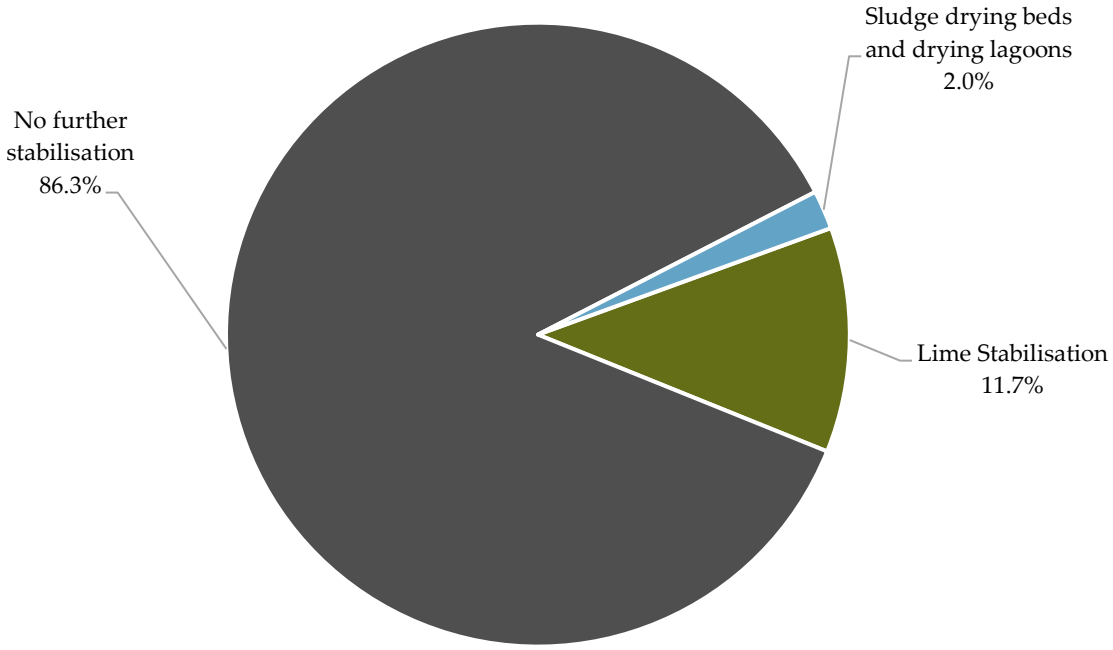

Figure 4-38: Secondary stabilisation process (dry mass basis), Tasmania 2023

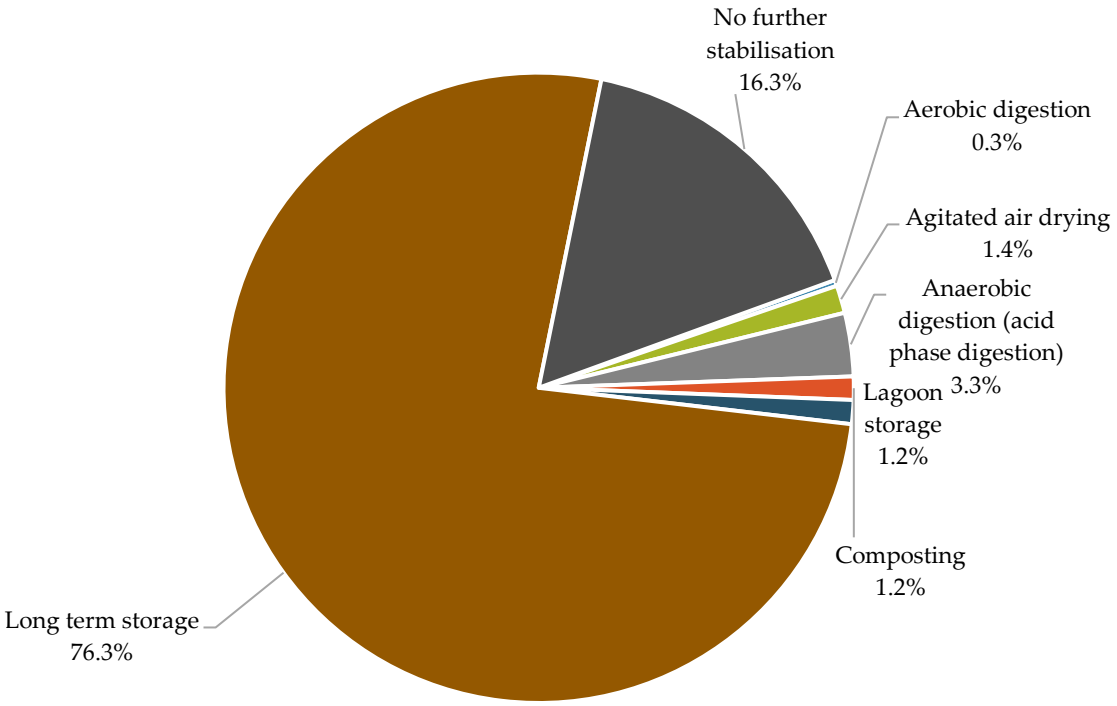

Figure 4-39: Secondary stabilisation process (dry mass basis), Victoria 2023

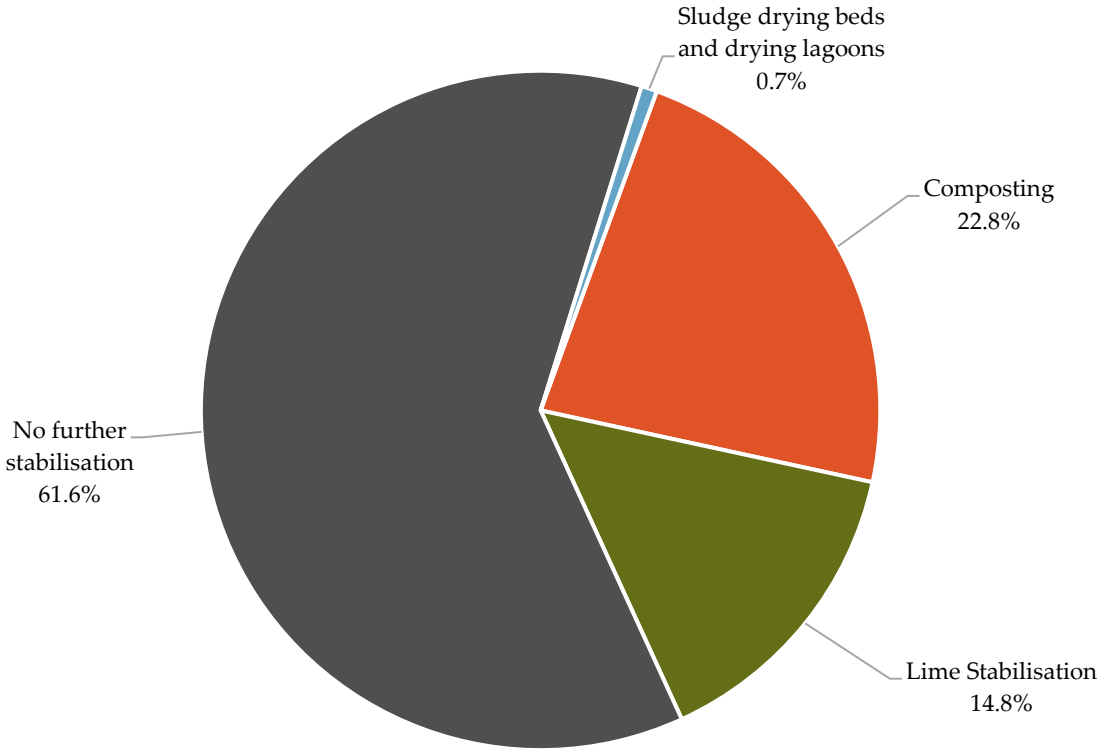

Figure 4-40: Secondary stabilisation process (dry mass basis), WA and NT 2023

4.6 DEWATERING PROCESS

Biosolids dewatering process nationally and for each state is presented in Figure 4-41 to Figure 4-47 following. There was very little change in the proportion of dewatering processes from the recent surveys.

Reported dewatering processes in the 'other' category included: Geobags, high solids centrifuge, contract dewatering, volute dehydrator, piston press, rotary screw press, fan press and trickle filter/lagoon/cold anaerobic digestion.

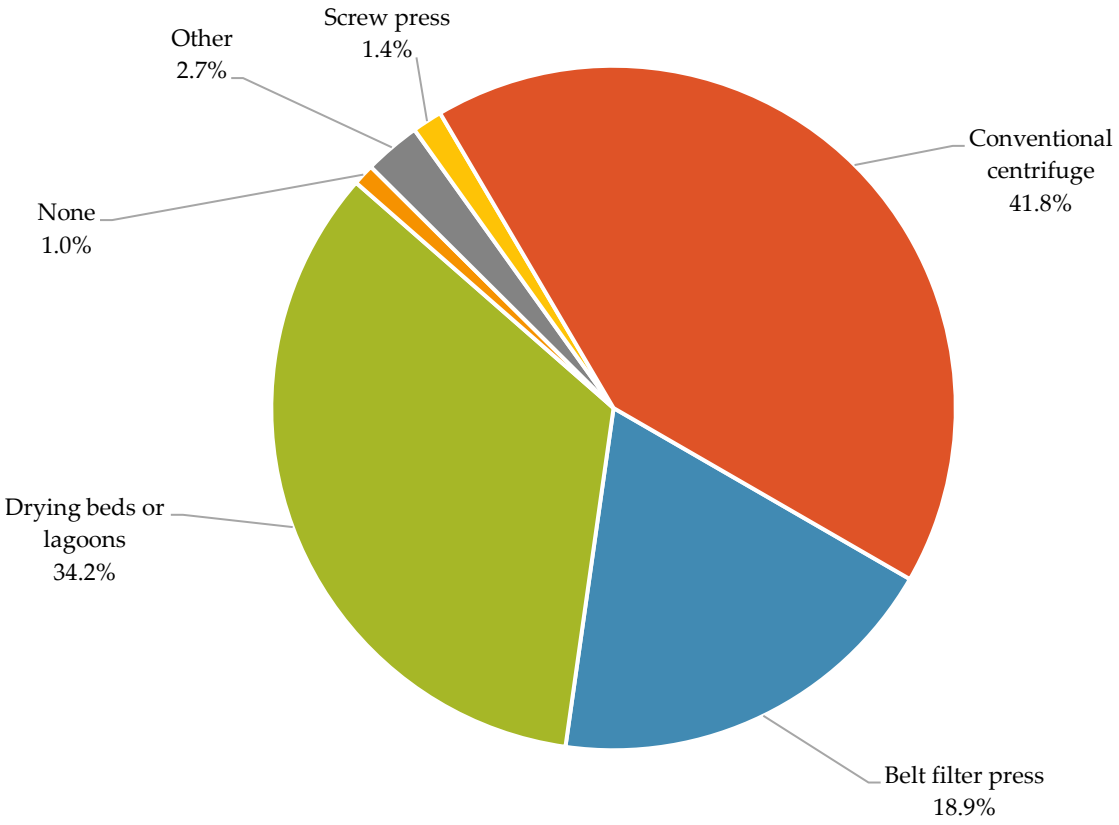

Figure 4-41: Dewatering process 2023 (dry mass basis), Australia 2023

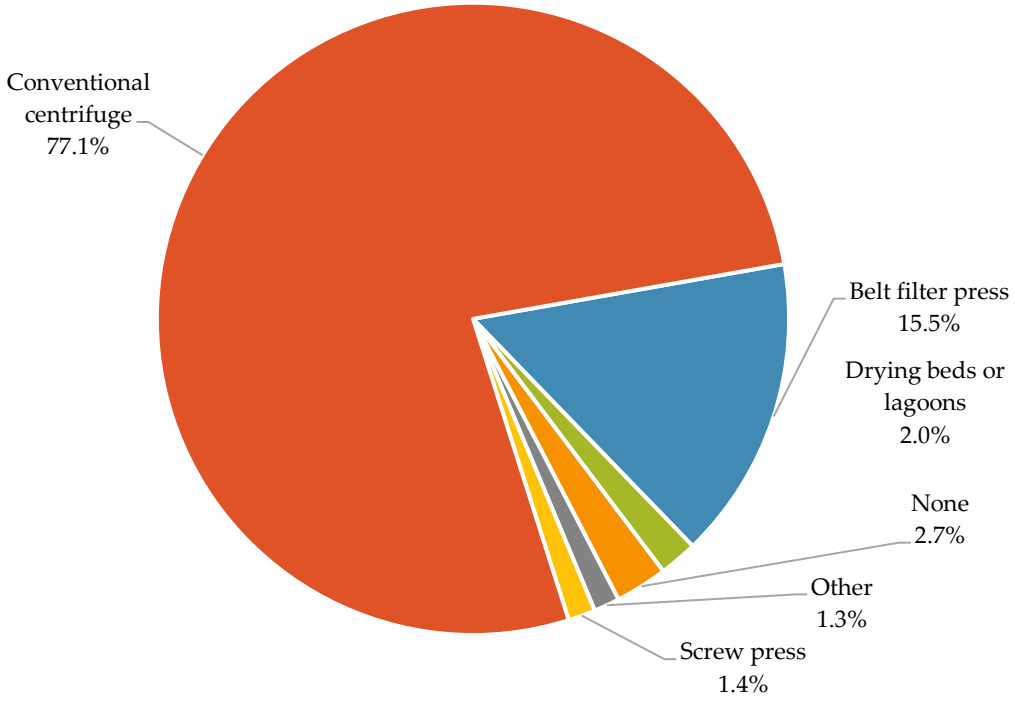

Figure 4-42: Dewatering process (dry mass basis), NSW and ACT 2023

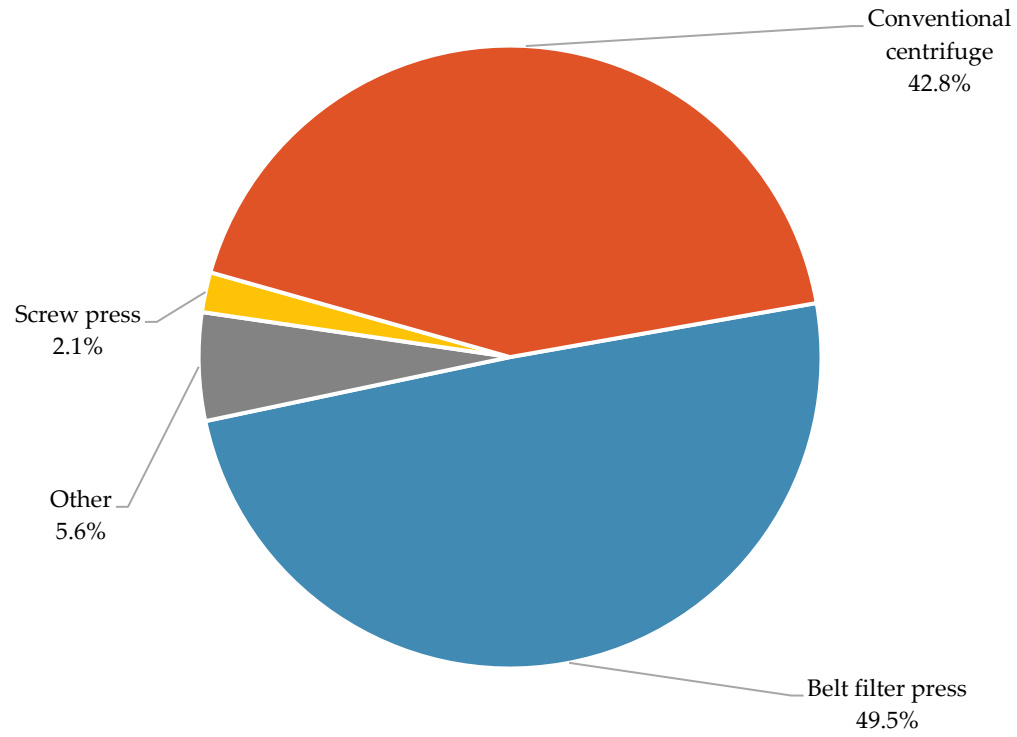

Figure 4-43: Dewatering process (dry mass basis), Queensland 2023

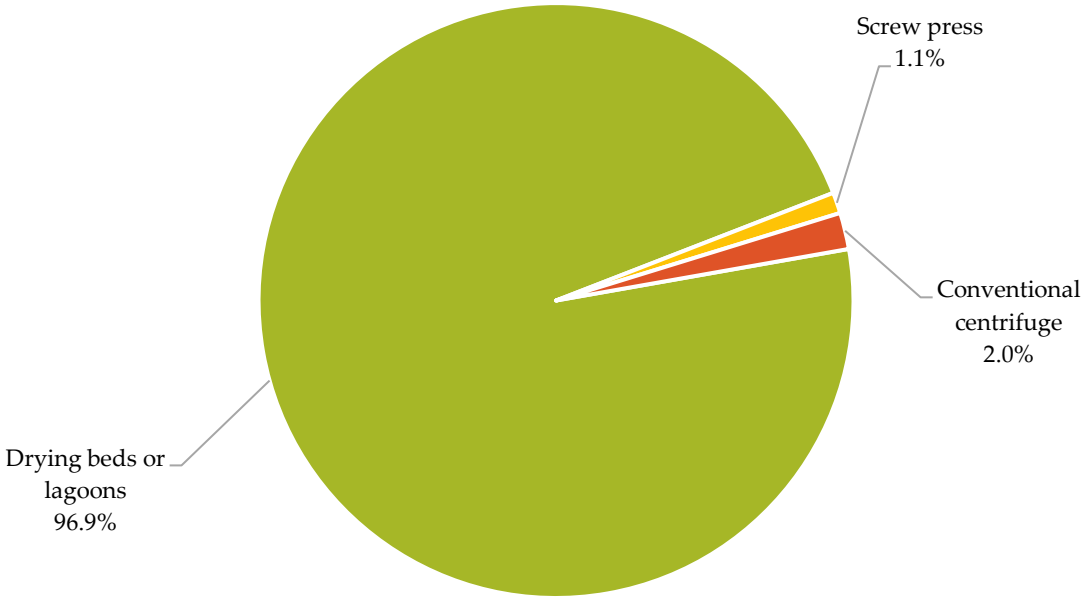

Figure 4-44: Dewatering process (dry mass basis), South Australia 2023

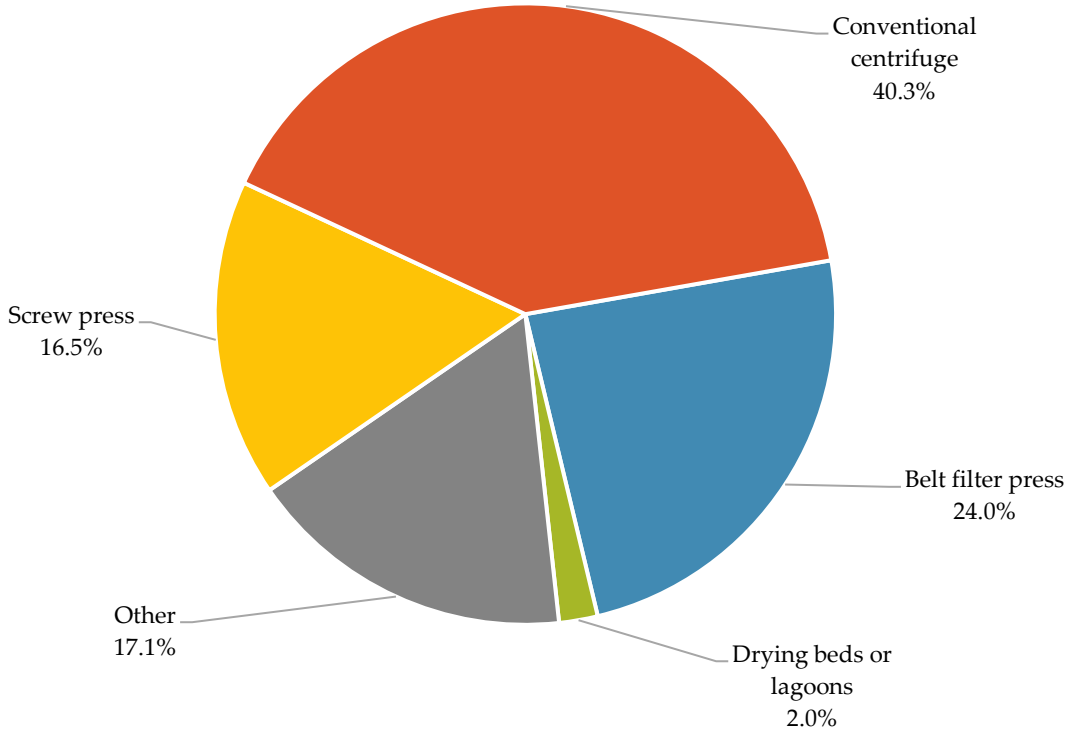

Figure 4-45: Dewatering process (dry mass basis), Tasmania 2023

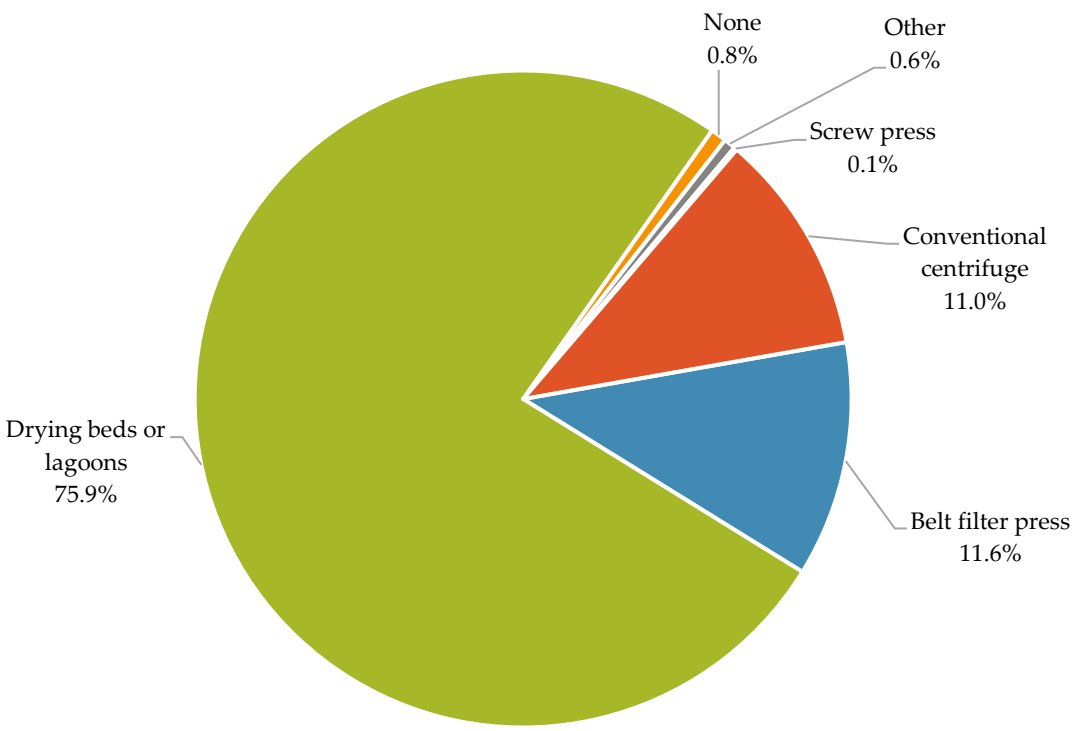

Figure 4-46: Dewatering process (dry mass basis), Victoria 2023

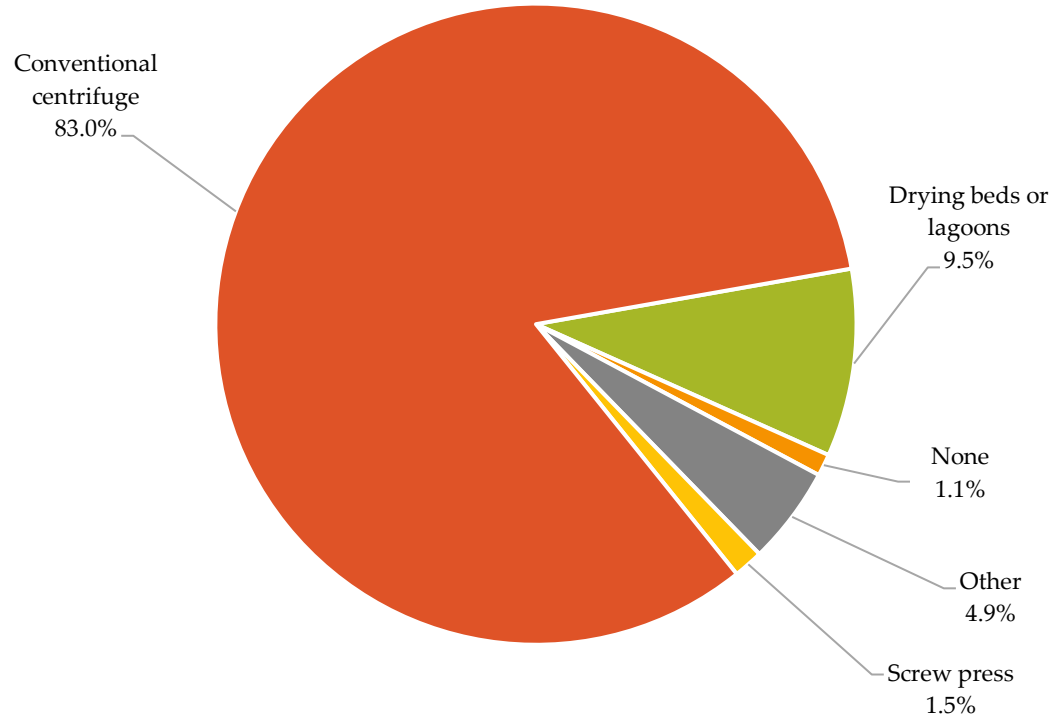

Figure 4-47: Dewatering process (dry mass basis), WA and NT 2023

4.7 BIOSOLIDS MANAGEMENT

4.7.1 Transportation distances

Transportation distances for biosolids to end use for Australia and each state are presented in Figure 4-48 to Figure 4-54 following. More than half of biosolids are transported between 50 and 400 km for beneficial use.

Biosolids produced in South Australia are transported all over the state, generally a distance of between 50 and 350 km, hence the high response percentage of 'other'.

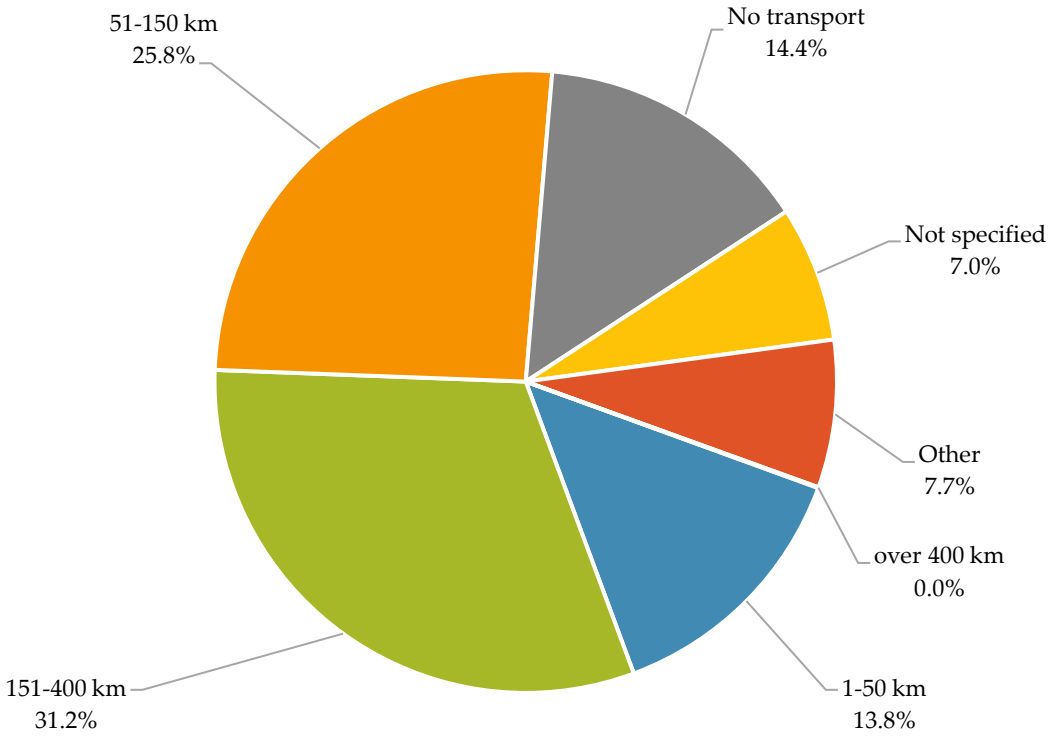

Figure 4-48: Transportation distances (dry mass basis), Australia 2023

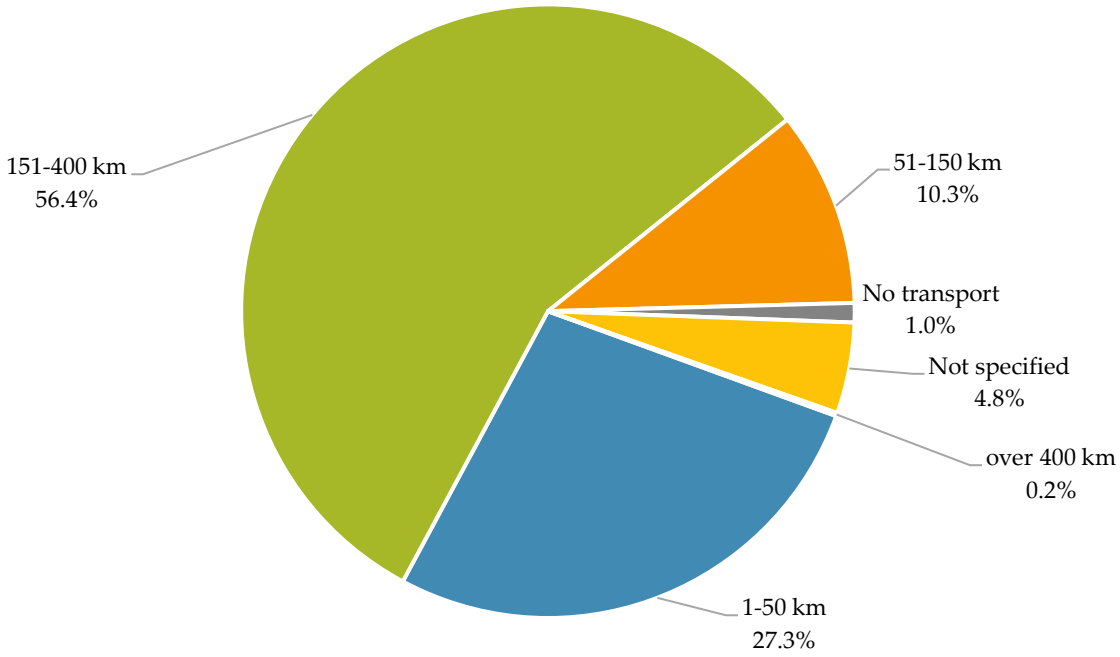

Figure 4-49: Transportation distances (dry mass basis), NSW and ACT 2023

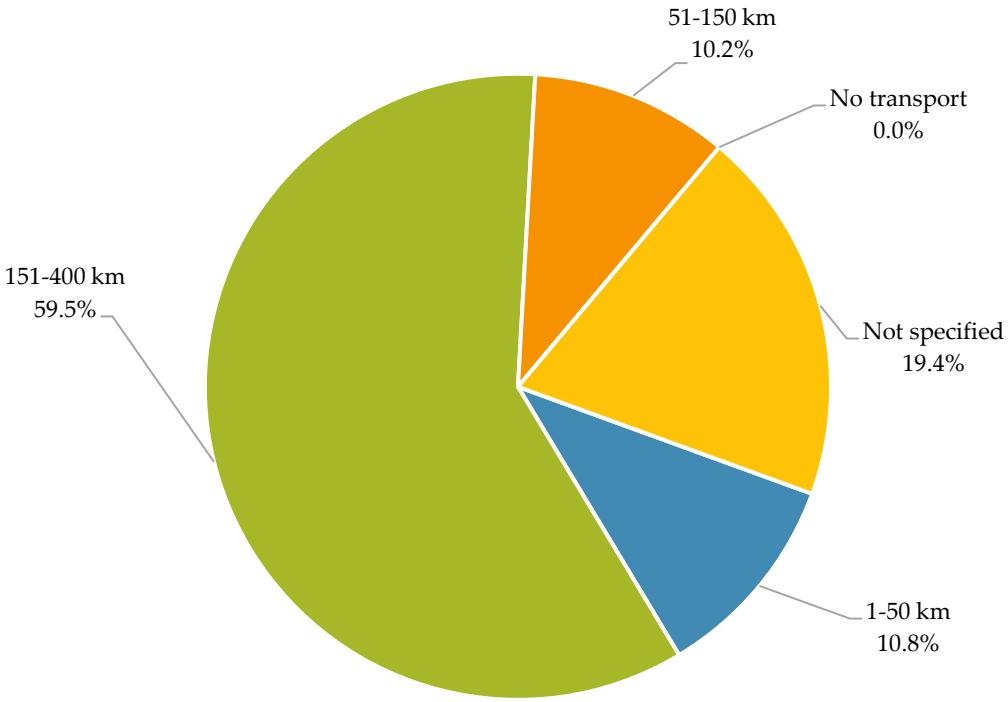

Figure 4-50: Transportation distances (dry mass basis), Queensland 2023

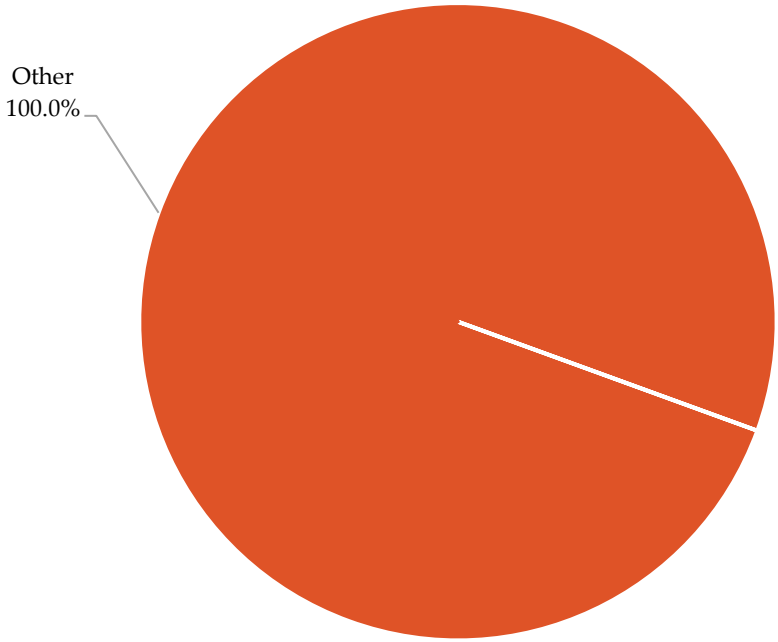

Figure 4-51: Transportation distances (dry mass basis), South Australia 2023

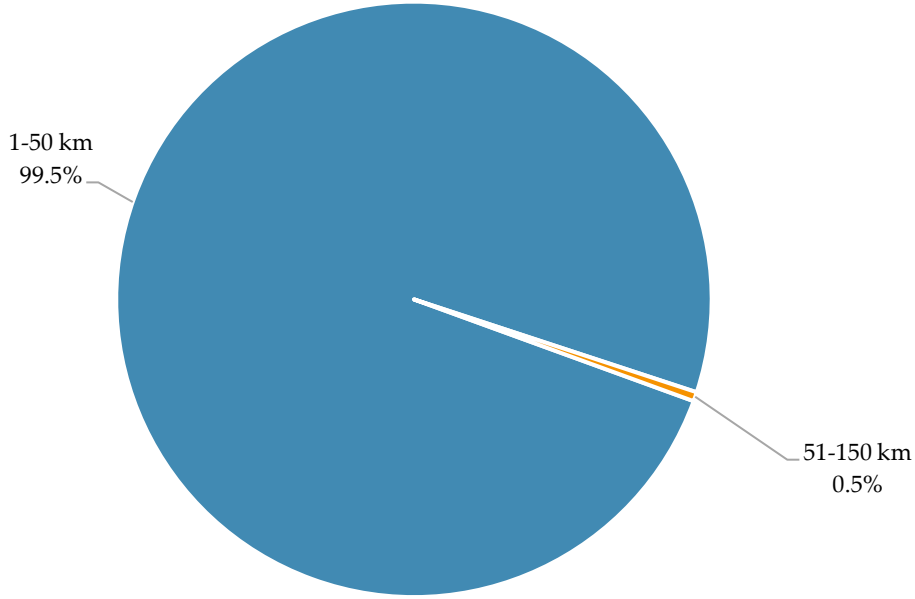

Figure 4-52: Transportation distances (dry mass basis), Tasmania 2023

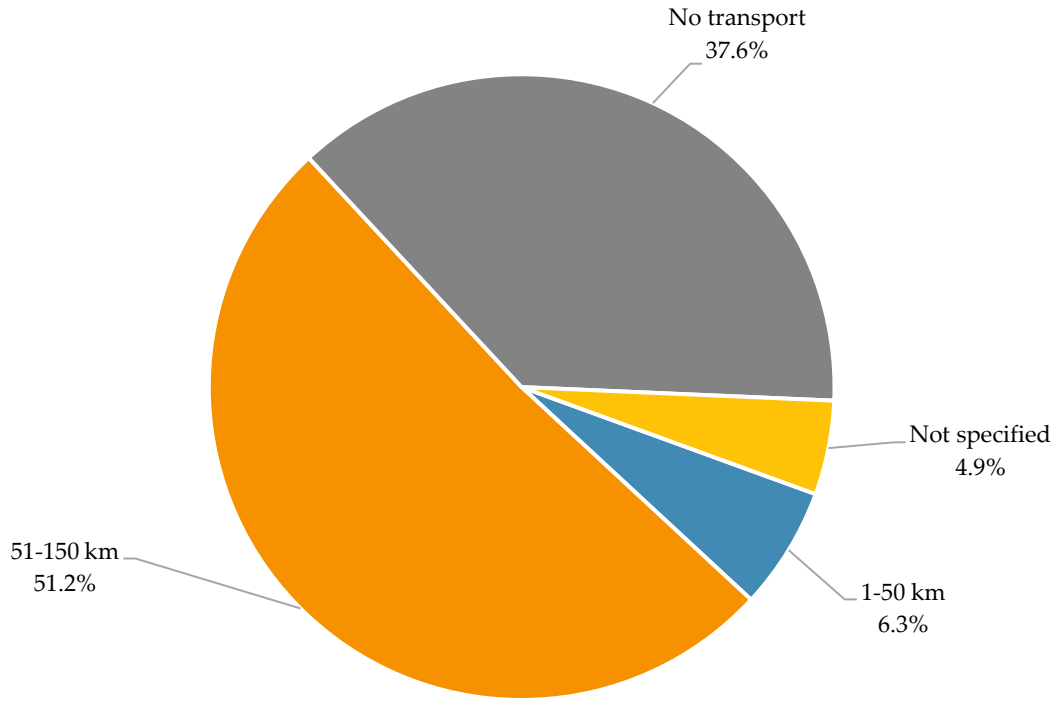

Figure 4-53: Transportation distances (dry mass basis), Victoria 2023

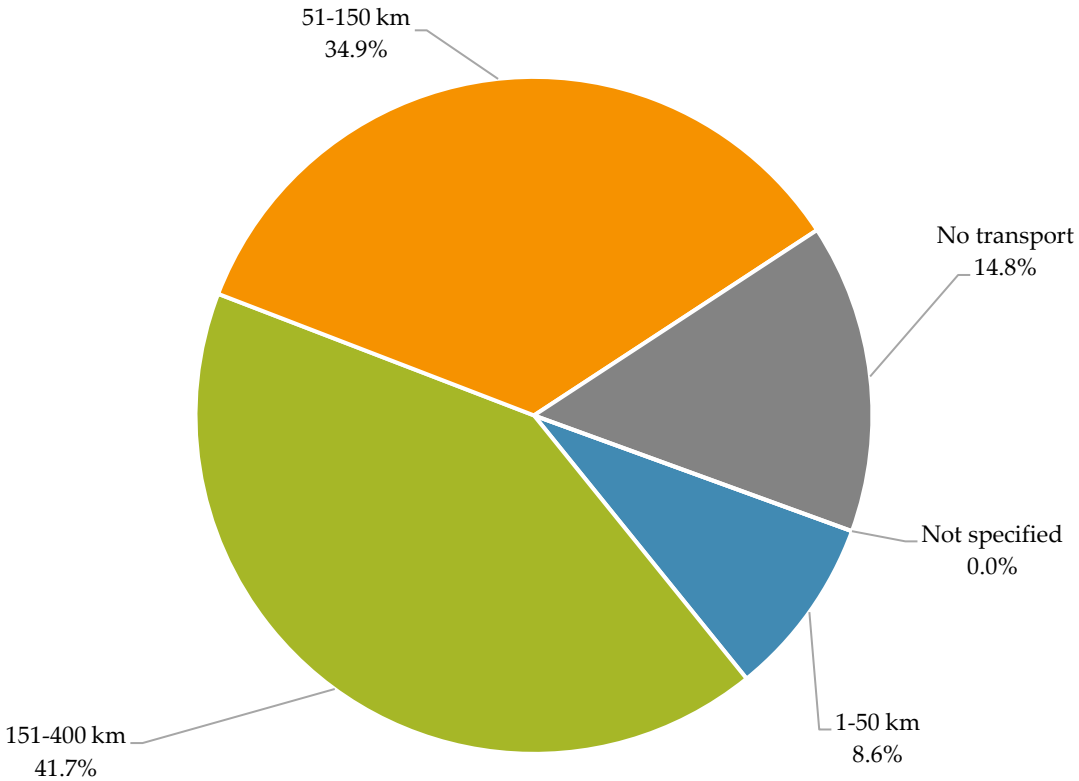

Figure 4-54: Transportation distances (dry mass basis), WA and NT 2023

4.7.2 Historical stockpiles

Data collection on historic stockpiles of biosolids started in 2021. Table 4-2 shows a summary of results from this survey. Nine sites were reported as having stockpiles of over 10,000 dry tonnes of biosolids.

These data should only be considered to have limited accuracy due to the difficulties of estimating stockpile sizes, changes in size as biosolids digests in stockpiles and general reporting errors which cannot be validated like other data in the report.

Table 4-2: Summary of reported historic stockpile data

Reported parameter	2021	2023
Number of sites with reported historic stockpiles	70	65
Reported historical stockpiles	2.5 million	2.6 million
Mass removed from stockpile in last year (dry tonnes)	74,000	5,000
Mass added to stockpile in last year (dry tonnes)	45,000	70,000
Median stockpile size (dry tonnes)	1100	130

4.7.3 Emerging contaminant measurement

Participants were asked if their biosolids was analysed regularly for PFAS or other emerging contaminants that are not yet regulated. By mass, 86% of biosolids produced in Australia is analysed for PFAS or other emerging contaminants.

Figure 4-55 shows the total approach in Australia, Table 4-3 shows the approach by mass basis by state.

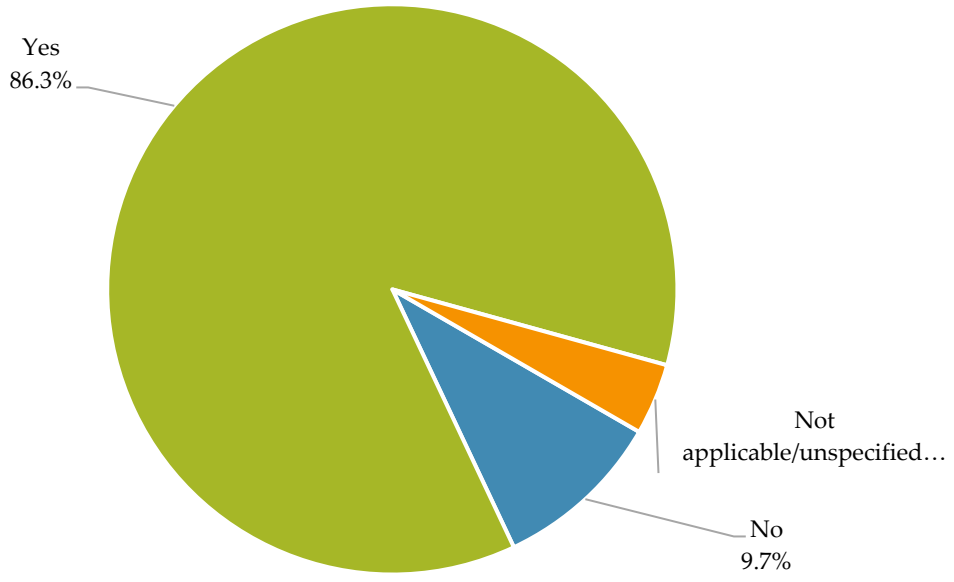

Figure 4-55: Biosolids analysed for emerging contaminants (dry mass basis), Australia 2023

Table 4-3: Emerging contaminant approach by state (dry mass basis), Australia 2023

Response	NSW & ACT	QLD	SA	TAS	VIC	WA & NT	Total
No	16%	12%	0%	0%	7%	8%	10%
Yes	79%	80%	100%	100%	89%	92%	86%
Not applicable	5%	8%	0%	0%	3%	0%	4%

4.7.4 Emerging contaminant risk management

Participants were asked which statement best agrees with their organisation's risk management approach for emerging contaminants:

- No risk management approach to emerging contaminants
- Monitoring only
- High-level risk assessment
- Detailed formal risk assessment.

As shown in Figure 4-56, 35.5% of biosolids produced Australia (by dry tonne) undergoes a detailed risk assessment. This is 7.7% of the reported sites for this survey.

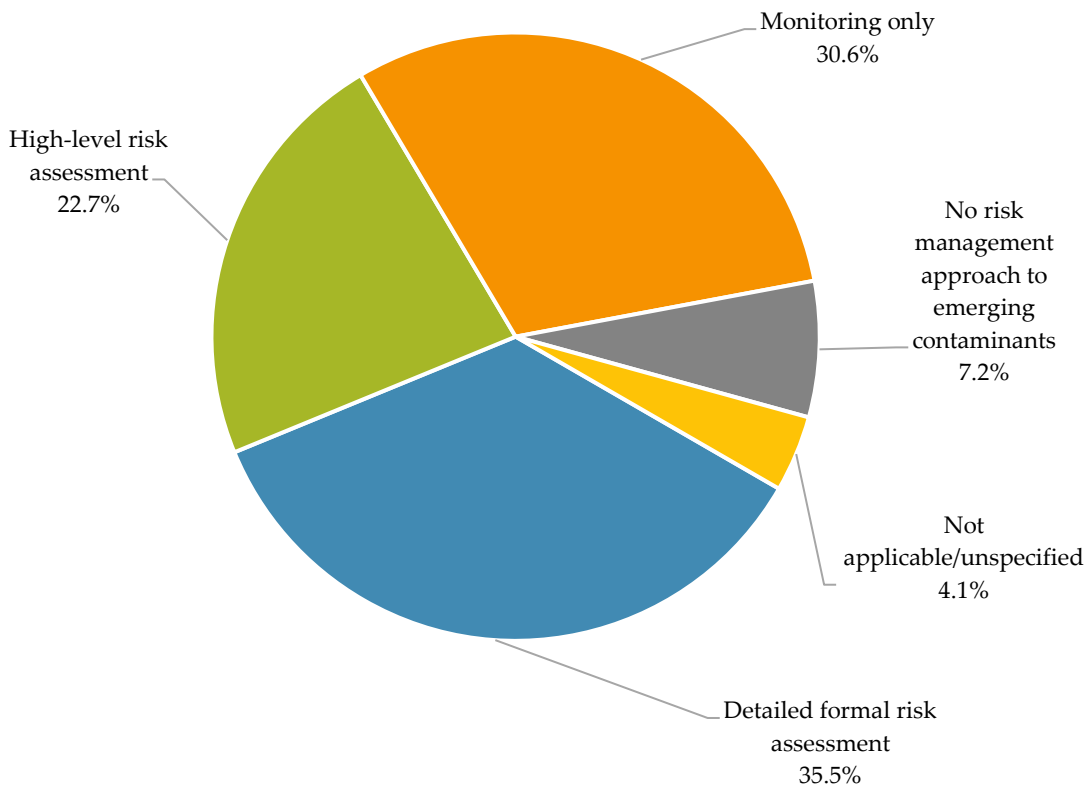

Figure 4-56: Organisational approach to managing emerging contaminants, Australia 2023

4.7.5 Renewable energy

Participants were asked if renewable energy was produced from biosolids. 42.5% of biosolids (by dry mass) from 40 sites is used to produce energy from biogas from anerobic digestion, burnt on site for heating or electricity production. In 2023 no utilities export biogas or heat.

This may not be a complete accounting of number of sites because several utilities did not respond to the 2023 survey where this data was collected. Additionally, several who did reply classify their energy production from biogas as part of the liquid treatment stream not the biosolids treatment stream so did not give data for this survey.

A total 129.6 GWh of electricity were produced as a minimum in 22/23. Electricity was both used on site and exported. Data was not provided for 7 of the 25 sites which stated electricity is produced on site.

Figure 4-59 shows the number of sites which use biogas for energy production onsite, categorised by dry tonnes of biosolids produced; a stand in for size of the treatment facility. For context, 85% of reported sites produce less than 5 dry tonnes per day and 5% of reported sites 5 to 10 dry tonnes per day.

The 13 sites producing heat from biogas were across the 0 to 5 dry tonnes per day size range.

Electricity production from biogas was in place at sites from as small as 0.5 dry tonnes per day.

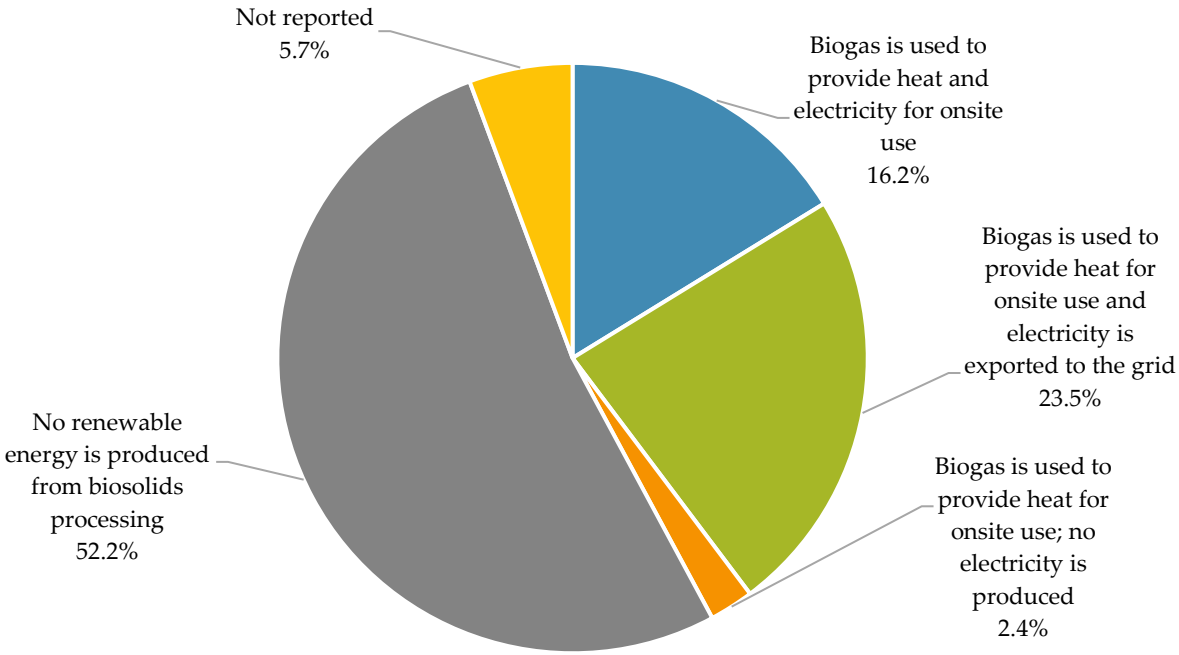

Figure 4-57: Biosolids renewable energy, (dry mass basis), Australia 2023

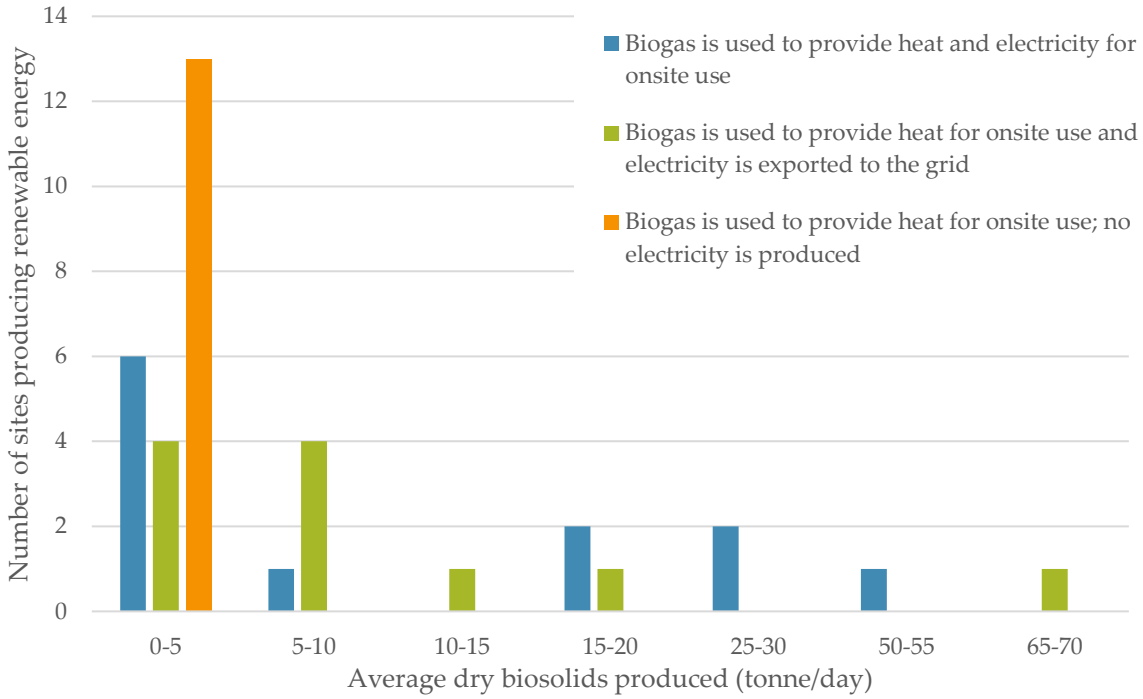

Figure 4-58: Number and size of sites producing renewable energy (dry mass basis) 2023

4.7.6 Biosolids transaction

Producers were asked about the transaction that takes place when biosolids is removed from site.

The final biosolids which is removed or disposed of does the producer:

- Receive payment for biosolids;
- Give biosolids away;
- Pay for removal from site for end use/disposal.

This question targets the transaction between producer and the end user, not any third party which may reprocess and sell a product containing biosolids. Results are shown in Figure 4-59 and reported by tonne dry solids.

Overall the mass of biosolids where payment was received by the producer doubled from 7% to 14 % but this all occurred for one producer in Victoria not in Western Australia as reported in 2021. The mass of biosolids where the producer had to pay for removal from site increase proportionally by about 3% to 59.3%.

The producers reporting 'other' were not able to specify what transaction was used.

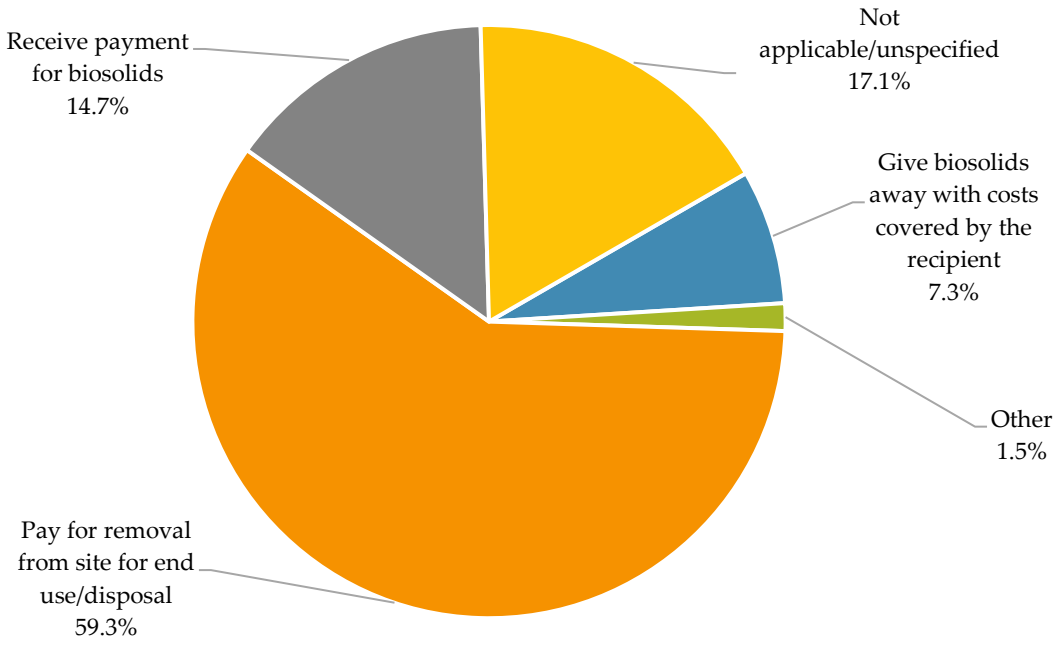

Figure 4-59: Biosolids transaction, (dry mass basis), Australia 2023

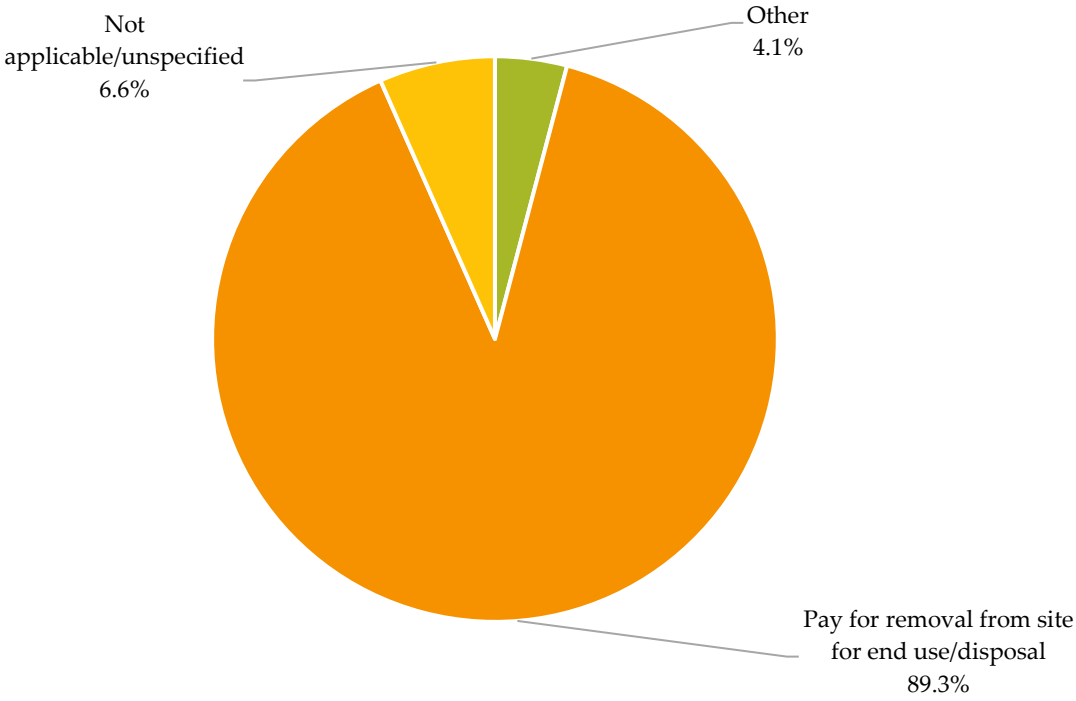

Figure 4-60: Biosolids transaction, (dry mass basis), NSW & ACT 2023

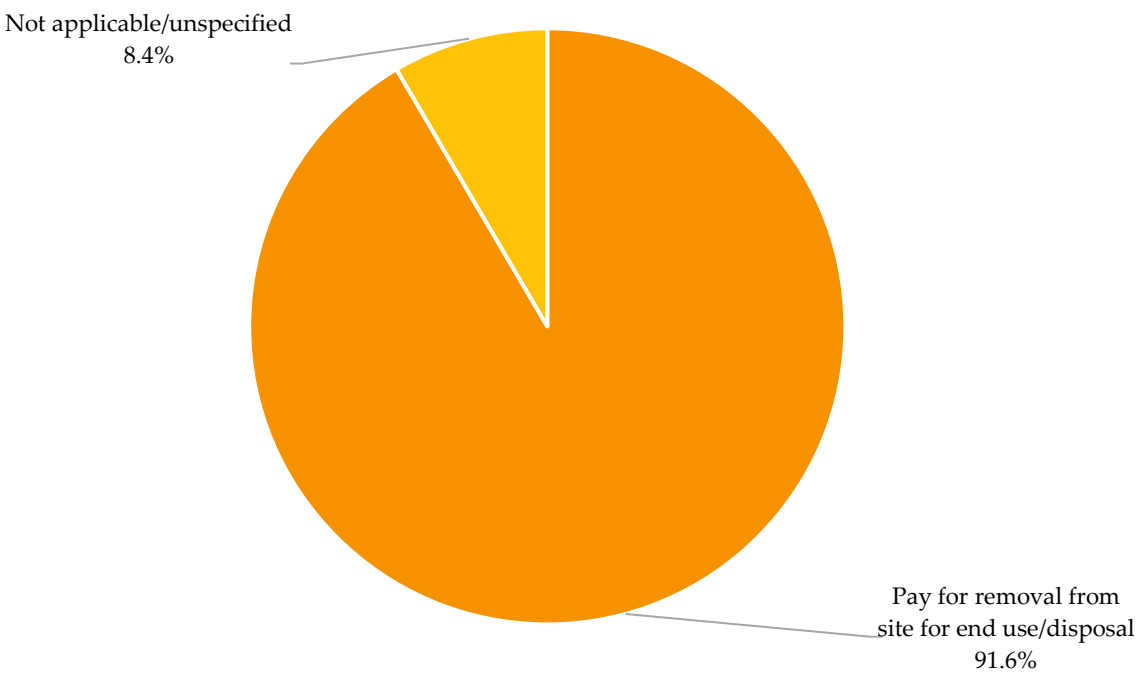

Figure 4-61: Biosolids transaction, (dry mass basis), Queensland 2023

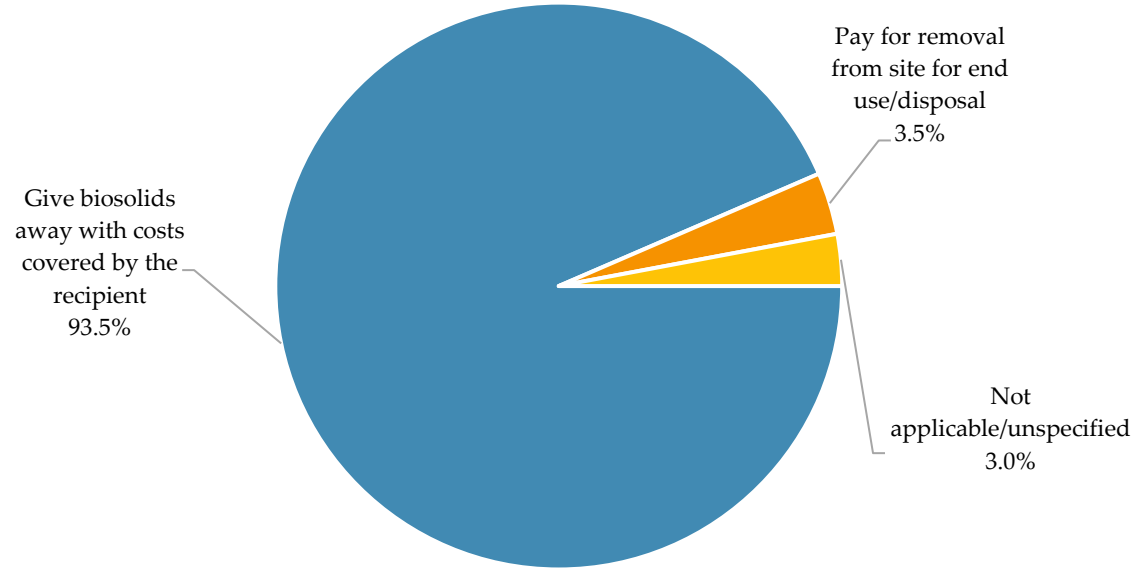

Figure 4-62: Biosolids transaction, (dry mass basis), South Australia 2023

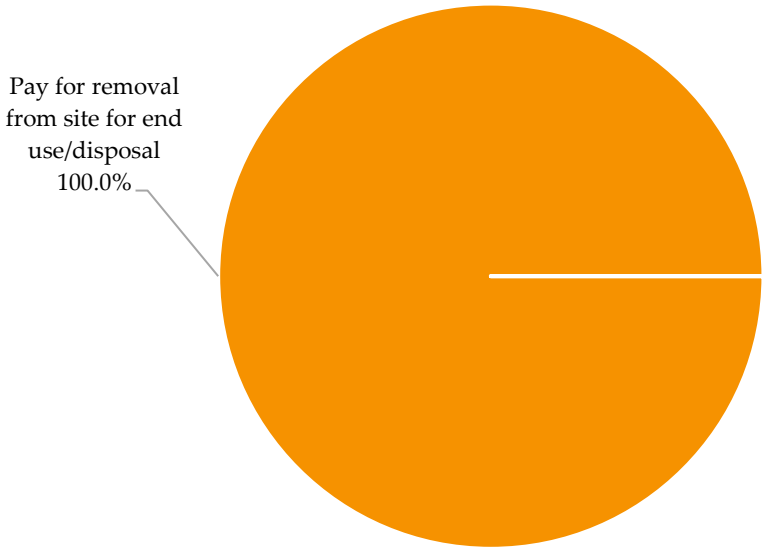

Figure 4-63: Biosolids transaction, (dry mass basis), Tasmania 2023

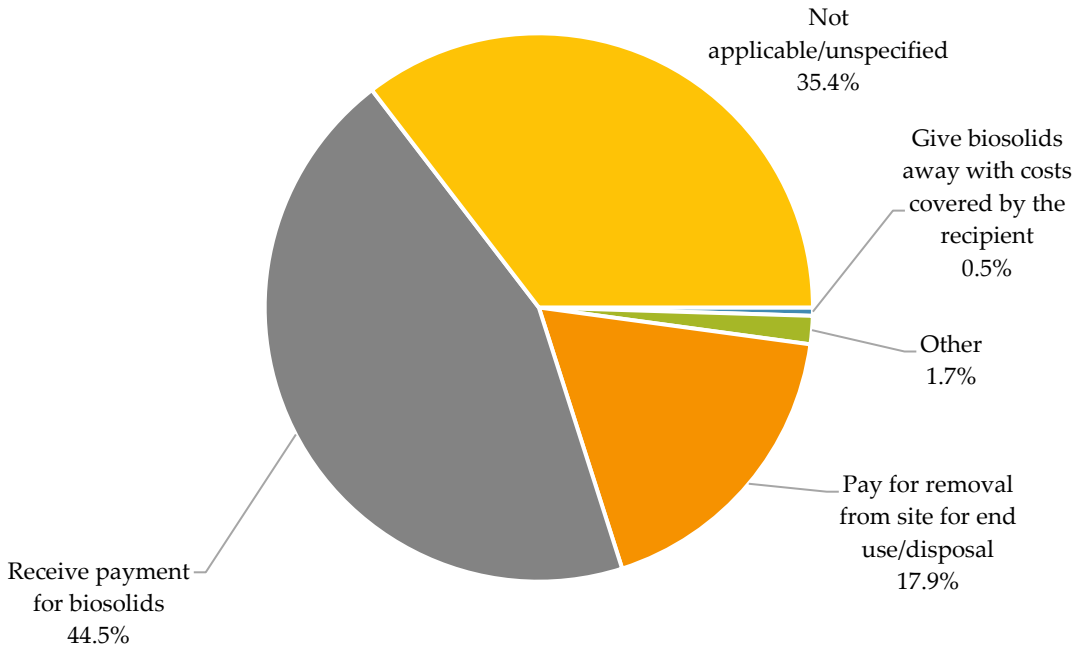

Figure 4-64: Biosolids transaction, (dry mass basis), Victoria 2023

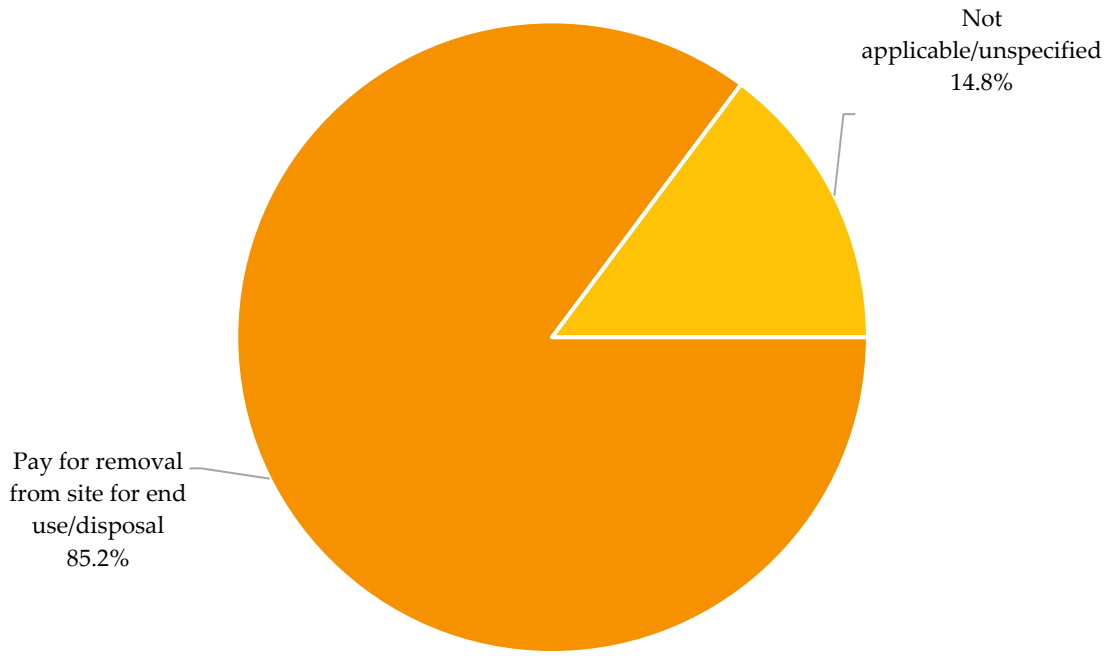

Figure 4-65: Biosolids transaction, (dry mass basis), WA & NT 2023

4.7.7 End use management

Participants were asked how their biosolids end use process risks are managed. Which of the follow statements apply:

- The biosolids end-use risks are managed by a 3rd party;
- The biosolids end-use risks are managed by a 3rd party, and audited in-house;
- The biosolids end-use risks are managed in-house.

Results are shown in Figure 4-66 These results are very similar to 2021 reported practices.

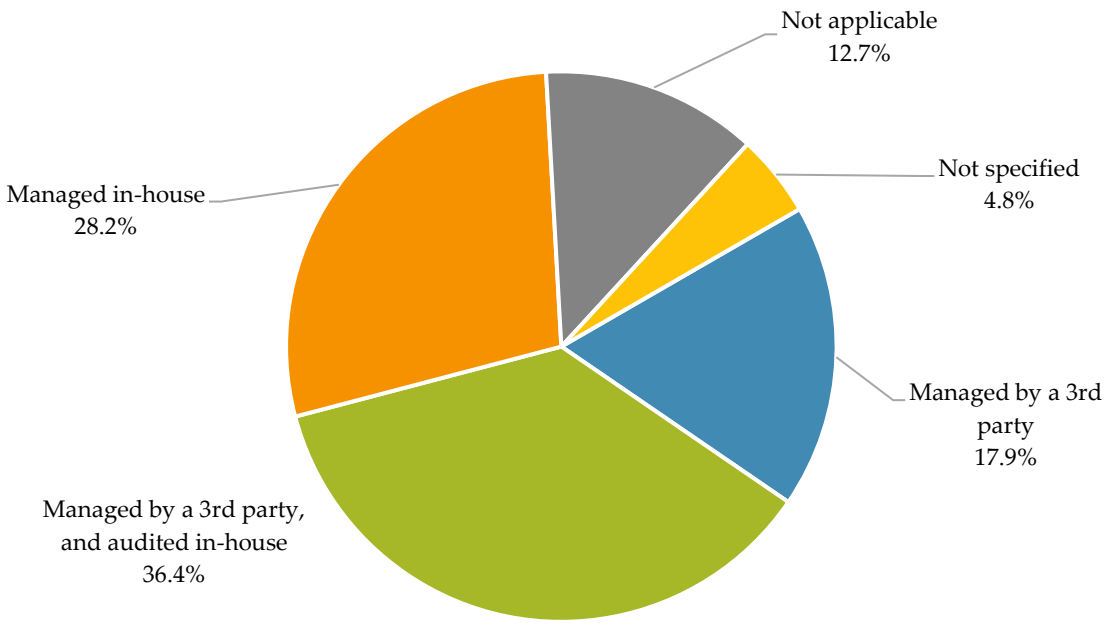

Figure 4-66: Biosolids end use program management, (dry mass basis), Australia 2023

4.7.8 Biosolids product branding

Participants were asked if their biosolids were ultimately sold and if the biosolids were a branded product. Results are shown in Figure 4-77. 38.9% of biosolids are eventually sold although not generally directly by the utility. This is an increase of 3.9% compared with 2021.

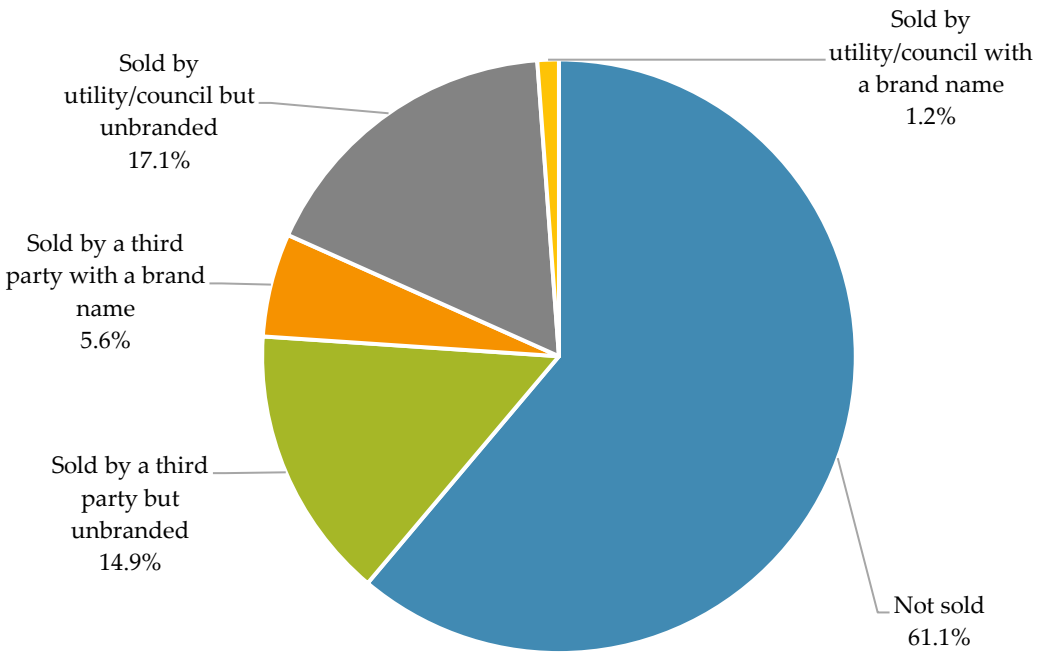

Figure 4-67: Biosolids product branding, (dry mass basis), Australia 2023

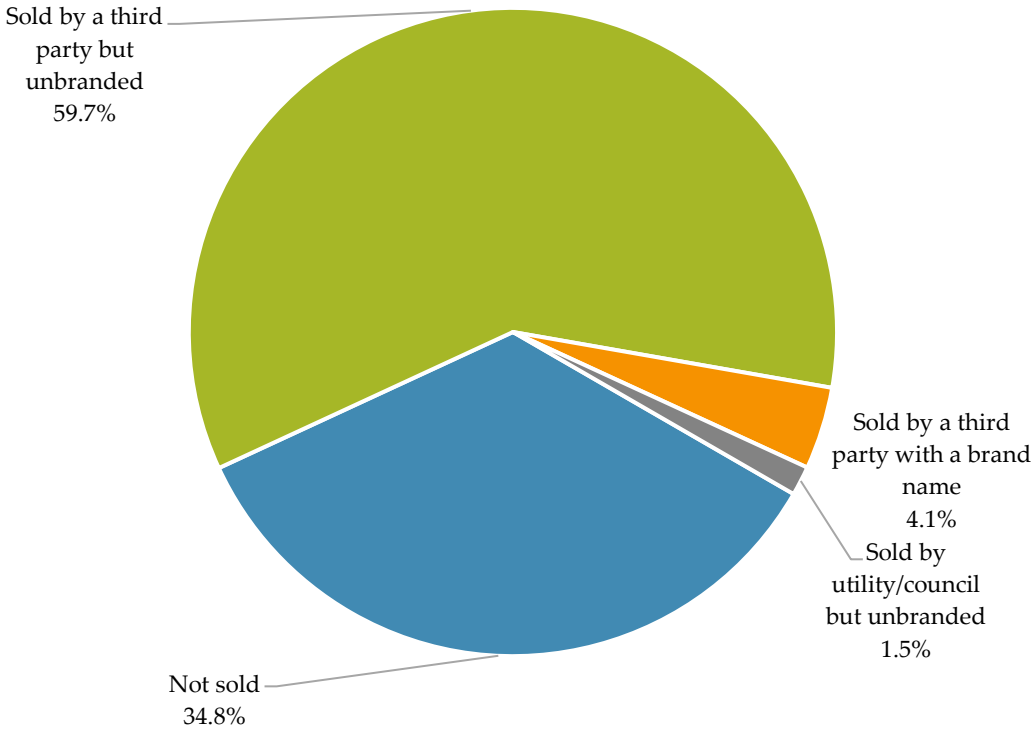

Figure 4-68: Biosolids product branding, (dry mass basis), NSW & ACT 2023

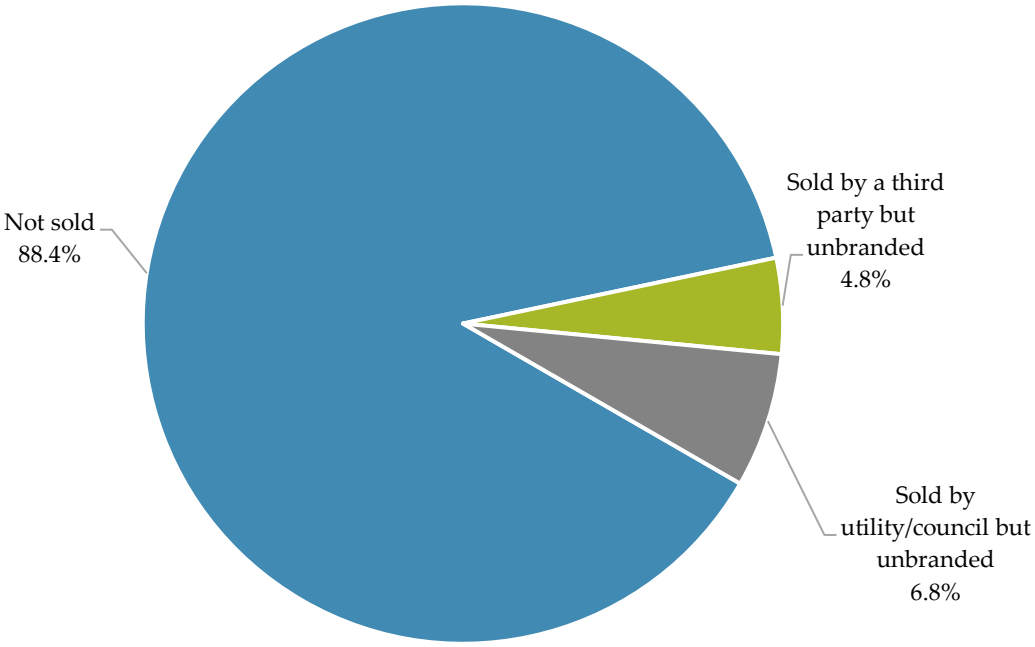

Figure 4-69: Biosolids product branding, (dry mass basis), Queensland 2023

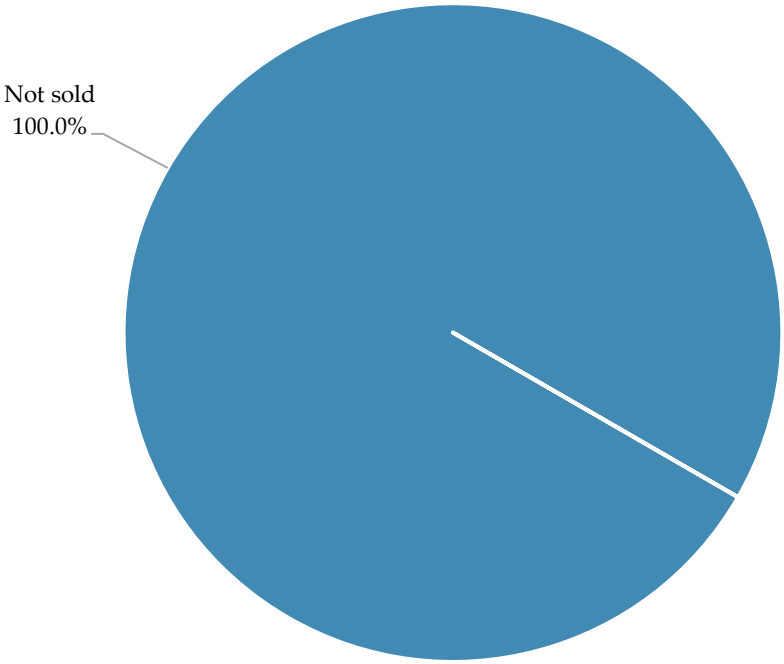

Figure 4-70: Biosolids product branding, (dry mass basis), South Australia 2023

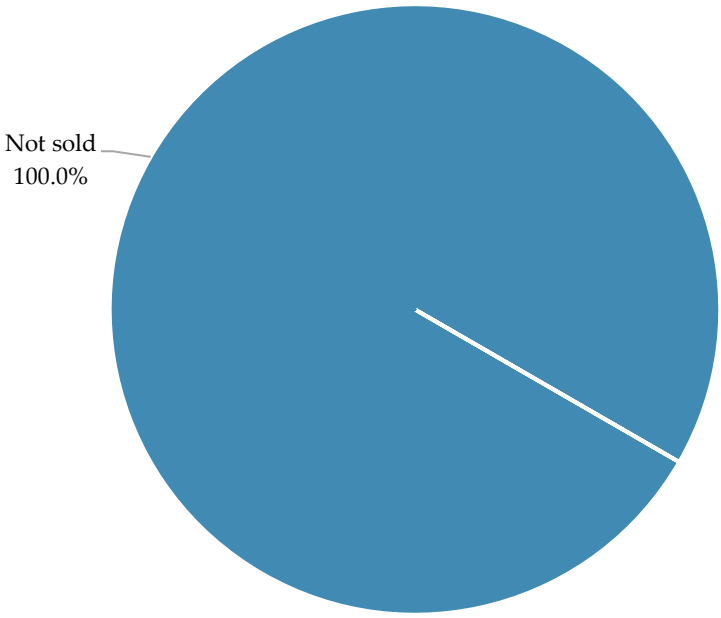

Figure 4-71: Biosolids product branding, (dry mass basis), Tasmania 2023

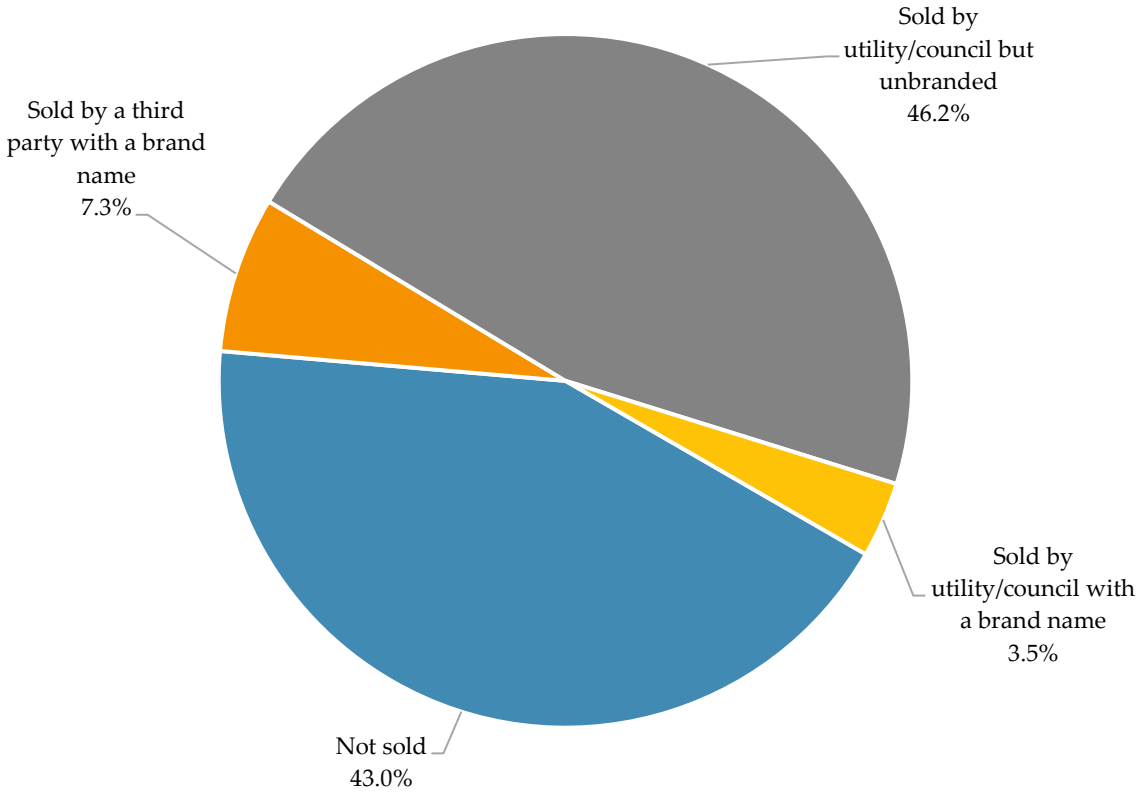

Figure 4-72: Biosolids product branding, (dry mass basis), Victoria 2023

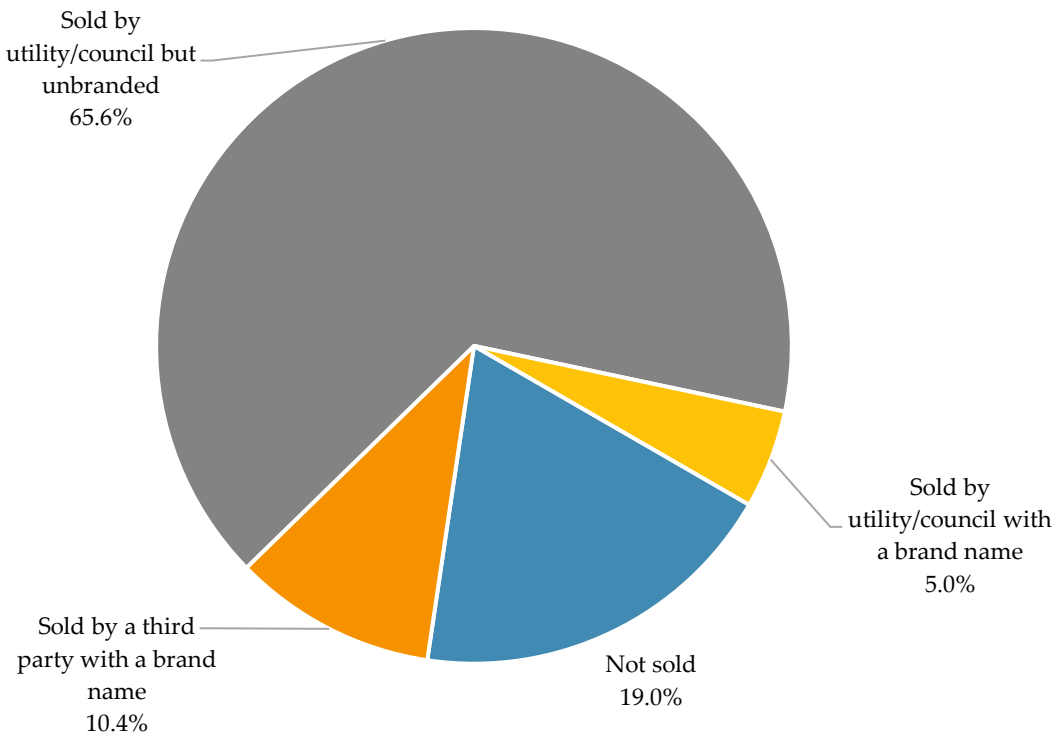

Figure 4-73: Biosolids product branding, (dry mass basis), WA & NT 2023

The breakdown of the quantity of biosolids sold directly or indirectly across Australia in 2023 is shown in Figure 4-74.

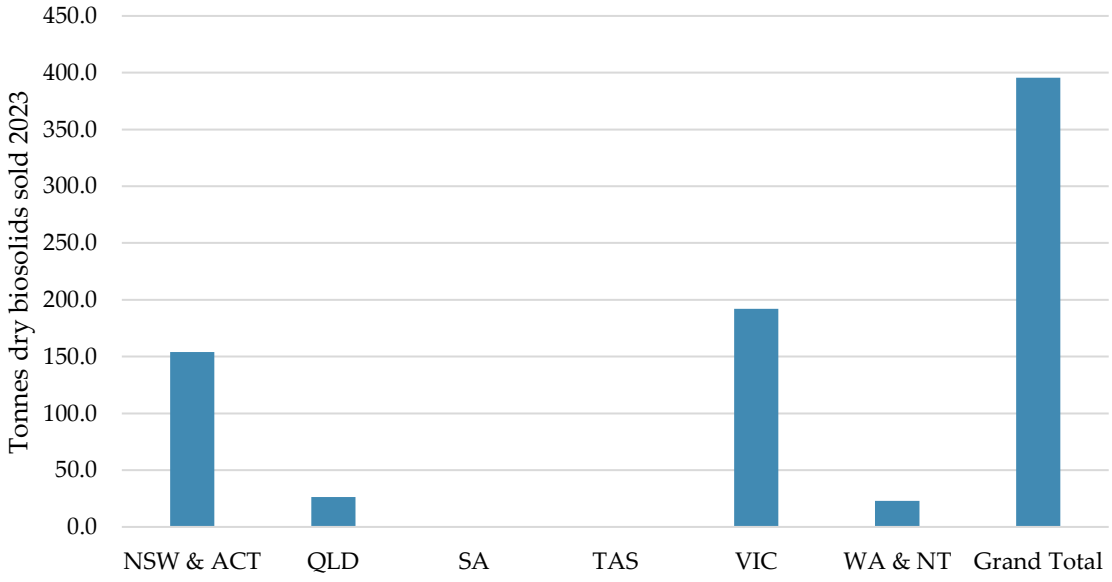

Figure 4-74: Dry mass biosolids sold, directly or indirectly, total and by state, Australia 2023

4.8 INDUSTRY RISKS & OPPORTUNITIES

Participants were asked to share their views on industry risks and opportunities. 25 utilities responded with opportunities and 29 utilities responded with risk. Results are shown in Figure 4-75 to Figure 4-77, with a discussion below.

4.8.1 Risks

The responses were grouped as follows to enable quantitative reporting:

- **Changing regulations** – responses where a regulatory change was cited as causing a risk, generally being a restriction on access to land application for end use of biosolids. Examples are:
    - Emerging contaminant regulations hindering reuse;
    - Changes to guidelines;
    - Increased regulation for waste crossing state borders.
- **Emerging contaminants** – responses relating to emerging contaminants as a concern. Examples are:
    - The impact of emerging contaminants such as PFAS (and its derivatives), Chlordane, Galaxolide and other emerging contaminants and their impact on future use of biosolids;
    - Potential for loss of markets due to known and unknown contaminants of concern;
    - Microplastics.
- **Stakeholder and public perception** – responses where these aspects were listed as a risk.
- **Technology risks** - including safety risks of new technology, limited testing in an Australian context, providing evidence of success of new technologies.
- **Cost** – responses relating to capital or operational costs of treating and disposing of biosolids. Examples include:
    - Cost of disposing of biosolids;
    - High financial and environmental costs associated with transport of biosolids to land due to large distances;
    - Changes in reuse conditions resulting in significant increase in the cost to serve our communities and insufficient time to install the necessary capital to comply;
    - Requirement of massive capital investment to compensate/remove contaminants to required level.
- **Miscellaneous** – used where individual responses did not fit into the above categories. Examples are:
    - Increasing alum use in WWTP binding up phosphorous, reducing appetite for agricultural reuse;
    - Distances or volumes make resource recovery opportunities difficult;
    - Odour control with site encroachment around treatment plants;

- Processes used to remove emerging contaminants also remove nutrients.

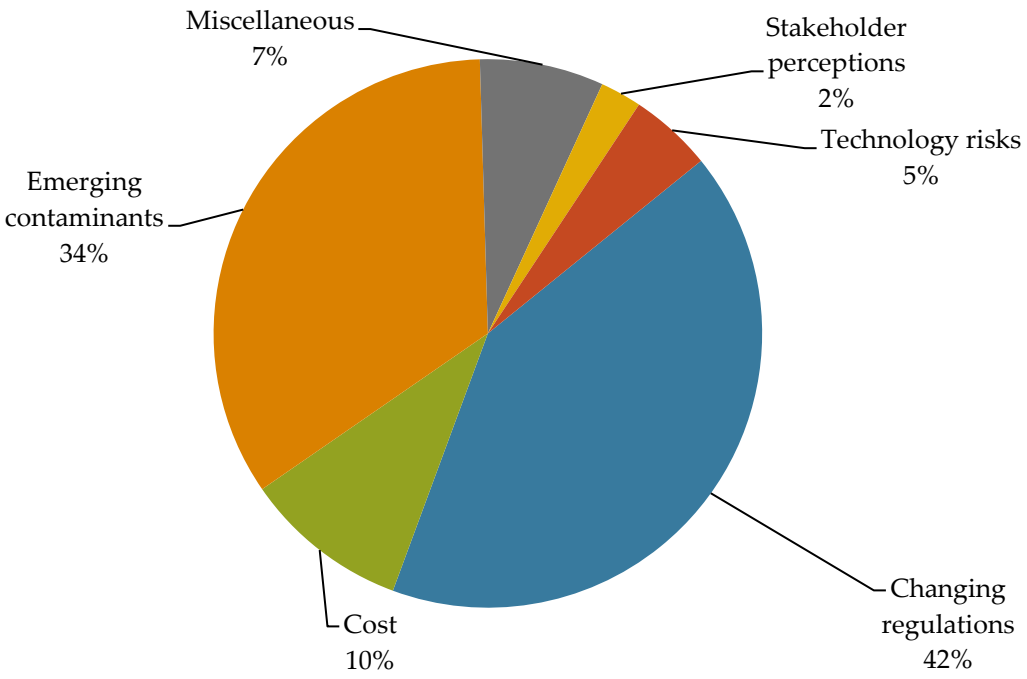

Figure 4-75: Biosolids industry risks, (count basis), Australia 2023

The risks of changing regulations, emerging contaminants, and stakeholder and public perception, can also be classified into a broader group as concern about loss of biosolids markets. 81% of responses were concerned with risks that, if realised, would see a loss of biosolids end use market and nowhere for biosolids to go once stabilised. These consolidated risks are shown in Figure 4-76.

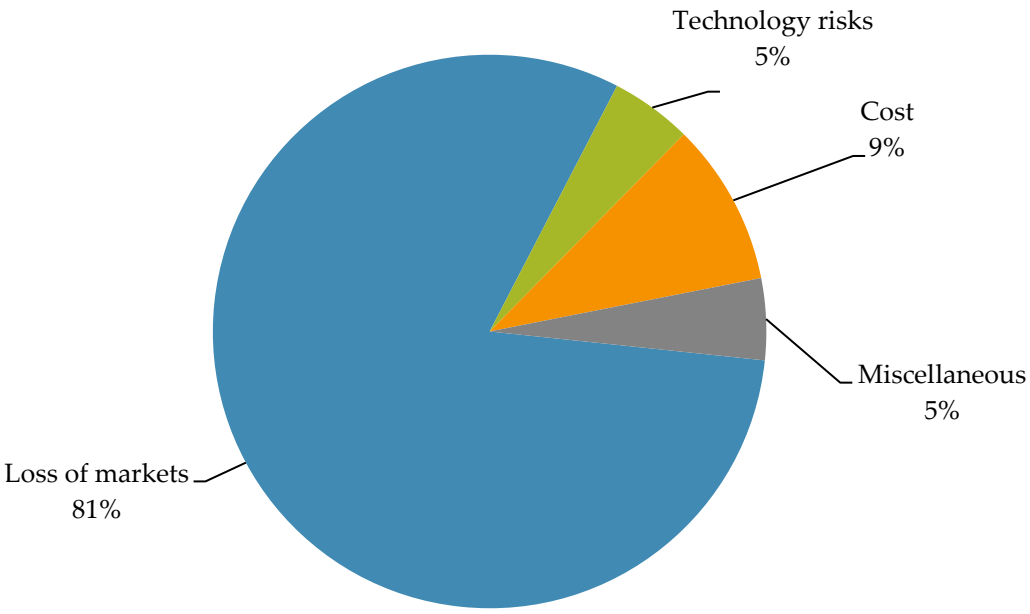

Figure 4-76: Biosolids industry risks consolidated, (count basis), Australia 2023

Example risk comments:

"[A risk is] emerging contaminates of concern preventing direct spreading to land or composting and increased costs of dealing with biosolids."

"[A risk is] overly conservative regulatory limits based on limited indirectly related scientific research with scaling factors to adjust to the Australian context."

"[A risk is] jumping to new and unproven technologies to try and solve perceived problems."

"Agriculture is no longer viable due to emerging contaminants, e.g., PFAS. This could be due to the customers not wanting biosolids because the low application rates means it doesn't have enough agronomic value or they don't want biosolids because they are fearful of any PFAS (or) emerging contaminants on their land."

"No alternative treatment and or use of biosolids is readily available and the amount of biosolids produced exceeds storage capacity, which is really a consequence of agricultural reuse no longer being viable."

"Historically [we] initially applied biosolids to land at 25 tonne/hectare. With recent Emerging contaminants risk, detailed risk assessments have been completed with the recommendation for a reduction in Biosolids application rates to land."

4.8.2 Opportunities

The responses to the opportunities question were grouped as follows to enable quantitative reporting:

- **Emerging technologies** – such as advances in technology for small and medium sites particularly for waste to energy, advances in pyrolysis and gasification, research into the benefits of biosolids.
- **Carbon opportunities** – such as carbon credits, carbon sequestration and carbon capture.
- **End use markets -** Creation of high value products such as biochar, struvite and being more conscious of producing a high value product if there has to be a high capital expenditure; and reuse of biosolids including further use in agriculture, redefining biosolids to enable circular economy benefits such as multiple feed stocks and market diversification; combined treatment with Food Organics and Garden Organics (FOGO) and alternatives to landfill.
- **Education and collaboration** – improved public messages around beneficial reuse and biosolids management, collaboration between utilities.
- **Front end solutions** – legislative changes to stop PFAS use.
- **Renewable energy** – waste to energy and other biogas opportunities.

- **Soil health** – including use of biosolids for the rehabilitation of former mine sites to improve the quality of rehabilitation, benefits of biosolids to soil including macro/micro-nutrients, soil conditioning and organic material.

The general themes from this survey are ones of circular economy, making use of emerging technologies and market diversification.

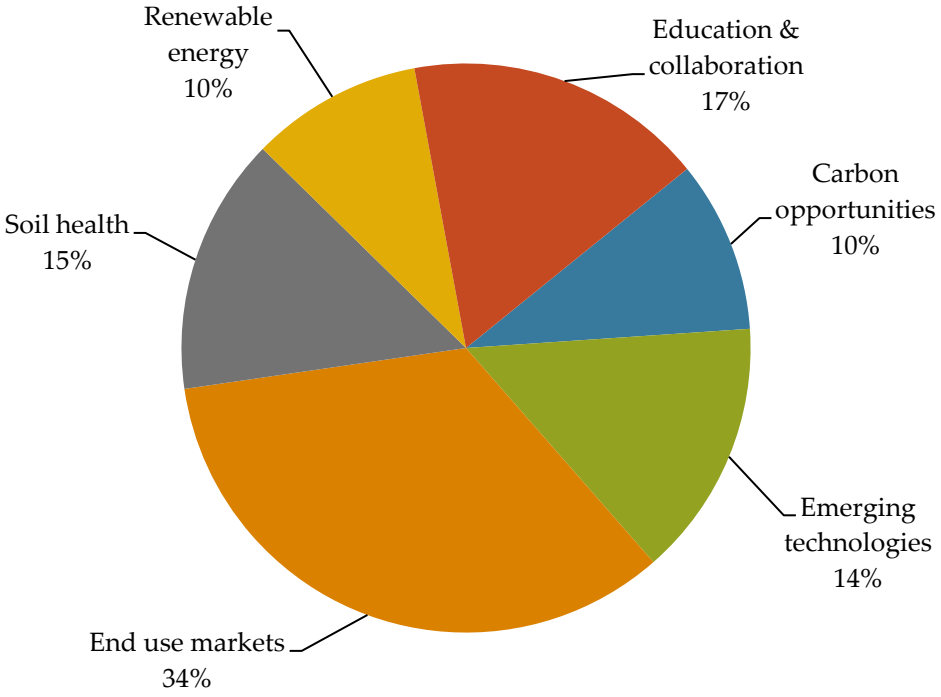

Figure 4-77: Biosolids industry opportunities, (count basis), Australia 2023

Example opportunity comments:

"If driven to thermal treatment processes, processing should be designed for the combined treatment of biosolids and other wastes."

"Opportunities to implement advanced biosolids technologies capable of eliminating/reducing PFAS contaminants (these technologies could also be used to improve dewatering)."

"Producing higher grade and dryer materials for use in closer proximity to sewage treatment plants. Reducing the impact of transportation by reducing mass/volume and distance."

5 CONCLUSIONS

While management of biosolids has not fundamentally changed over the past few years there are trends emerging and findings of interest to the biosolids management community. Some of these are:

- Movement of biosolids or sludge to other sites for processing is becoming more common and complex;
- Utilities are finding value in further processing and drying;
- The overwhelming concern about biosolids management is about emerging contaminants and changing regulations;
- There is strong interest in the opportunities from biosolids which contribute to a circular economy approach.

6 ACKNOWLEDGEMENTS

PSD would like to acknowledge the ANZBP board for their support and review and all the utilities who provided data, without which this work would not be possible.