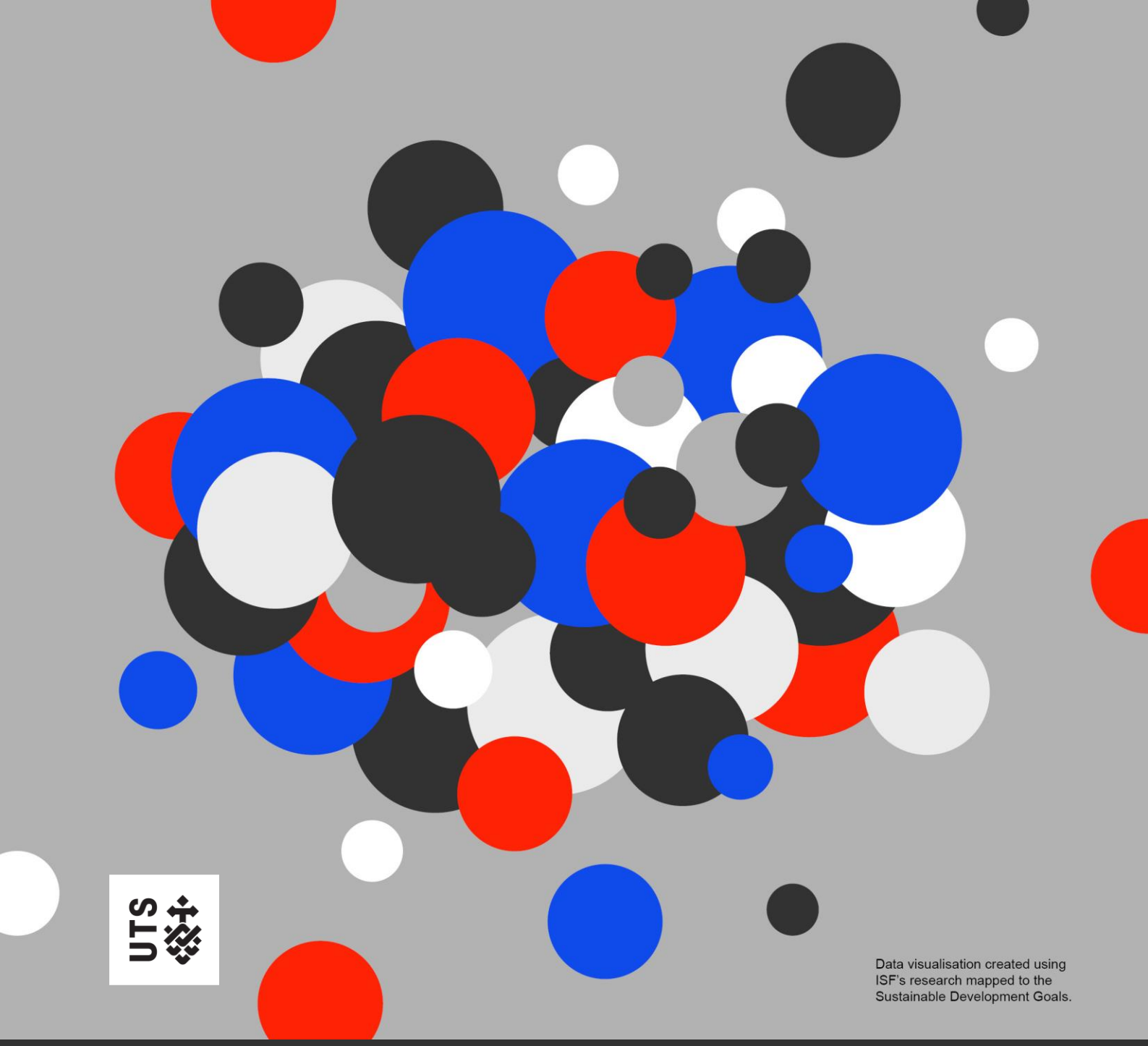

Data visualisation created using ISF's research mapped to the Sustainable Development Goals.

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Sustainable Futures

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Pathways towards sustainable burial and cremation options for NSW

PREPARED FOR:
Cemeteries and Crematoria NSW

About the authors

The Institute for Sustainable Futures (ISF) is an interdisciplinary research and consulting organisation at the University of Technology Sydney. ISF has been setting global benchmarks since 1997 in helping governments, organisations, businesses and communities achieve change towards sustainable futures.
We utilise a unique combination of skills and perspectives to offer long term sustainable solutions that protect and enhance the environment, human wellbeing and social equity.

ISF acknowledges and respects the Aboriginal and Torres Strait Islander custodians of Australia and the Gadigal peoples upon which the UTS City Campus now stands. We continue to value the generations of knowledge Aboriginal and Torres Strait Islander Peoples embed within our University and we pay our respect to their Elders past, present and emerging.

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Executive summary

This report was commissioned by Cemeteries & Crematoria NSW (CCNSW), in line with its legislative objective to promote the environmental sustainability of the interment industry, and its function to promote environmentally sustainable practices among the cemetery and crematoria operators it regulates. The report is intended to spark conversations across the sector, and among consumers and families, and promote best practice sustainability by looking at what is currently occurring both globally and in Australia. The future opportunities for sustainable practice identified in the report do not represent NSW Government policy but may be taken into consideration as part of CCNSW's future work on sustainability in line with its governing Act, the *Cemeteries and Crematoria Act 2013*.

This report describes work undertaken by the Institute for Sustainable Futures at the University of Technology Sydney on behalf of CCNSW. Our research investigated opportunities to improve the environmental sustainability of body disposal practices in NSW, as well as explore opportunities to address land use issues related to interment and to foster innovation in body disposal in the state. We aimed to identify a broad range of disposal practices and products available around the world and within Australia, and provide a comparison of various environmental impacts. We also identify opportunities and barriers for innovative and sustainable options for body disposal and memorialisation in NSW. To achieve this, we undertook a systematic review of the literature, a review of media and web resources, interviews with key stakeholders both in NSW and internationally, and an industry workshop.

Findings

We identified the range of practices and products both currently available and emerging in NSW. A summary of our findings relating to these various practices and products is provided below.

Preparation of the body

- Practices associated with the preparation of the body for disposal (e.g. embalming with formaldehyde) may be significant contributors to both environmental and health concerns relating to the disposal of bodies

- Safer and more sustainable alternatives are available on the market, however their suitability and fit with the existing regulatory environment remains unclear, and more research is required to investigate shifting to safer and more sustainable options.

Vessel

- The vessel (casket, coffin etc) or covering in which the body is buried or cremated is another major source of environmental impact, arising from the resources (timber, metal, fabrics etc) used to produce the vessel. The extent to which pollutants in leachate (burial) or airborne (cremation) arise from the vessel as distinct from the body itself remains somewhat uncertain, but is another possible source of environmental impact.

- A wide range of alternative and sustainable coffins and caskets is available on the market, however these are not often offered to consumers by funeral directors at the point of purchase. Bamboo, wicker, cardboard and wool coffins are among options available, and tend to offer both cheaper and more environmentally-friendly alternatives to conventional coffins and caskets. However, funeral directors rarely promote these options, reportedly because profit margins tend to be lower on these products. Information and education may be required to help consumers exercise choice and become aware of alternatives.

- Shrouded burials and cremations present great potential for improving environmental impact of these body disposal practices, however in NSW shrouded burial is possible only when an exemption is granted to the Public Health Regulation, and shrouded cremation is not presently allowable. Regulatory change could help shift practices and improve environmental impacts.

Burial and variations

- Conventional burial is associated with a wide range of environmental impacts, and is associated with major land use challenges in urban areas. Burial is also very expensive in urban areas, largely due to land pressures. Many cultural and religious groups require burial, and we can expect that burial rates will remain largely unchanged in the future. There exist significant opportunities for improvement by introducing new practices and technologies, and expanding consumer choice.

- Natural and conservation burials offer opportunities to limit the environmental impacts of burials and achieve dual benefits of biodiversity conservation and provision of burial spaces. The high cost of land in urban areas will likely prove prohibitive, however these may be viable options for rural and regional areas.

- Several research projects are currently underway to understand how changes to burial practices could enable hastened decomposition and pave the way for improved practices relating to renewable tenure, recently introduced in NSW.

Cremation

- Cremation is by far the most popular option for disposal of bodies in NSW at present, and is also significantly cheaper than burial, especially in urban areas where burial costs are highest. Cremation is the preferred option for several religious and cultural groups, however appears to be chosen by consumers largely due to its lower cost. However, cremation is associated with significant emissions and release of pollutants relating to the use of fossil fuels as well as resource inputs into coffins and caskets conventionally used as part of the practice.

- Opportunities exist to improve the sustainability of cremation practices, particularly through retrofitting crematorium facilities to use renewable energy, including solar power and biogas. This review was unable to uncover much research regarding renewable-powered crematoria, suggesting a need for further research in this space in future.

Emerging alternatives

- A number of emerging technologies present alternatives to existing practices, which may particularly appeal to those segments of the market without a strong cultural or religious preference for burial or cremation. These alternatives include promession (freeze drying), alkaline hydrolysis ('water cremation') and composting. Composting of bodies has been legalised in one US state, and alkaline hydrolysis is legal in a small number of jurisdictions internationally, though neither are yet widely practiced.

- The extent to which each of these options presents a likely improvement in environmental impact is unclear. Recompose Washington's model of composting has been demonstrated, through life cycle analysis, to offer significant improvements upon conventional cremation and burial methods, and is also significantly cheaper than burial. Life cycle analyses for alkaline hydrolysis and cryomation/promession do not appear to be available.

- These options are expected to be unlikely to attract large numbers of consumers in NSW, however a small market may be identifiable. Research may be required to understand the likely social acceptability of various options, and to understand their potential fit with existing regulatory requirements and industry practices.

Memorialisation and services

- Memorialisation practices have shifted significantly with the move towards cremation in recent decades, with many consumers choosing not to formally memorialise remains. Simultaneously, interest has grown in more personalised—and secular—services/events and memorials which more closely reflect the values of the deceased and their community. This points to an opportunity for innovation with regards to memorialisation practices.

- Significant occupational health impacts relate to the production of manufactured stone memorials, which needs to be addressed in future. Consumers appear to be readily accepting the range of alternatives available for memorialisation, including a number of planted memorialisation options (e.g. Bios Urns etc) and online memorials.

Barriers to sustainable practice

Our research identified a number of barriers to sustainable practice, which are discussed in greater detail in the final chapter of this report. We identified that more sustainable practice is inhibited by:

- **Regulation and planning** including a heavy public health focus in regulation, limited choices exacerbated by legislative restrictions, inconsistency across regulatory areas and a lack of active planning for cemeteries.

- **Industry inertia** including a heavily profit-driven operating environment, a lack of consumer choice, consumer disempowerment, and a lack of incentives for innovation and change.

- **Social and cultural factors** including cultural and religious preferences, cost and affordability issues, social acceptance of alternatives and some resistance to emerging methods, and a lack of information to inform consumer decision making.

- **Infrastructure and commercial viability** including the small market in NSW compared with other jurisdictions, and the high cost and uncertainties relating to establishing new interment infrastructure.

Opportunities

Our report identifies opportunities for facilitating a transition to a more sustainable future for body disposal and memorialisation in NSW. Key to this is a focus on facilitating consumer choice, through an expanded range of options and improved provision of information. Opportunities for enabling pathways towards a more sustainable future include:

- **Research** including to identify actual environmental impacts of various options, to identify sustainable alternatives and to understand how to best facilitate implementation.

- **Information and consumer awareness-raising programs** including to ensure consumers are given adequate choice and supported through provision of adequate and independent information to assist decision making.

- **Support for innovation and research** to assist industry members to understand how to implement more sustainable practices.

- **Regulatory review** to ensure consistency across regulatory areas and to ensure that regulations and legislation do not unnecessarily inhibit innovation and sustainable practice across the industry—significant opportunities are arising in 2020 with the review of both the Public Health Regulation 2012 and the Cemeteries and Crematoria Act 2013.

- **Engagement and guidance** for the industry to enable those willing to transition to more sustainable alternatives to identify the business case for doing so and understand the opportunities that may arise through adopting more sustainable practices.

Glossary of terms

This glossary is intended to provide an overview of terms used frequently throughout this report. It is not exhaustive but intended to provide clarity about how we use common terms relating to body disposal practices. We introduce a number of novel terms, generally associated with new technology, which are defined as they are introduced.

body disposal/disposal of bodies	Methods for disposing of bodily remains, including burial and its variations, cremation, and emerging alternatives. This is the broadest term used throughout this report to capture the range of practices relating to treatment of dead bodies
burial	Placement of a body through underground interment, or placement in a mausolea or crypt
cremation	Process for the reduction of bodily remains using heat/fire
exhumation	Process of removing an interred body or remains from the ground, a vault or mausoleum
interment	Placement of a body or other remains in an underground vault, or placement in a mausolea, niche or crypt
memorialisation	Monuments, markers, digital sites and other practices or items intended to serve as a memorial to the deceased. We discuss these as distinct from body disposal practices throughout the report.
the sector	We use this term throughout this report to refer to the wide variety of operators conducting activities relating to the disposal and interment of bodies, ranging from funeral directors to cemetery operators
service	An event or funeral marking the passing of the deceased or celebrating their life, this may be a religious or non-religious event. This may or may not involve the body/coffin being physically present

Contents

1 Introduction

Almost every aspect of human life has some degree of environmental impact. Death is no exception. The conventions, traditions and customs that we practice around death have evolved over centuries. The growth of human population and changes in social norms over time have resulted in many ‘post-life’ practices becoming significant contributors to environmental damage, especially those relating to resource consumption, land-use change and pollution. As detailed throughout this report, these impacts include the energy use and carbon emissions associated with cremation practices, pollution and leachate from conventional burial, the use of chemicals in practices such as embalming, and unsustainable use of resources in production of coffins and in the maintenance of lawn cemeteries.

As noted by Olson, '[t]he funeral industry and the cultural objects it helps to create are subject to the same ideological, economic, industrial and individual agential forces as any other domain of human production and consumption' (Olson, 2016, p. 331). Just as resource consumption and the generation of waste have historically been an indispensable part of production in all sectors, these problems have been an ever-present part of the process of disposing of bodies and memorialising the dead.

The environmental impacts of our practices surrounding death will, without intervention, continue to expand as our population continues to both grow and age. The annual number of deaths nationwide in Australia is set to more than double, from 142,000 in 2012 to 300,000 by 2050 (Davenport, 2019). In addition to the burden of environmental damage rendered by interment practices, a range of imminent pressures challenge the future of interment. Land-use pressures in our cities, with growing urban populations putting pressure on land prices, result in little new space allocated to interment. In NSW, the 310,000 currently-available plots are expected to be exhausted by 2050 (Cemeteries and Crematoria NSW, 2017b; Ryan & Steinmetz, 2017). With the heavy concentration of Australia’s population in a small number of eastern seaboard cities, the spatial character of this land pressure is resulting in localised land shortages for interment practices, drastically inflating the costs of interment in particular urban areas.

Globally, there is increasing recognition of the need to transform the practices implemented around death to reduce environmental impact (Marshall & Rounds, 2011; Rumble, Troyer, Walter, & Woodthorpe, 2014; Stewart, 2018). However, this space is complex, falling at the intersection of cultural and religious beliefs and values, social traditions, socio-economic disparities, public health concerns, land-use planning concerns, environmental and commercial interests. The funeral directors, crematoria and cemeteries industry in Australia is a sizeable sector, worth around $1.7 billion in 2019 (IbisWorld, 2019)

While adherence to cultural or religious practices, beliefs and traditions may constrain many people to traditional burial or cremation practices, there is growing interest within society to explore alternatives, which may be less costly, have fewer environmental impacts and/or may align more closely than conventional disposal and memorialisation options with emerging social values on sustainability.

1.1 This report

This report was commissioned by Cemeteries & Crematoria NSW (CCNSW), in line with its legislative objective to promote the environmental sustainability of the interment industry, and its function to promote environmentally sustainable practices among the cemetery and crematoria operators it regulates. The report is intended to spark conversations across the sector, and among consumers and families, and promote best practice sustainability by looking at what is currently occurring both globally and in Australia.

We acknowledge that some of the report content may be considered challenging or confronting, including raising the possibility of the ending of tenure for existing older graves. There is no current intention to change NSW Government policy in this area, but it is important that discussion around sustainability and land use continues.

The future opportunities for sustainable practice identified in the report do not represent NSW Government policy but may be taken into consideration as part of CCNSW's future work on sustainability in line with its governing Act, the *Cemeteries and Crematoria Act 2013*. As always, CCNSW's first priority is to recognise the right of all individuals to a dignified interment and treatment of their remains with dignity and respect.

This report summarises the findings of our research exploring pathways towards improving the sustainability of practices relating to body disposal and memorialisation in NSW. In the report, we considered both current practices and emerging alternatives, working to develop a picture of the current state of the system and its suitability for transformative change towards a more sustainable future.

This research was exploratory in nature. We sought to understand new and emerging practices and technologies which promise to provide more sustainable alternatives to practitioners and consumers in the sector. We considered all stages of the post-life process, ranging from the preparation of the body through to its placement in its eventual resting place. We considered practices ranging from those already in use in NSW to innovation in development globally and not yet operationalised. Many of these alternatives involve minimal changes to existing practices—for example, the substitution of conventional coffins with biodegradable caskets—which do not require significant shifts in the practices common to the sector. Other alternatives might be considered transformative, such as the use of compositing for human remains, which has recently received legislative approved in Washington State, USA.

Our research indicated that consumer choice is limited when it comes to purchasing post-life options in NSW. It is our hope that through identifying a range of more sustainable practices that a host of new alternatives could emerge that reduce environmental impacts and to provide consumers with greater choice—especially when it comes to affordability of burial.

Throughout our literature review we identified several main categories of practices and alternatives that we use to organise information. These are:

- Preparation of the body (e.g. embalming)
- Vessels (coffins, caskets, shrouds etc.)

- Burial
- Cremation
- Emerging alternatives (innovative new practices and technologies)
- Memorialisation (practices/products which involve memorialisation of remains).

We recognise that not all practices discussed here will be suitable in NSW in their current form, and consider in our discussion whether these practices might be adapted for the local context. Further, we acknowledge that the emergence of a single solution for the post-life challenge is unlikely to emerge. Rather, improved sustainability is likely to be most achievable through the adoption of a range of environmental, regulatory and socio-cultural changes which each address specific aspects of the sustainability of interment. And, of course, we recognise that any practices that are to be adopted in NSW must have some fit with existing social expectations and cultural practices, meaning that a range of solutions with varying environmental impacts will be required to service the need of all NSW citizens.

In this report we draw conclusions about the likely *relative* environmental and other benefits of a range of practices to provide a comparison of alternatives. This comparison is not intended to be prescriptive, rather it recognises that many practices will persist due to cultural, religious and operational imperatives despite their current environmental impacts. We provide a table (Table 3) which compares various options, making suggestions about the relative sustainability and viability of these options. In the final chapter, we make some suggestions as to how a range of alternatives could be enabled in NSW, recognising that specific practices require various types of change by the business community and or in the regulatory environment. The intention of these 'recommendations' is to identify potential opportunities to enable more sustainable practices in NSW.

1.1.1 Sustainability

The most widely-recognised definition of sustainability is that which emerged through the Brundtland Commission to the United Nations in 1987: 'sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. Increasingly, sustainability is recognised as a 'process' rather than a 'destination'—no product, event or policy can be described as achieving 'sustainability', but rather sustainability is a guiding principle.

'Sustainability' is often used as short-hand for environmental impact. In this report, however, we consider sustainability not just in terms of environmental impact, but at the nexus of a number of intersecting factors. In particular, we consider social and economic sustainability of various practices in addition to environmental sustainability. In the context of this report, this means paying close attention to the social, cultural, affordability and feasibility aspects of a range of practices, methods and products in order to understand their implications for a more sustainable future for the sector. We recognise that there is little value in promoting a product that has minimal environmental impact but which does not fit with socio-cultural demands or religious preferences for body disposal or memorialisation. Similarly, we recognise that an environmentally beneficial process which is exorbitantly expensive will not constitute a solution to current challenges. We consider the assessments we make here to be relative or comparative—that is,

no one product or practice can be said to be ‘sustainable’, but we consider the relative merits of various methods in comparison to other options, and identify strategies to minimise negative impacts and boost positive outcomes.

This last point is perhaps a key element that should be emphasised: that sustainability is not just about minimising environmental harms, but is also about *maximising* opportunities to deliver positive impacts. A shift has taken place in sustainable development thinking in recent years, moving from design strategies which seek to simply reduce impacts upon the environment to those which seek to have a positive or regenerative effect upon environments and ecosystems. An example, discussed in detail later, might be conservation burial practices, which seek to provide a minimally-impactful burial process while simultaneously contributing to conservation goals. Further, we are interested here in how various options can both limit environmental impact and serve communities in a positive way, for example by expanding choice available to consumers or offering more affordable alternatives to mainstream practices and products. Sustainability is not, then, an assessment limited to practices which simply reduce environmental impact, but is a broad approach to thinking holistically about the suite of impacts and benefits delivered by a product or process.

Despite this emphasis on social and economic sustainability, environmental sustainability remains the starting point for our analysis here. In this report, environmental impacts are considered in particular across three categories: land-use efficiency, resource inputs, and pollution. **Land-use efficiency** refers to the consumption of land involved with various practices—as discussed throughout the report, this is a particularly salient issue for both environmental and economic sustainability, with poor supply of cemetery space in the Sydney metropolitan area contributing to extraordinarily high costs for interment. **Resource inputs** refers to the resource production and consumption association with various practices: for example, inputs such as plastics, timber and chemicals for the production of coffins, or of formaldehyde for embalming. **Pollution** refers to those outputs and leachates that result from body disposal practices, such as emissions from cremation processes and leachate from burial practices. Of course, not all environmental impacts fit neatly into these three categories, and in the absence of comprehensive life-cycle analyses for the various products and processes assessed here, it is difficult to make definitive statements about impacts in each of these categories. However, these categories proved useful for understanding the relative impacts of body disposal and memorialisation practices, and guide much of our analysis.

1.2 NSW context

Roughly 55,000 deaths currently take place in NSW every year, with over half of these occurring in metropolitan Sydney (Cemeteries and Crematoria NSW, 2017b). The majority of people who die in NSW are either interred in a cemetery or cremated, with a very small number of people choosing other options, such as being buried on a family property or being buried at sea. In 2017-18, around two thirds (66.3%) of individuals were cremated while a third were interred in a cemetery (Cemeteries and Crematoria NSW, 2017b). The rate of cremations is highest in the Central Coast, Hunter and Illawarra regions and lowest in rural and regional NSW (IPART, 2019a). Formal memorialisation rates for cremated remains are relatively low, with research participants indicating that only around a third of all cremations are interred in a formal niche in a cemetery or other memorial park. Most families choose to scatter remains in a significant place or to keep them in the family home.

NSW is home to a diverse multi-cultural community, with over 200 languages spoken, 125 religions represented and with residents descended from over 300 ancestries (Cemeteries and Crematoria NSW, 2017b). As a result, there is a wide variety of expectations and requirements for the treatment and disposal of bodies, as well as around memorialisation and commemoration of death. Despite the diversity of the population, at present, consumers are quite limited as to the options available for management of their body after death: for the vast majority of people, placement in a coffin—we discuss exceptions to this later in the report—followed by burial or cremation, are the only options available in NSW. In this report, we pay close attention to this issue of choice, focused on expanding choice available to consumers as well as considering how existing options can be sustained and made less environmentally impactful in future.

The availability of land for burial is a critical issue in the Sydney metropolitan area. At 2015, CCNSW identified 301,000 available burial plots in NSW. If there is no change to existing cremation and grave occupancy rates, cemetery capacity in metropolitan Sydney is expected to be exhausted by 2051, with availability of grave sites—that is, consumers' ability to secure a grave site in a location and/or religious-designated area of their choice—being affected well before that date (Cemeteries and Crematoria NSW, 2017b). By 2056, an additional 11,800 plots per year, roughly 4 hectares of cemetery space, will be required to keep up with demand (Cemeteries and Crematoria NSW, 2017b). Pre-sale of burial plots may mean that 'at need' access—that is, the ability to purchase plots at the time of death—will be compromised as soon as 2026, depending on trends in demand (Cemeteries and Crematoria NSW, 2017b). When completed, the newly-approved Macarthur Memorial Park in south-western Sydney (not factored in to the 2017 projections) is expected to provide an additional 136,000 burial plots across a range of interment types. Macarthur Memorial Park will, depending on precise numbers of deaths, rates of burial and other factors, have potential to extend availability of burial plots by up to 13 years beyond 2056 under some scenarios, however may not extend availability beyond 2056 under other scenarios (Cemeteries and Crematoria NSW, 2017b). However, Macarthur Memorial Park is located far from the population centre of Sydney and therefore is unlikely to be suitable to serve the entirety of the city population. Further, an additional burial ground the size of Macarthur Memorial Park is required to be added to the Sydney metropolitan area every 15-20 years to keep pace with likely demand (Cemeteries and Crematoria NSW, 2017b)

Cemeteries have not been considered a priority within strategic land-use planning processes in NSW. However, the NSW Government has taken some steps to consider the future of interment in the State. A discussion paper was issued in 2008 by the former NSW Department of Lands. This paper sought public feedback on various options to extend the longevity of existing cemeteries and to increase provision of new burial spaces in Sydney (NSW Department of Lands, 2008b). In 2013, the Cemeteries and Crematoria Act sought to reconfigure the interment landscape through the introduction of renewable tenure. There appears to be interest at the State Government level in understanding how strategic planning could improve planning for cemeteries: in 2019, the NSW Government asked the Greater Sydney Commission to provide advice regarding planning consideration for the provision of new cemeteries.[1] At the time of writing, it appears that reporting has not been released publicly.

[1] https://www.greater.sydney/project/strategic-planning-considerations-cemeteries

In response to the pressures facing Sydney's cemeteries, the NSW Government passed the Cemeteries and Crematoria Act (2013), with Part 4 of the Act which came into force in 2018 making renewable tenure available for interment rights. We discuss this in greater detail later in this report).

Pressures on land and, consequently, interment costs, are not evenly distributed across the State. In regional areas of NSW, a perpetual interment right could cost as little as $1,000 (IPART, 2019a). In contrast, a perpetual interment right in a lawn cemetery in the Sydney metropolitan region can cost around $6,000, or up to $38,000 in a section that can accommodate significant monumentation (IPART, 2019, p. 7). These are fees to purchase interment rights, and do not include the additional fees (often around $2,000) charged for the burial process itself including excavation of the grave site and burial of the body, nor does this figure include funeral costs (IPART, 2019a).

Questions and concerns regarding the funeral industry, body disposal and interment are being addressed in a number of arenas at present. NSW's Independent Pricing and Regulatory Tribunal (IPART) is undertaking a review of the costs of interment, in response to concerns regarding escalating burial costs in NSW (IPART, 2019a). The 2019 review was limited to a review of the costs of interment, however IPART will also undertake a review of the funeral sector in 2020, looking more broadly at the pricing of funeral services. The Hayne Royal Commission into misconduct in the finance and banking industry made a number of rulings relevant to the sale of funeral insurance products (Hayne Royal Commission, 2019). A 2019 episode of ABC's Four Corners raised consumer concerns regarding the ethics of practices in the funeral industry, particularly around pricing and transparency. Recent proposals for new cemeteries have garnered media attention and political debate, and the issue of renewable interment has been a contentious one—at least amongst mainstream media outlets. The emergence of a growing not-for-profit funeral sector and sustained pressure from consumer advocacy groups, such as Choice, continue to place pressure on the mainstream sector to improve practices. The sector is, then, subject to more scrutiny than it has been in recent years, making this perhaps a prime opportunity to address issues relating to both the sustainability of the sector and the need for improved consumer choice and empowerment.

1.2.1 Regulation and legislation

A number of pieces of legislation are relevant to the disposal of bodies in NSW, including:

- The Cemeteries and Crematoria Act 2013
- The Public Health Act 2010 and the Public Health Regulation 2012
- The Local Government Act 1993
- Crown Land Management Act 2016 (requires Ministerial consent to develop land for cemetery use).

The Cemeteries and Crematoria Act 2013 makes reference to the need for sustainability. The Objects of the Act seek to promote environmental sustainability of the interment industry, including provision for natural and private burials. Furthermore, the Act describes the principal functions of the Cemeteries Agency as: to provide advice or make recommendations to the Minister in relation to the sustainable use of cemetery and crematorium space and capacity, and to promote environmentally sustainable practices in the interment industry.

The Human Tissue Act 1983 (provides a definition of death) and the Anatomy Act 1977 (covering donations of bodies to science) are also relevant to disposal of bodies.

The Public Health Regulation sets specific regulations about the handling and treatment of bodies for burial and cremation, and so holds perhaps the most significance for the focus of this work. The Public Health Regulation makes a number of requirements that are directly relevant to the sustainability and environmental impact of body disposal practices, including:

- Requirements regarding embalming: for example requiring all bodies to be buried in vaults to be embalmed)
- Requirements regarding the use of coffins: bodies must be placed in coffins for both burials and cremations except where express permission has been given to exempt individuals or groups from this requirement
- Transportation of body by coffin
- Specifications regarding how cremations are carried out
- Specifications for sealing vaults/crypts.

We discuss these in more detail in the relevant sections throughout the report. We provide a comprehensive list of regulation and legislation at both NSW and Federal levels relevant to disposal of bodies in Appendix 1.

The review of both the Public Health Regulation 2012 and the Cemeteries and Crematoria Act 2013, both scheduled for 2020, provide significant opportunities to amend regulation and legislation to ensure improved outcomes. We make recommendations throughout this report regarding these possible amendments, including relating both to strategic approaches and specific regulatory and legislative changes which might be considered.

2 Methodology

The main objective of this project was to identify sustainable, innovative and land-efficient body disposal strategies worldwide and as well as new and emerging practices to understand what the barriers and enablers may be regarding their implementation in NSW. To achieve this, we proceeded in three steps. First, we undertook a systematic review of the scientific literature, which enabled us to gain an understanding of the existing methods for sustainable practices, the benefits and limitations of each method and the barriers and opportunities to their adoption. This review was complemented by a review of press articles and online resources related to sustainable, innovative and/or land-efficient body disposal strategies. Secondly, we conducted 21 interviews with a variety of stakeholders involved in the sector in NSW and internationally, to generate insights on the feasibility and suitability of the implementation, in NSW, of the strategies and practices identified in the literature. Finally, we conducted engagement and sought input from a range of stakeholders. This included active engagement with CCNSW's Community and Consumer Consultative Group, members of which provided significant input at a presentation and for a preliminary draft of this report, and a presentation to the CCNSW Board with opportunity for members to provide high-level input. The project was guided by a steering group, comprised of representatives of the commercial funeral/interment sector, the local government sector, an urban planner familiar with cemetery planning issues and a social scientist with expertise in cultural practices regarding body disposal and death. We hosted an industry workshop, which included members from CCNSW's Industry Consultation Group, where we presented the initial results of the research and collaboratively identified priority pathways to transformation towards a more sustainable sector in NSW.

2.1 Literature review

A systematic review of the literature was conducted using two search engines, Web of Science and Scopus. Keywords related to sustainability/land-efficiency/innovation, as well as to different interment practices were identified:

(sustainable OR eco-friendly* OR affordable* OR environmental* OR alternative* OR equitable* OR land-efficient* OR low impact* OR green OR innovative*) AND (burial* OR interment* OR cremation* OR funeral* OR burying* OR cemeteries* OR crematorium*)*

This search led to the identification of over 1,500 papers which were reviewed for relevance to identify a smaller number of papers with direct relevance to our research objectives. In total, 67 articles were systematically analysed according to a range of categories: purpose of the paper, methodology adopted, location of the study, and main findings. In addition to the review of the academic literature, we conducted an 'ad hoc' review of media articles and web resources. This analysis focused on identifying the key points made in the article and the sustainable, innovative or land-efficient practices that were mentioned.

2.2 Interviews

Twenty-one interviews were conducted with key stakeholders from the sector. These included Cemeteries & Crematoria NSW Board members, funeral directors, crematorium operators, cemetery managers, churches and other religious and community organisations, planners, as well

as organisations engaging in innovative, sustainable, land-efficient and/or affordable interment practices.

Stakeholder recruitment was through a list of contacts provided by Cemeteries and Crematoria New South Wales (CCNSW) and identification of potential interviewees by the research team during the literature review phase. Finally, the project steering committee suggested further potential participants, and snowballing (gathering contacts from interviewees) was also undertaken.

The main objective of the interviews was to understand the technological, social, cultural, regulatory and commercial opportunities and barriers to the introduction of innovative, sustainable and/or land-efficient interment practices in NSW. The interviews were carried out over the phone or face-to-face. Interview notes were analysed thematically, with the research team identifying themes relating to the practices, methods and challenges that had arisen in the literature review, as well as several novel themes that appeared particularly relevant to the NSW context.

The literature review and the interviews were used to structure the sections of the report, as well as to develop a summary table of the environmental benefits provided by each practice, as well as their feasibility in the NSW context.

2.3 Stakeholder engagement

The research team sought input from a range of stakeholders to ensure the project's rigour and relevance to the NSW context. This included a review of this report by members of the CCNSW Community and Consumer Consultative Group, as well as high-level input from CCNSW board members following a presentation. The project steering group was given opportunity to review the final report, providing further input.

Towards the end of the research project, an industry workshop was held with over a dozen attendees from across the sector, which aimed to identify barriers, challenges and priority pathways towards more sustainable alternatives. Key stakeholders involved in the interment and funeral sectors, including members of the CCNSW Industry Consultation Group, were invited to participate in the workshop, representing a broad range of interests within the sector. The workshop was structured around three group discussions focusing respectively on:

1. The current drivers of change towards improving the sustainability of the sector
2. The challenges/barriers to change
3. The identification of priority actions.

3 Findings: Social and cultural considerations

Before delving in detail into practices and methods, we will report on the findings that relate to the social and cultural aspects of practices, which provide context for the findings which follow.

3.1 Social and cultural groups and practices in NSW

At core, practices relating to memorialisation and body disposal are integral aspects of our social/cultural lives, strongly rooted in culture, custom, tradition and beliefs. The range of practices and processes highlights the various cultural and religious values, traditions, hierarchies, social structures and social identities (Fahlander & Oestigaard, 2008). A funeral is both a social and ritual practice that celebrates and commemorates a person's life and prepares the body of the deceased for a transition through various processes such as fast or slow decomposition of the body through burial, consumption by fire during cremation, or through other forms of body treatments. These transition rituals can be influenced by the religious as well as personal beliefs held by the individual and their family (Cook & Walter, 2005). Funerals are considered symbolic practices that assist the bereaved to express their grief, heal from pain and accept the reality of death (Allam, 2019).

Burial is the interment of a deceased body in a grave or tomb, typically accompanied by a series of ritualised funeral rites (Fahlander & Oestigaard, 2008). Until several decades ago, burial was the only option available for interment in Australia. Burial is highly important to many cultures, and continues to be so today for certain cultural and religious groups, despite the declining proportion of burials occurring in Australia.

Cremation is currently seen as the 'default' alternative to burial and is now more a popular option than burial in NSW. In 2015, 66% of bodies were cremated which is comparable to the rest of Australia where 69% of bodies were cremated (Department of Industry, 2015; Cremation Society, 2017). Anecdotally, affordability is considered to be a major driver for this rise, with cremation costing a fraction of burial in NSW, particularly in urban areas where the cost of burial tenure rights is extremely high. This shift towards cremation also coincides with the population growth of minority groups for whom cremation is the first choice, including Hindu and Sikh communities.

While the proportion of people in Australia not identifying with a religion is growing, there is an increasing proportion of the Australian population made up by several ethnic and cultural groups that have specific requirements around the disposal of bodies (ABS, 2016). For example, the Islamic community—who generally require burial—is growing (ABS, 2016). This is likely to mean that the demand for spaces for burial is unlikely to continue to decline at the same rate as witnessed over the last several decades; demand for burial may be relatively stable into the future. Further, our research participants indicated that they perceive that many people tend to revert to the beliefs and practices of their family and ancestry around death, even if they did not actively practice religion or spirituality in life. This is supported by Holloway et al (2013, p. 44), who note that many mourners draw on traditions and rituals which they are not actively participants in, such as reading prayers and other religious traditions, as part of their attempt to seek and make meaning as part of the funeral process. This may mean that people become more traditional about post-life choices as

they age, and that trends in census data are not directly translatable into trends regarding post-life preferences.

Based on our discussions with various stakeholders from across NSW, we identified a range of consumer categories relevant to this research:

- **Those groups with a preference for burial (religious groups which mandate burial; roughly 30% of the NSW population, including Catholic, Orthodox, Islamic, Presbyterian and Jewish communities)**[2]**:** these groups will likely continue to practice burial, however as we identify in this report, many opportunities exist for tweaking existing practices to reduce environmental impacts without impinging upon cultural/religious preferences;

- **Those groups with a strong preference for cremation (religious groups which mandate cremation, comprising less than 6% of the NSW population, including Buddhist, Sikh and Hindu communities) and those for whom burial was traditional but cremation is now common (Anglican and Baptist faith groups, around 30% of NSW population):** as above, these groups will likely continue with these practices and are unlikely to seek out alternatives, however opportunities to reduce the impact of these practices are identified throughout this report;

- **Those who elect cremation as a 'default' option (the size of this cohort is unknown, but likely sizeable, with around 30% of the NSW population having no religious affiliation, many of this cohort choose cremation for affordability or simplicity):** Enormous potential exists to either shift these consumers to more sustainable alternatives or to improve the choices available to them to allow the achievement of improvements to environmental impact associated with cremation;

- **Those who actively seek alternatives but whose needs are not currently met (a smaller subset of the above group; the size of this cohort is unknown):** this group is likely a slightly younger or progressive cohort, interested in funeral and interment practices aligned with their beliefs and values. Many of these consumers are unlikely to have their needs met in the current market, and there exists substantial opportunities to deliver new offerings, products and practices to meet this group's needs.

The relevance of sustainable choices to these groups will vary, however may be most relevant to these final two groups, who do not have strong cultural or religious preferences regarding body disposal options.

Research participants indicated that, for many cultural and religious groups, community leaders are a significant source of influence regarding practices around commemoration, memorialisation and body disposal. Practices of even conservative religious groups can change and shift over time, provided they have the support of community leaders—a common example given is the shift towards multiple-occupancy burial amongst the Muslim community of NSW: previously, this practice was not common, however engagement with community leaders has produced a significant shift leading to adoption of multiple-occupancy graves as a relatively common practice

[2] Catholics traditionally had a prohibition on cremation, however in more recent years cremation has become acceptable—and is growing though not particularly common—amongst Catholics due to the Pope's announcement that cremation was acceptable so long as cremated remains were interred on consecrated grounds.

among this community. Engagement and communication with leaders of cultural and religious communities will therefore be critical to the success of any efforts to improve the environmental impact of established practices.

In addition to being social, cultural and religious practices, decisions about memorialisation and body disposal entail financial considerations, which influence purchases. However, our interviews indicated that in many ways these decisions are unlike other consumer purchase decisions. Consumers tend to be grieving, adding considerable emotional overtone to the transaction. Further, our interviewees shared that there is (perhaps unnecessary) time pressure applied to the decision, with commercial operators pressuring families to make quick decisions. Many people making decisions about funerals and body disposal will find themselves doing it for the first time, having little experience of the process and finding themselves highly uninformed. This combination of factors often results in consumers doing very little research about the options available to them. The sector is already one characterised by a lack of choice, and this problem is further compounded by a lack of consumer preparedness and knowledge, allowing the commercial providers to guide choices. Consumers tend to be given little information about the potential array of choices and alternatives available to them—especially low cost or sustainable alternatives—and are rarely even given a thorough indication of costs prior to the purchase decision.

3.2 Financial and economic factors

The funeral director, cemeteries and crematoria sector in Australia is worth around $1.7 billion (IbisWorld, 2019). Overall, the industry gains most of its revenue (54%) through cremation and burial services, with about a fifth each coming from sales of coffins and caskets and from funeral directing services (IbisWorld, 2019). Small and medium enterprises make a higher proportion of their revenue (around 30%) from the sale of coffins and caskets, with the majority of their revenue stream arising from funeral directing services.

Funeral and body disposal costs place enormous burdens on families and communities. The costs of interment are significant for Australian households. The average Australian funeral, including body disposal, costs around 8.5% of average Australian annual earnings, however can be as much as 30-40% of annual earnings for those in lower income brackets (SVA Consulting, 2019). Interment costs are not currently regulated, though costs for Crown cemetery interments must be approved by Crown cemetery boards (IPART, 2019a). For residents of metropolitan Sydney, interment right costs for burial of between $6,000 and $20,000 are normal, though can greatly exceed this if consumers have special requirements, and the cost for the burial itself can be up to $2,000 (IPART, 2019a). Interment of ashes tends to be less expensive, though still considerable, with costs ranging from $1,800 to nearly $6,000 for an interment right, with additional fees in the hundreds of dollars for the placement of the ashes (IPART, 2019a). These costs don't include the costs of the coffin, funeral service, memorial and other expenses, which can further inflate the financial burden upon the family.

Research participants, particularly in our industry workshop, reported that consumers often feel social pressure to 'spend big' on funerals and interment in order to reflect their love and respect for the deceased, as well as to keep pace with peers. This, coupled with pressure from funeral directors and others in the sector, encourages consumers to spend beyond their means.

Interment costs in Sydney are significantly more expensive than those in other jurisdictions: in Melbourne, costs range from between $2,600 to $9,400; in Brisbane between $3,600 and $6,200;

and in Adelaide, where renewable tenure is the norm, a 25-year tenure costs $2,800—$5,900 and a 50-year tenure costs around $4,900 (IPART, 2019a). A number of factors influence these costs, including the ownership of the cemetery—in Victoria, cemeteries are almost entirely on Crown land)—and land use pressures, which are arguably higher in Sydney than elsewhere.

These costs are substantial, often incurred suddenly and are rarely planned for. In many cases, people least able to meet the significant costs of body disposal are those whose cultural practices require them to select the most expensive options: for example, Australian Islamic households, who require burial of the deceased, are over-represented in lower income cohorts (Hassan & Lester, 2015). Some people are eligible to receive assistance for the cost of funerals and interments, including some Centrelink payment recipients, veterans, Aboriginal and Torres Strait Islanders (through a Land Council grants program) and those eligible for assistance in some charitable assistance programs (IPART, 2019a). However, evidence suggests that many households struggle to afford the costs of funerals, burials and cremations, with many going into debt to cover costs.

There is a pressing need for more affordable choices for communities. A review is currently underway by the Independent Pricing and Regulatory Tribunal regarding interment costs and whether opportunity for improved regulation exists in relation to these costs (IPART, 2019a). The growth of the not-for-profit funeral sector, several representatives of which were engaged for this research, is indicative of the growing demand for affordable funeral, memorialisation and body disposal options.

While few Australians pre-plan for their funeral or interment, those who do are often exposed to exploitative financial products; these products were the subject of enquiries in the Royal Commission into misconduct in the financial services industry, and recommendations were made that significant changes should be made to regulation to prevent the sale of exploitative products (Hayne Royal Commission, 2019). Funeral insurance is one such product: many consumers of funeral insurance believe they are ‘pre-paying’ for their funeral, when in fact they are paying premiums that are not available to their family upon their death to cover costs. Instead they are paying premiums that will make them eligible for a payout, which is subject to the insurer’s policies and discretion.

3.3 Indigenous Australians

Access to affordable burial is a particular issue for Indigenous Australians. Most—though not all (Hiatt, 1969)—indigenous cultures and traditions involve burying the deceased (Littleton, 2007; Pardoe, 1988). Given that Indigenous Australians number among the most disadvantaged in our society (AIHW, 2019), meeting the cost for burial of family and community members presents a significant burden for these communities. Aboriginal communities have been targeted in marketing for exploitative funeral plans that promise to help families cope with the costs of funerals but end up costing many times more than funerals might otherwise.[3]

The enormous financial burden of purchasing burial tenure feels particularly egregious given that Indigenous Australians are the traditional owners of this land and have been practicing their burial traditions for many tens of thousands of years on this land. While considerations for Indigenous

[3] https://www.afr.com/companies/financial-services/banking-royal-commission-interim-report-funeral-insurance-all-but-dead-20180927-h15xjb

Australians does not comprise a major focus of this report, we wish to acknowledge here that several stakeholders proposed that Indigenous Australians should have burial tenure costs waived, in acknowledgment of their long-standing custodianship of this land, and in recognition of the socio-economic disparities between Indigenous and settler Australians.

4 Findings: Preparation of the body

Traditionally, practices preparing the body for interment were generally performed by the family or community of the deceased. The family would wash, prepare and clothe the body in preparation for burial or cremation. The preparation of bodies for interment became widely professionalised in the 20th century, taking the process out of the hands of families and into the realm of commercial funeral directors.

4.1 Family/community involvement

There is, according to our interviewees, increasing interest among some segments of the population in re-involvement of family members in the preparation process. Current regulations do not prevent family or community members from participating in or leading the preparation of the body for interment. For example, Tender Funerals, a community-based not-for-profit provider, invite family members to participate in the process to whatever degree they choose. Providers interviewed for this project reported that, when given the choice, family members become quite active in this process, which can be empowering, rather than alienating.

Life Rites, a social enterprise providing both end-of-life and after-death care, facilitates at-home after-death care where allowable, desired and appropriate. At present, this is only possible in NSW when a family member dies at home, meaning many families who would like to care for their deceased at home are unable to due to them passing away in hospital or palliative care. For those who passed away at home, cold plates can be utilised to ensure the integrity of the body for up to five days. The body can be held in the home for a maximum of five days before the body must be handed over to a funeral director for coffining and transportation, as bodies must be coffined in a registered mortuary. It is unclear what, if any, sustainability benefits might arise through at-home after-death care, however such options certainly expand consumer choice and empower families to become involved in the process. Regulatory changes enabling home coffining and allowing the use of cold plates as temporary mortuaries would help more consumers access these options.

4.2 Embalming

Embalming arose as a practice in the US in response to the need to transport deceased soldiers back to hometowns during the US Civil War. It continues today in part because of a widely-held but largely erroneous public belief that dead bodies—especially unembalmed bodies—pose a health risk to the living. The World Health Organisation notes that this belief is largely unfounded, and that few risks arise from dead bodies, even in the presence of infectious diseases (Eberwine, 2005), concluding that embalming is not more hygienic. Embalming, then, provides no public health benefit—and in fact is considered a dangerous practice (Hugo, 2019).

Embalming involves replacing blood with formaldehyde and other chemicals to retard decomposition. It poses health risks for funeral directors, as well as potentially negative environmental impacts. Formaldehyde is a known carcinogen which poses serious health concerns for funeral industry workers that are exposed to formaldehyde in high concentrations (Michel and Lee, 2017)—funeral directors have higher-than-average rates of myeloid leukemia, thought to be as a result of regular exposure to formaldehyde (Merchak, 2019). Regarding environmental impacts, formaldehyde has the potential to contaminate groundwater (Zychowski, 2012). However,

as the risk presented by formaldehyde is not clearly established there is no legislation in the USA—where embalming is used extensively—on the allowable concentration of formaldehyde in groundwater (Zychowski, 2012). In addition to groundwater, formaldehyde is also released in municipal sewer systems during the preparation of the body by funeral homes (Michel and Lee, 2017). Here, again, no details are known regarding the scale of the risk that formaldehyde use by the interment industry represents for public and environmental health (Michel and Lee, 2017).

While this practice is very common in the USA, this is not the case in Australia, with embalming used on less than 25% of all bodies, according to anecdotal evidence gathered in our interviews, however this varies between operators, with community-based operators such as Tender Funerals embalming less than 0.5% of bodies. In NSW, embalming is required only when the body is being interred in an above-ground mausoleum or crypt, or if the body is to be transported overseas or interstate (Potter, 2019). Even though it is not a legal requirement, our interviewees suggested funeral directors reportedly see embalming as an opportunity to upsell services, giving consumers the impression that it is required in instances where it may not be.

Embalming is commonly performed in Australia when a viewing will take place or where there will be a delay of several weeks between the death and the funeral. Embalming tends to be associated with, though in NSW is not required for, those cultural and religious groups who opt for open-casket services. The Public Health Regulation 2012 specifies the procedures that must be followed if a funeral director is to allow a viewing of an unembalmed body. Embalming is reportedly also commonly used in Australia in instances when a funeral service will be delayed due to the need to wait for family to travel from overseas, resulting in some delay in the service being held, or if the body needs to be transported significant distances or internationally.

More sustainable and safe alternatives to formaldehyde embalming include refrigeration, dry ice, and ecobalming[4]—based on essential oils. Little information on these techniques was available—and no scientific literature was found as part of this review—about the efficacy of natural alternatives compared to formaldehyde nor about how they relate to standards or requirements regarding embalming. Essential oils are regarded as having anti-microbial properties (Cvijovic, Djukic, Mandic, Acamovic-Djokovic, & Pesakovic, 2010) and some patents for these types of embalming fluids exist in the USA (Rendon, 1975).

Our research participants also indicated that current embalming practices don't fit with what is actually needed: formaldehyde is a long-term embalming response which preserves the body for a long time, whereas solutions that keep the body in a good condition for only 3-4 days are generally all that is required for the purposes of arranging a viewing or transporting a body interstate or overseas. Other chemical solutions that preserve the body's state for a shorter period of time may provide less toxic alternatives, which also do not serve to inhibit decomposition.

Given that we identified some interest in moving towards more space-efficient methods of interment, there may be a need to identify more sustainable alternatives that could be used in cases where embalming is currently required, such as for above-ground mausolea and crypts. Further, given that these regulations are not consistent across Australian jurisdictions—in Victoria, for

[4] Enigma ecobalming is a plant-based alternative to formaldehyde derived from essential oils: https://thechampioncompany.com/product-catalog/enigma-ecobalming

example, embalming is not required for interment in mausolea and above-ground crypts, there may be a need to review their necessity in NSW.

Natural burial grounds, discussed in a later chapter in greater detail, rarely accept embalmed bodies (Kim, Hall, Hart, & Pollard, 2008), though some are flexible about this, recognising variation in cultural practices which tend to involve embalming (Kowarik, Buchholz, von der Lippe, & Seitz, 2016), for example, those cultures where open-casket viewings are common. It is not clear how natural burial grounds contained within traditional cemeteries (e.g. the newly-approved Macarthur Memorial Park) will address this issue.

4.3 Transportation of bodies

Transportation of bodies is currently regulated under the Public Health Regulation 2012. Clause 65 of Part 8 requires that bodies be transported only if enclosed in a 'watertight coffin'.

While there exist many methods for safely and securely transporting a body without the use of a watertight coffin, including the use of body bags, shrouds, coffins with detachable bases that allow shrouded bodies to be released into graves, and specialised containers within vehicles inside which un-coffined bodies can be secured, in practice this requirement has helped the industry maintain the status quo with regards to the use of coffins. The industry has a strong interest in maintaining this status quo as these products are sold at significant margins, with a large proportion of the industry's profits derived from the sale of coffins and caskets. The public health requirements have encouraged the manufacture of coffins with plastic liners and other treatments intended to comply with this 'watertight' requirement. These plastic liners inhibit decomposition and also introduce further toxic materials into cemetery soils, or are burnt in the cremation process, releasing nitrous oxide and other potential pollutants (Keijzer & Kok, 2011). As discussed in greater detail below, conventional coffins and caskets tend to be produced using MDF/chipboard and contain a range of synthetic materials which are problematic when released into the environment through either cremation or interment. Several research participants indicated that there are multiple methods both currently available and currently in use in NSW—for example, for burials involving shrouds, relatively rare but certainly an existing practice in NSW—which do not present any public health risks.

The requirement in the Public Health Regulation currently allows the industry to perpetuate the notion that watertight coffins are required in all circumstances without exception. Given the role that alternatives to conventional coffins could provide in improving environmental impact of body disposal practices (see detailed discussion in the following section), there is a need to consider how more widespread uptake of alternatives could be facilitated. Raising consumer awareness of the ability to use alternatives to conventional coffins will undoubtedly be a critical component of this—at present, most consumers remain unaware that the use of eco-coffins or shrouds is possible. However, changing regulation to allow more flexibility around the vessel used for transportation could also help ensure that the use of alternatives is better facilitated and enabled.

5 Vessels

The interment vessel—that is, the coffin, casket or other covering used for burial or cremation—is a key contributor to the environmental impact of interment practices. We discuss the key products and alternatives throughout this section, paying attention to their environmental impacts and seeking to understand how these may be improved.

The materials used for the production of coffins includes timber, varnishes, metal, and fabric, amongst others. Many of these materials are burnt and may emit toxic chemicals during cremations—though metal components such as plaques and handles are generally removed for cremation. If buried, they may leach chemicals into ground water following interment processes, though the extent to which these have potential to infiltrate the local environment appears to be small (Dent, 2002).

We note also that the clothing worn by the deceased for burial is also relevant to environmental impact. Clothing used for funerals is often made from polyester materials that do not biodegrade (Fiedler et al., 2012). The use of natural fibres is encouraged for natural burials (Michel & Lee, 2017), to reduce plastic contamination of the environment and hasten decomposition. Shrouds made from natural materials also significantly improve environmental impacts, however as we note below, individuals must secure permission to be buried in a shroud in NSW.

5.1 Coffins, caskets and shrouds

In NSW, burial or cremation with a casket or coffin[5] is standard practice and is required by regulations. Exceptions exist; however, these options are not well known or utilised by the public. Members of the Muslim faith are granted exemptions, and bury their dead in cotton or linen shrouds, and other exemptions may be granted with permission by the Chief Health Officer of NSW. Exemptions can be applied for on other grounds in addition to religious grounds, including a 'community' or personal preference for burial in a shroud, however evidence from our interviewees suggests that applications for this exemption from people outside the Muslim faith are uncommon in NSW at present. Further, disposal of a body by alkaline hydrolysis (explained further in a subsequent chapter) does not require the body to be placed in a coffin, according to the Public Health Regulation 2012.

Coffins are a major element of the environmental impact of burial and cremation (Keijzer, 2017). Materials used to produce coffins include timber, varnishes, metal, and fabric, amongst others. Figures are not available for Australia, but in the US annually, 30-plus million board feet[6] of hardwoods, much of it tropical timber, is used for the manufacture of caskets, 1,636,000 tonnes of reinforced concrete is used for vaults, and 90,272 tonnes of steel is used for caskets (Raymond, 2019). Timber inputs for caskets are thought to require around 1.6 million hectares of forest annually (Gathered Here, 2017b). Timber for coffins is often treated with creosote—a coal-based substance thought to be carcinogenic in humans, polyvinyl chloride (a plastic polymer which can have health impacts ranging from cancer to reproductive, developmental and immune disorders) and insecticides. Chemical contaminants used in production include varnish, wood preservatives

[5] Casket and coffin are used interchangeably both in common usage and throughout this report. Casket, however, refers to a rectangular vessel, usually hinged, while coffin relates to a classically-shaped tapered vessel, usually unhinged.
[6] Board foot is a measurement of timber in the US imperial system, which refers to 144 cubic inches of timber.

and metal parts of coffins—handles and props can release: lead, zinc, copper, chromium, nickel and iron (da Cruz et al., 2017). Textiles used to bed the corpse tend to be made of barely degradable polyester, also treated with chemical moisture binders (Fiedler et al., 2012). However, cotton linings may also be problematic: Keijzer (2017) notes that cotton production contributes to the overall resource intensity of the coffin. However, the biodegradable nature of cotton means that its life-cycle impact may be lower than that of polyester fabrics, which may contribute plastic contamination to the environment and will not biodegrade at the same rapid rate as cotton.

In the case of burial, these contaminants, as they are not biodegradable, may remain for many decades or centuries. The extent to which they are likely to be transported into the local environment and cause contamination depends upon a great many local contextual factors (Dent, 2002), and is difficult to definitively describe without knowledge of local circumstances. The use of plastic liners and other plastics in coffins is a major source of pollutants and retards decomposition—this is a significant environmental impact requiring redress. In the case of cremation, substantial release of noxious gases may result from burning coffins. The scientific literature does identify the substances and amounts of contaminants that might be expected to arise from leachate and emissions from burial and cremation, however it is unclear the extent to which these toxins arise from the vessel as separate from the body itself.

Coffins, especially those made from treated timber, with plastic and polyester liners, retard the decomposition process, meaning that decomposition takes much longer than it might in other circumstances. This has implications where more land-efficient options are planned, such as renewable tenure or removal of remains to an ossuary. Hindering decomposition prevents the body from fully breaking down, complicating any efforts at exhumation.

A key component of more sustainable practices is the replacement of conventional coffins or caskets with biodegradable vessels or shrouds. The US and Canada, where natural burials are increasingly common, have seen increasing use of biodegradable coffins and shrouds (Michel & Lee, 2017). Alternative burial vessels use materials that are sourced from either sustainable and rapidly renewable sources such as seagrass, willow, bamboo, cork, cardboard, and/or shrouds that are comprised of natural fibres such as linen, wool, silk, hemp, or corn-starch to cover the body and aid decomposition (Stewart, 2018).

Figure 1: Ecocasket from Handwoven Caskets (source: handwovencaskets.com.au)

Figure 2: Woollen eco casket from Serendipity Coffins (source: serendipitycoffins.com.au)

In Australia cardboard coffins are readily available and meet regulatory standards for coffins: companies such as Leaving Lightly offer cardboard coffin options that use minimal amounts of water-based glues, and 100% post-consumer recycled cardboard to produce personalisable vessels, and LifeArt, which uses up to 97% recycled fibres from recycled cardboard and sugar cane waste to produce caskets. [7] According to LifeArt, these cardboard coffins release 87% less nitrous oxide when cremated than conventional MDF/chipboard coffins, and require 80% fewer trees as inputs than conventional coffins. Handwoven caskets made from willow without glues or chemicals are also available in Australia (for example, see Handwoven Caskets and Serendipity Coffins). Given that a number of sustainable alternatives currently exist in Australia, communication and awareness raising is clearly required to ensure that consumers are aware of the available options and significant shifts in industry practice are required to see commercial operators providing sustainable alternatives as standard.

In cremation, while biodegradable caskets do have the obvious advantages of having reduced resource inputs and lower toxicity than conventional caskets, the fact that they are burned after a very short use is a major problem from the perspective of environmental sustainability. While cremation in a sustainably-sourced biodegradable coffin would be preferable to cremation in a conventional coffin, significant environmental impacts remain.

Shrouds may present significant sustainability advantages over coffins and caskets, especially when the shroud is biodegradable. Shrouds have significantly fewer resource inputs, avoiding the timber, metal and plastic inputs associated with coffins and caskets, and tend to be made of natural fibres such as cotton or linen. Cotton production is associated with some environmental impacts, especially related to water use, however its biodegradability is an important factor contributing to its sustainability—as is the overall lower resource input requirements for shrouds in contrast to coffins. Further, our research participants indicated that a body buried in a shroud in Sydney soils will fully decompose within a year, whereas the use of coffins or caskets significantly inhibits decomposition, a problem for renewable tenure, as discussed later in this report. Shroud bearers (timber frames used to carry the body) can be used to support transport and facilitate interment, to allow the body to be lowered into the grave or to be rolled into the cremator.

A number of religious groups—predominantly, the Islamic religion—mandate burial only in a shroud. Other religions, for example Judaism, specify that coffins or caskets must be made only from natural materials to facilitate the body breaking down to become one with the soil. However, burial in a shroud is disallowed under existing regulations in NSW, except when an exemption to the Public Health Regulation is granted. In NSW, shrouded burials practiced by the Muslim community tend to involve the use of a re-usable outer coffin for transportation, allowing the body to be transported in accordance with regulation but removed for placement in the grave. This makes the use of shrouds difficult for those who would prefer to opt not to purchase a coffin, especially given funeral directors tend to have direct incentives—e.g. high profit-margins associated with coffin/casket sales—to ensure consumers use coffins rather than shrouds. A funeral director's mark-up on coffins is often greater than 100% (IbisWorld, 2019).

In NSW, the environmental impact of the coffin is to some degree determined by regulation. As discussed earlier, at present, the Public Health Regulation 2012 specifies that bodies must be placed in watertight coffins for transportation. This requirement is intended to reduce the likelihood

[7] http://www.cardboardcoffinsaustralia.com.au/; https://www.lifeart.com.au

of leakage of fluids during the transportation of the body. This requires that coffins include some kind of plastic liner, which inhibits decomposition of the body and contributes pollutants into the environment. The need for this liner is questionable—other jurisdictions, for example Victoria, do not place the same regulatory requirements upon coffins, and the use of shrouds being permissible in NSW indicates a likely negligible public health risk. Further, body bags are deemed satisfactory for the initial transport of the body (e.g. from the home or hospital to the funeral home). The World Health Organisation does not see the use of coffins as critical for ensuring public health, and several of our research participants noted that good mortuary practice would prevent any risk of body fluid leakage, negating the need for a sealed coffin.

Research participants also suggested that waterproofing liners could be made of biodegradable material, as these vessels only need to be made watertight for a short period of time (usually, less than one week). Biodegradable liners could minimise plastic inputs and reduce the inhibition of decomposition. However, questions regarding the need for watertight vessels in the first place may mean that even biodegradable liners are not necessary.

A further regulatory issue with coffins relates to the lack of regulation regarding harmful substances that can be used in coffin manufacture. For example, the lack of Australian standards or regulations in place means that many coffins imported from China and elsewhere are treated with formalin, a formaldehyde solution. The presence of formalin inhibits decomposition of both the body and the coffin. Formalin, like formaldehyde, is highly toxic: in addition to being carcinogenic, it can cause respiratory problems and other irritations. Research participants indicated that its use in coffins is unnecessary for any practical or public health purpose—and that its presence in coffins is in fact problematic given its role in inhibiting decomposition. Thus, two regulatory responses are likely required to better manage the environmental impact of coffins: a loosening of requirements in NSW that all bodies be buried or cremated in coffins, as well as a relaxation of the requirement that vessels be watertight; and a strengthening of Australian standards to prohibit coffins treated with toxic chemicals and containing plastic from being manufactured or imported.

A range of novel, sustainable vessels have also been identified internationally, including:

- US-based company Coeio[8] offers mushroom suit shrouds for burials (Figure 3). These mushroom-based burial suits and shrouds allow for quicker decomposition and claim to neutralise toxins found in the body. The suits and shrouds are made from organic cotton and a bio-mix of mushrooms to facilitate rapid decomposition. These suits and shrouds can be purchased online for around $US1500. We were not able to uncover specific literature on their likely treatment in the Australian context; however, we understand that, in NSW, these suits and shrouds would be allowable only with permission from the Departmental Secretary of NSW Health to be buried without a coffin.

- *Capsula Mundi* designed an egg-shaped burial pod (Figure 5), in which a body would be placed for burial. The pod, made from a biodegradable material, contains a seed allowing a tree to grow from the pod. Capsula Mundi's burial pods are not commercially available at present, with the developer's future intent for this product unknown. However, Capsula Mundi's urns for cremated remains are currently available. Capsula Mundi would only be suitable for use in natural burial grounds rather than conventional lawn cemeteries. It

[8] https://coeio.com/coeio-story/

remains unclear how the burial pod compares in terms of resource consumption with shrouds made from natural fibres, making its sustainability impact uncertain.

- *The Kiwi Coffin club,* created by Katie Williams in New Zealand, welcomes elderly people who want to build their own coffin. It provides a variety of social and economic benefits, by lowering the costs of funeral, encouraging social interactions, getting accustomed to the prospect of dying and creating a personalised coffin that better reflects the deceased's personality. These practices do not *necessarily* reduce the environmental impact, however our interviewees indicate that these kind of hand-made coffins tend to use fewer resources, including less varnish, fewer plastic products (such as polyester linings), and are often produced with recovered materials, such as recycled timber and fabric.

- *Leaves* is a project by Shaina Garfield which involves a biodegradable board and woven shroud for burial (Figure 4). The family and friends of the deceased can be involved in the weaving of the Leaves covering, responding to demand for personalisation and intimacy in these processes.

Figure 3: The Coeio mushroom suit demonstrated (Image source: Coeio).

The main challenge with the use of these unconventional coffins and shrouds is reported to be the leakage of bodily fluids, which becomes a concern if there is a delay between the death and the burial. Conventional coffins and caskets have a plastic lining which prevents fluids from leaking. However, these plastics and polyester materials are pollutants, taking many centuries to break down and instead remaining in the soil. However, alternative and eco-friendly coffins and shrouds have been used in many services in Australia without issue. Adequate refrigeration of the body until immediately before moving the body to the burial ground appears to largely address the need to manage bodily fluids leaking. Rapid burial helps circumvent this issue: hence why Muslim communities, who hold burials very soon after death, are easily able to use shrouds in lieu of coffins. Other practices such as the use of refrigeration and cold plates can assist in managing this issue, and research participants—especially those from outside the mainstream sector—indicated that proper mortuary practice and adequate shrouding should ensure that shrouded bodies present no risk of leaking bodily fluids.

Shrouded cremation is not currently allowable in NSW, as the exemption to the requirements of the Public Health Regulation 2012 only applies to burial. From a practical perspective, research participants representing the conventional interment sector voiced resistance to the notion that

shrouded cremation could be easily facilitated in NSW. Private operators in particular believed that the shrouded cremations would be prohibited by WH&S regulations preventing cremator operators from handling shrouded bodies, however our investigations have found that such claims do not bear scrutiny. Other research participants representing organisations outside the conventional interment industry indicated that these practices are accessible in other jurisdictions—for example in Victoria, where shrouded cremations are allowed due to regulatory differences regarding the use of shrouds. Even if shrouded cremation was allowed by public health regulations in NSW, likely practical barriers exist to implementation. Research participants indicated that a lack of private ownership of crematoria in Victoria helped facilitated a wider variety of practices. All crematoria in Victoria are operated by not-for-profit providers regulated by the government, meaning that control over practices is more tightly held by the state.[9] This difference in ownership compared to NSW—where 75% of cremations are conducted by private operators (NSW Department of Primary Industries, 2015)—may mean that a regulatory change may not be sufficient to prompt a chance in practice, as private operators consulted for this project indicated that they are highly resistant to the idea of shrouded cremations. Again, this resistance is likely strongly linked to the industry's interest in ensuring the status quo around the use of conventional coffins is maintained. Research participants indicated that resistance from private crematorium operators may make the practice of shrouded cremations difficult to implement in NSW even if regulatory change was to be implemented, as they may choose not to accept shrouded bodies.

Figure 4: A shroud woven as part of the Leaves project (source: shainagarfield.com)

Figure 5: Capsula Mundi's burial capsule (source: capsulamundi.it).

Coffins and caskets represent a significant proportion of the cost of a funeral. Shrouds and eco-coffins tend to be significantly cheaper than less sustainable alternatives, meaning that there is a commercial disincentive to sell sustainable options. A key action to encourage changed practices in this regard will be to promote consumer awareness of their ability to take up alternatives, such as eco-coffins and shrouds. At present, consumer awareness of vessel options is generally framed by mainstream sector operators, who push conventional coffins and do not make consumers aware of more sustainable options as standard practice. Raising consumer awareness to help empower

[9] We were unable to ascertain numbers of shrouded cremations performed in Victoria.

consumers and expand their understanding of the choices available to them will be a critical step. Changes in public health regulation and policy to allow shrouded cremation would be required to enable this option to be taken up in NSW.

5.2 Rental coffins and cremation capsules

Reusing coffins was a common practice in the 17th and 18th centuries amongst the working classes. Coffins would be lowered into graves, then the bodies would be released onto the grave floor and the coffin removed for reuse (The Australian Museum, 2019). Nowadays, in the US, rental coffins with removable inserts are available for cremations. These allow consumers to rent a suitable coffin for a funeral service, but include a removable cardboard insert which contains the body that is cremated (Ever Plans, 2019). These allow a less resource-intensive burial, by seeing the body buried in a simple timber or cardboard vessel, rather than a treated-timber vessel.

Reportedly, these options are also available in Australia; however, it remains unclear whether consumers are offered these options when arranging a funeral and cremation. Our interviewees indicated that they did not believe such options were commonly offered. Further social research would be required to determine whether there is any market for such arrangements in contemporary NSW.

Cremation capsules are available from some funeral directors in Australia (Gathered Here, 2017a). These are simple cardboard or particleboard coffins designed for direct cremation—that is, cremation without any commemoration of the deceased person (discussed in more detail in a later section). However, anecdotal evidence suggests that many funeral directors do not offer cremation capsules to consumers, offering more expensive—and resource intensive—coffin and casket options instead. The funeral industry in NSW appears concerned that the use of such capsules will foster perceptions often held by consumers that coffins are reused by funeral directors to save money, as operators are concerned that the availability of such products would confirm perceptions that reuse of coffins without family permission is a common practice in cremation. Hence, seeing reusable coffin inserts used more widely would require some significant shifts within the industry and communication efforts with consumers.

There appears to be resistance on several fronts from the industry: in addition to funeral directors appearing concerned about any public perception that they might reuse coffins without client permission, they also worried about reduced profits if rental coffins were to become more popular, as the sale of coffins/caskets is a major source of revenue for funeral directors. Increasing consumer awareness and demand may be a key strategy for combating this resistance: many funeral directors claim that they do not offer reusable coffins because there is no demand for such products.

6 Findings: Burial and variations

In conventional burials, the body is contained within a casket usually made of an upholstered treated timber or metal. The caskets are usually placed in a burial vault enclosure that is designed to support the weight of earth and prevent cemetery maintenance equipment from collapsing the casket buried beneath the ground. Modern burial vaults are made using metal, concrete, or plastic—which not only are resource intensive, but have the potential to leach chemicals such as varnish, wood preservatives and heavy metals into the environment over time (da Cruz et al., 2017).

Burial is likely to remain an integral part of body disposal practices in NSW, due to its centrality in many traditions and religious practices. However, as mentioned previously, burial rates have been declining in recent decades, at least in part due to the significant costs associated with burial interment rights. A burial with perpetual interment rights in NSW can cost upward of $8,000, and often costs over $20,000 in the Sydney metropolitan area, placing a significant financial burden on the bereaved. Interviewees indicated that burial rates are not expected to decline further in future but rather remain at current levels, due to the proportion of society who hold a strong cultural or religious preference for burial.

The sensitive nature of cemeteries makes existing burial grounds ‘essentially permanent’ (Basmajian & Coutts, 2010), especially given the convention in many countries, including Australia, regarding interment rights as perpetual. Burial in perpetuity is largely a legacy of the 19th century; however, it has led to many challenges in jurisdictions globally, including in the UK, where it has contributed to the closure of many cemeteries, which are no longer able to accommodate new interment and therefore have no income stream (Woodthorpe, 2011). These cemeteries become vulnerable to vandalism, and often deteriorate to an unkempt or unruly condition due to the lack of funds to cover upkeep.

Burial has been associated with leachate into soil and groundwater both from bodies and coffins. Cemeteries are known to have a potential impact upon the occurrence of viruses and bacteria in soil, as well as ammonia, phosphates, magnesium, potassium, sodium, chloride, bicarbonates, nitrates, calcium, iron, aluminium, lead and zinc (da Cruz et al., 2017). From coffins, varnishes and timber preservatives can leach into surrounding soil and water, as can a range of metals from coffin fastenings and handles (including lead, zinc, copper, chromium, nickel and iron) (Feagan, 2007).

As the body decomposes, various organic and inorganic substances and gases are potentially released into the environment leading to contamination of soil, groundwater and sewer systems (Michel & Lee, 2017). Gases released include hydrogen sulphide, ammonia, carbon dioxide and methane (Neckel, Costa, Mario, Sabadin, & Bodah, 2017). High groundwater concentrations of formaldehyde, ammonia, orthophosphate, magnesium, potassium, sodium, chloride, bicarbonates, nitrates, calcium, viruses, bacteria and metals such as iron, lead, aluminium and zinc have been detected near cemeteries (da Cruz et al., 2017; Keijzer, 2017). Other impacts from conventional burials include land occupation, metal depletion and surface water contamination from the intensive maintenance of lawn cemeteries using fertilizers and pesticides (Clayden, Green, Hockey, & Powell, 2018a). Many of these emissions will linger for decades and centuries after interment: a US study found elevated levels of arsenic, copper, lead and zinc persisted downstream from 19th century graveyards, where bodies had been interred a century beforehand (Fiedler et al., 2012). The extent to which the presence of such leachate poses real environmental health threats remains

unclear, however Australian-based research does suggest that transport of these toxins into neighbouring ecosystems depends heavily upon a range of contextual factors (Dent, 2002). Our knowledge of the transport of bacteria and viruses is lacking, meaning we do not presently have a good grasp of the potential for these microbes to travel and enter groundwater and other resources. One challenge is that the same kinds of soils which facilitate transportation of pollutants and microbes (sandy soils with good drainage) are also those which facilitate more rapid decomposition. Higher densities of burials on a particular site could contribute to higher concentrations of pollutants, however this depends on a range of factors including local soil conditions and factors relating to the age and condition of the buried remains. In principle, however, multiple burials remain a sound use of resources and also present opportunities to contain potential pollutants (rather than facilitating sprawl of cemetery sites, potentially effecting broader areas).

Burial as practiced in Australia is also associated with higher greenhouse gas emissions than cremation (Adelaide Cemeteries Authority, 2011), with each standard burial found to be responsible for the emission of 780kg of CO2 equivalent. Natural burial was found to have significantly lower contributions to greenhouse gases, emitting around 380kg of CO2 equivalent per natural burial (Adelaide Cemeteries Authority, 2011). This aligns with findings of overseas studies, which identify that burial has the highest environmental impact across all impact categories (Keijzer & Kok, 2011)

Throughout this section, we discuss a range of methods, products and practices relevant to burial. We discuss the sustainability implications of a range of practices, including conventional burial and emerging alternatives, such as conservation burial. We address a range of issues relevant to the sustainability of burials, including interment tenure, grave occupancy rates and design issues relating to cemeteries. The purpose is to provide an overview of the range of practices and alternatives relevant to burial, and to understand the possibilities for making these practices more sustainable.

6.1 Urban planning and cemeteries

Before addressing the practices, products and methods associated with burial, we will address briefly the major concern constraining the future and affordability of burial in the Sydney metropolitan region: planning for cemeteries.

Cemeteries play an important role in our cities. Clayden and Green (2018b) describe them as 'spatial vessels of civic identity' which tell stories of our cities and express regional identities. Bennett and Davies (2015) also describe the role that cemeteries can play in providing an anchor for cultural communities, often helping to ‘root an immigrant community to the new homeland’, an important aspect of a multi-cultural society.

Planning for new cemeteries is fraught with challenges. Cemeteries are not necessarily perceived to make good neighbours (Basmajian & Coutts, 2010). Reasons for opposition to the establishment of new cemeteries appear to include, according to our interviewees, perceptions around aesthetics, safety, as well as superstitions and cultural beliefs or values. Our interviewees indicated that there often exists substantial community opposition to the siting of cemeteries, as many people hold beliefs and values that lead them to feel uncomfortable about living adjacent to a space that houses the dead.

Cemeteries are complex spaces: they are spaces in which social, cultural, geographical, historical, political and economic concerns collide (Woodthorpe, 2011). They are in some ways multi-

functional landscapes, often facilitating a range of land uses. Cemeteries also operate as 'private memory sites' (Swensen, 2018), which often conflicts with other public uses.

Allocating sufficient space for cemeteries is becoming a particular challenge now that the majority of the world's population is urbanised: as more of our population lives in cities, we are witnessing increasing competition between various land uses. Cemeteries, in the highest and best use equation so often deployed by land-use planners, are considered a relatively low-value use. Conventional burial practices and cemetery designs are quite land-intensive. As a result, existing cemeteries are running out of space, with many metropolitan Sydney cemeteries already at capacity and others nearing capacity in coming decades. Allocating land for new cemeteries close to population centres is expensive, and is rarely a high priority.

Ironically, the low value placed on cemeteries in planning processes now means that burial sites are one of the most expensive forms of land in NSW, with a $2m^2$ grave in a metropolitan Sydney cemetery costing as much as $40,000 (IPART, 2019a; Ross, 2018).

In NSW, cemeteries have not been treated as priority land uses in planning processes. With the cost of land drastically inflated in Sydney, driven largely by the housing market, the economic case for cemeteries is difficult to make. As a result, space in existing urban lawn cemeteries is being depleted, with few solutions on the horizon. The Greater Sydney Commission has identified that allocating space for new cemeteries should be a priority for local governments as they review their local environmental plans. Interviewees who were involved in recent attempts to develop new cemeteries within the Sydney Basin reported significant challenges associated with gaining approval for cemeteries to local opposition. Much of this opposition appeared to be due to perceptions regarding the aesthetics of cemeteries, which may be based on the appearance of Victorian-era cemeteries. Education and engagement may be needed to engage residents near proposed cemetery developments regarding improvements in cemetery design and possibilities for multi-functional cemeteries which are complementary with their local environment. Cemeteries are not deemed to be essential infrastructure, as are as schools, parks and hospitals, and thus have not been considered a priority by many local governments.

A major issue for cemetery planning from the perspective of at least metropolitan Sydney cemetery operators is that planning is not currently undertaken in a strategic or coordinated manner. The interim report for the IPART review (IPART, 2019b) recommends that CCNSW be made responsible for acquiring land for new cemeteries in NSW, in order to address this lack of state-level strategic coordination of acquisition of land. As recommended by IPART, planning for critical infrastructure should be coordinated and managed in a strategic and coherent way (IPART, 2019b). The current approach appears to lead to inefficiencies and is reportedly failing to actually secure useful land for the expansion of cemetery trusts. This function could be better and more cost-effectively performed if centrally coordinated and planned through CCNSW as recommended by IPART in its interim report (IPART, 2019b). CCNSW would require additional resourcing to implement what would likely be a significant expansion of its current responsibilities.

6.2 Interment tenure

It is not the purpose of this report to provide extensive commentary on recent changes to interment tenure in NSW, as this is the subject of statutory review separate to this project. However, interment tenure is an integral component of the interment landscape in NSW, and discussions regarding tenure inevitably arose throughout our research and have implications for the sustainability of

practices in this sector, especially due to the close relationship between interment tenure and land-use efficiency. Thus, we provide some commentary here regarding our findings and their relevance for sustainable practice.

Burial in perpetuity is a relatively recent phenomenon in the history of interment, emerging as a legacy of 19th century Victorian cemeteries (Woodthorpe, 2011). Burial in perpetuity is associated with several challenges: primarily, land-use inefficiencies, due to each plot being locked-up forever once a burial right has been purchased. Further, the mismatch between revenue and cost streams creates, according to IPART (2019b), a risk that cemetery operators set prices too low to recover costs in perpetuity.

In other jurisdictions—both elsewhere in Australia and internationally—it is common to have renewable or shorter-term tenure, sometimes as short as 10 years (Canberra Cemeteries, 2017). This appears to be seen as compatible with some of the major global religions, including Orthodox Christianity, for example as practiced in Greece, regions of which have renewable tenure in place, and Catholicism, for example as practiced in Italy, where renewable burial tenure is often used in conjunction with transfers to ossuaries to facilitate efficient use of space (Canberra Cemeteries, 2017). In terms of visitation and its role in the grieving process, renewable tenure still has potential to facilitate the kind of visitation deemed most important for assisting in grief. Bachelor (2001) notes that cemetery visitation offers the most value for mourners in the immediate period after a death, with frequent visitation allowing mourners to work through and mitigate intense emotions and loneliness. Visitation tends to subsequently abate with the acceptance of loss, with visits becoming significantly less frequent over time, with fewer than 1% of all cemetery visits occurring more than 20 years after a death (Bachelor, 2001).

In Australia, South Australia (SA) and Western Australia (WA) have had renewable tenure for some time. In WA, the standard interment tenure is 25 years, renewable for additional terms up of to 25 years upon application to a cemetery board (Cemeteries Act 1986). In SA, where re-use of graves has been a common practice since early in European settlement, both renewable and perpetual interment tenure are available, with perpetual interment introduced in 2013.

Renewable interment rights were made available for all cemeteries in NSW in 2018. The optional renewable interment right is for a minimum period of 25 years, up to a maximum of 99 years (Cemeteries and Crematoria NSW, 2017a). Renewable rights do not operate retrospectively, so the availability of renewable tenure does not mean that perpetually-interred remains can be exhumed for re-use of burial sites (Cemeteries and Crematoria NSW, 2017a). Further, perpetual interment rights still remain available in NSW, allowing consumers choice of interment tenure. The regulatory change received negative press when introduced, and take-up of this option is currently low. For families, the prospect of renewable tenure raises concerns regarding the exhumation of remains of family members and signals a possible loss of control over a grave site, which is concerning for many members of the public, who would prefer to retain control of a site in perpetuity.

Uptake of renewable tenure has previously been possible in non-Crown land cemeteries operated by local government and privately-owned cemeteries through the absence of any restrictive statute. Among the small number of cemeteries who offered this, uptake has historically been low: in 2017-18, only 53 interments out of over 18,000 were undertaken under renewable tenure (IPART, 2019a), with only two cemeteries (Waverley and Kemps Creek Natural Burial site) offering renewable burial tenure. It is understood that no Crown cemeteries have introduced renewable tenure to date (IPART, 2019a).

In addition to a lack of current social acceptance for the practice, there are significant practical and infrastructure issues associated with renewable tenure. Our research identified considerable reluctance by cemetery operators to offer renewable tenure to consumers. Renewable tenure is associated with additional costs for interment operators in two categories compared to perpetual tenure: the administrative cost of contacting tenure rights holders regarding the renewal or relinquishment of the right, and the cost of removing remains for grave reuse (IPART, 2019a, p. 5). Of course, the ability to secure subsequent income through renewal or re-sale of the interment right should balance these additional costs, though it is unclear whether current pricing structures adequately facilitate this—and IPART recommends a pricing tool to ensure that ongoing costs and revenue of both renewable and perpetual tenure help facilitate financial sustainability of operators (IPART, 2019b). Cemetery operators indicated that they expect the administrative costs of managing the renewable tenure—contacting family of the deceased after the cessation of tenure period, securing permission for exhumation etc—to be significant. However, precedent exists for carrying out such processes in a cost-efficient way: in South Australia, for example, reuse of graves in the Centennial Park cemetery was facilitated through a consultation process which advertised the extinguishment of around 10,000 burial rights at one time through a range of communications channels, including mass media. Descendants of those buried were encouraged to call a hotline to discuss renewal or otherwise of rights. A research participant familiar with the project indicated that 1 in 3 families contacted the hotline regarding burial rights that were up for renewal, and around 1 in 5 chose to renew those rights, freeing up around 8,000 plots for renewal.

Further, the costs of carrying out the removal of remains, if required as part of renewal processes, is perceived by cemetery operators to be prohibitive. Cemetery operators engaged throughout this research, including local government operators outside metropolitan areas, indicated that they feel few staff in their cemeteries have adequate training at present to enable them to safely carry out exhumations. Cemetery operators also indicated that machinery required to access graves in areas populated with monuments is challenging: smaller machinery will likely be required, and our research participants indicated that this may limit the capacity to excavate to the required depth—especially where deepened interment to accommodate multiple remains is required, though we note that specialised equipment for such purposes is currently readily available. There is also an apparent paucity of evidence about likely decomposition states at the end of the renewable tenure period (25 years) in NSW soils—though as mentioned below, research is being done to improve our understanding of this. NSW cemeteries also generally lack ossuaries in which exhumed remains could be interred, meaning that 'dig-and-deepen'—that is, exhuming remains, deepening the grave depth and re-interring remains at greater depth, to make space for additional burials—is the most suitable method for facilitating renewable interment. Building ossuaries or undertaking 'dig-and-deepen' for each renewable interment site is likely to be associated with significant cost, which may outweigh the current costs of perpetual tenure. Again, precedent does exist for managing these processes in ways that are viable for cemetery operators: in South Australia, processes which facilitate the renewal of areas of 200-300 graves at a time allow for revitalisation and reuse of degraded areas of cemeteries, and due to the scale are cost-efficient for operators.

A research project into accelerated decomposition, being undertaken in partnership with Rookwood Cemetery,[10] may provide some promise for managing renewable tenure in the future. This project involves exploring whether the composition of soils used to backfill could be managed to be more conducive to decomposition, determining whether the design of interment spaces could be altered

[10] https://www.smh.com.au/national/rookwood-cemetery-to-conduct-pig-experiment-on-same-sacred-site-as-jewish-and-muslim-graves-20170413-gvkmmn.html

to facilitate improved decomposition rates, and exposing cadavers to soil for controlled periods to establish baseline decomposition rates and assess the impact of various factors upon decomposition rates. Preliminary results from this project are promising indicating faster decomposition rates under some treatments according to preliminary information provided by Rookwood General Cemetery. Other research projects are also taking place to identify methods for facilitating hastened decomposition, to better suit renewable tenure arrangements. With faster and better-understood decomposition rates, exhumation and reinterment—whether into a deepened grave or an ossuary box—may be more viable. At present, however, with poorly understood (and likely slow) rates of decomposition in Sydney soils, renewable tenure and the exhumation of any remains at the end of the interment tenure period poses a challenge for operators.

There is reportedly currently marginal financial incentive to adopt renewable tenure. For cemetery operators, financial incentives to offer renewable interment are currently negative or negligible, meaning few are actively offering it to consumers. Despite operators' concerns mentioned above regarding costs of implementation, renewable options could contribute somewhat to financial sustainability where fees are paid by family members to continue tenure beyond the initial 25-year period (Canberra Cemeteries, 2017); however, it remains unclear how significantly this might influence the economics of cemetery operations in NSW. Our interviews suggested that financial incentives for renewable tenure may help stimulate consumer interest, as affordability is one driver in decision making around burial. At present, financial incentives appear to be insufficient to prompt consumer interest in this option—though IPART's voluntary pricing tool (IPART, 2019b) may prove helpful for operators in establishing a business case and determining pricing structures for renewable tenure.

Research participants indicated some resistance to renewable tenure arises due to the loss of control of the burial site after the initial tenure period expires. This could be alleviated through changes to the legislation which would permit families to retain control of burial sites under renewable tenure—that is, for multiple burials to occur over time using the 'dig and deepen' method, but for these to all be for members of the same family, with tenure remaining with the family who pays fees to reflect the continuance of tenure. Our interviews suggested that renewable tenure was common in Islamic cultures, including in Saudi Arabia and Lebanon, where common burial practice reusing the grave for burial of another family member after the previously-buried body had decomposed. In this way, despite significant constraints on space, the burial grounds of Lebanon and Saudi Arabia have reportedly managed to keep pace with demand, through reuse of burial sites. However, soil composition and other factors hasten decomposition in these regions and make renewable tenure more viable. Precedent also exists in the Australian context: for example, in South Australia, a research participant indicated that families often make use of renewable tenure to inter multiple members of the same family in a plot, including interring cremated remains above buried remains. There may be potential for this practice to be enabled through changes in practices related to the introduction of renewable tenure in NSW. This may remove concerns that relate to the loss of control over a burial site—although the burial plot is reused, it is not relinquished from the family, so the family is able to retain control over the plot. Research participants from varied parts of the sector believed that consumers may have greater levels of acceptance for reuse of a plot through the dig and deepen method if they know that the bodies buried on that site are all members of the same family. Enabling this in NSW would require slightly altered legislative arrangements from what is currently in place, as the tenure would be retained by a family in perpetuity but be reused for the burial of individuals over time. Again, the scheduled review of the

Cemeteries and Crematoria Act 2013 provides an important opportunity to amend such changes and facilitate improved outcomes.

In addition to renewable interment rights, the extinction of tenure for existing older graves (100 years or older) may present a possible option for freeing space in certain circumstances. At present the Cemeteries and Crematoria Act 2013 prohibits disturbing remains in perpetuity (except in those cases where renewable tenure rights have been exercised). However, given current land shortages for cemeteries, many research participants raised questions regarding whether retaining very old (100 years or older) remains in perpetuity is a viable strategy. At present, for cemeteries to extinguish tenure for older graves, the grave needs to be unmarked, there must be no identified descendants with an interest in the grave, a heritage assessment must have been conducted and the site must be deemed to have no significant heritage value (Department of Lands, 2008). Of course, any move to extinguish older interment rights would need to carefully manage public concern and perception regarding the treatment of older grave sites, and would require significant public consultation to ensure public buy-in for such processes.

Some potential for freeing up space in cemeteries exists in the extinguishment of tenure over unused burial plots. The Cemeteries and Crematoria Act 2013 allows for cemetery operators to revoke perpetual interment rights if that right is not exercised within 50 years (that is, if the grave plot is not used within 50 years of purchase). This may represent a significant proportion of grave sites: for example, a major metropolitan cemetery operator reported in an interview that around 3-6% of the plots are sites for which burial licences were purchased decades previously, but which have never been exercised. We were not able to ascertain the exact number of plots that might be made available through such reclamations. Reclaiming these unused sites could present opportunities to release more land within existing cemeteries to use space more efficiently, however any such moves must be carefully balanced with consumer protections ensuring that rights holders are given adequate notice and opportunity to retain and exercise the rights they hold over a plot—especially given evidence that some burial rights are invoked after more than 50 years have passed since purchase. Further challenges arise relating to heritage restrictions in older parts of cemeteries. Many unused sites are located adjacent to sites protected under the Heritage Act (1977), and disturbing nearby sites could disrupt these heritage values.

As current projections of burial plot availability by CCNSW are intended to demonstrate implications of status quo practice, they do not take into account the impact of renewable interment rights on future supply (Cemeteries and Crematoria NSW, 2017b), so it is not currently possible to estimate the extent to which uptake of renewable rights might extend the supply of burial plots. Considering the current apparent lack of social acceptance of this practice (as reported by our interviewees, and as amplified by media outlets[11]) and the degree of resistance which was apparent amongst many cemetery operators and others in the industry throughout our research, renewable interment rights may offer improved opportunities to alleviate land-use constraints through adaptation of the regulation to enable re-use by family members. Public education and communication campaigns designed to improve understanding of and familiarity with renewable tenure by members of the NSW public could help in facilitating wider uptake and reduce community opposition to renewable tenure in years to come.

[11] https://www.news.com.au/lifestyle/real-life/news-life/new-nsw-legislation-allowing-rentable-graves-to-be-scrutinised-in-public-inquiry/news-story/5da5a17c96fe5d7eefb8e21162d05d43

6.3 Single or multiple grave occupancy

Single grave occupancy is another practice associated with land-use inefficiencies, but is the most common mode of burial interment in NSW. The current rate of secondary or subsequent burials in the metropolitan area is 27.7%, resulting in an occupancy rate of 1.38 bodies per grave (Cemeteries and Crematoria NSW, 2017b). While prohibited by some religious and cultural groups, multiple grave occupancy could provide land-use efficiencies for groups that require burial. Multiple occupancy graves allow family members to be buried close together, which many families find comforting and which can facilitate memorialisation and visitation of multiple family members together. Also called 'grave intensification' (Coutts, Basmajian, & Chapin, 2011), multiple occupancy would usually involve vertical stacking of family members in a grave site, the first burial occurring at a deeper-than-usual depth, to accommodate subsequent burials above the initial interment.

Multiple grave occupancy is nowadays increasingly enabled when preparing an interment space for use. The proportion of customers opting for multiple occupancy is reportedly growing in NSW, though it is still relatively rare. Our interviewees indicated that many religious and cultural groups are becoming increasingly comfortable with multiple grave occupancy, especially where consultation has been carefully managed and where space constraints are present. For example, in NSW, the Jewish and Islamic communities have historically resisted multiple occupancy graves; however, in consultation with community leaders, some Jewish and Muslim people have begun to use dual occupancy graves. This method of interment could alleviate space issues without encountering many of the challenges associated with renewable interment rights, and present opportunities for some cost savings. A key challenge with managing this practice is protecting groundwater from contamination. Interviewees suggested few cemeteries are aware of the depth to the water table under their site, meaning that they may be unaware of impingement upon the water table due to grave depth. Multiple occupancy graves require deeper graves, potentially contaminating the water table. Deeper graves are also associated with increased fuel use and increased waste produced through excavations (Adelaide Cemeteries Authority, 2011), however research available in the Australian context to date does not account for efficiencies achieved through multiple grave occupancy, so it is unclear how digging deeper graves to accommodate multiple interments may contribute to environmental impacts.

6.4 Mausolea, ossuaries and vertical cemeteries

Mausolea, ossuaries and vertical cemeteries are common elsewhere in the world, providing a range of land-efficient options for interring buried or cremated remains.

Mausolea are above-ground buildings or structures that provide interment spaces for a number of people (either cremated or whole-body remains). Mausolea are commonly used in places where memorialisation is important, but land-use constraints are present, such as in Hong Kong, Europe and Japan. In a report by the NSW Department of Lands (2008), mausolea are identified as a strategy: i) to share costs, making interment more affordable, ii) to address the issue of renewable tenure without the challenges of the dig-and-deepen method for graves, iii) to respond to land-use constraints and iv) to reduce the possibility of ground-water pollution.

However, the use of above-ground mausolea for burial in NSW requires embalming and a sealed coffin (Department of Lands, 2008; Potter, 2019), so although this method has potential to improve

land-use efficiency, it presents challenges associated with the input of resources including toxic chemicals (embalming fluids). Further, embalming slows decomposition time, complicating the possibility of renewable tenure for mausolea (Department of Lands, 2008). However, Victoria, for example, does not require embalming for above-ground interment, indicating that precedent exists for alternative regulatory approaches within Australia.

Mausolea have been used to provide high-density burial space in areas where cremation remains unpopular but where cemetery space is limited (Basmajian & Coutts, 2010). In Brooklyn, New York, GreenWood cemetery added 5,200 burial spaces in mausolea and 8,000 niches for cremated remains, effectively extending the cemetery's life for a quarter century (Basmajian & Coutts, 2010). Our research participants indicated that there are problems securing uptake of mausolea in NSW. While some communities (especially the Italian-Australia community, according to our research participants) are comfortable using mausolea, uptake is relatively low. In particular, multi-storey mausolea (of more than 3 levels) are not popular because mourners cannot easily access or touch the vault in which remains are interred. Cemetery managers reported that people are less willing to purchase rights for the top and bottom tiers of five-level mausolea (the bottom because of proximity to feet, the top due to the vaults being out of reach and above the sightline). This means that 2-3 levels are the maximum that is considered feasible or financially viable by some operators, though in practice higher mausolea are possible. A Sydney cemetery recently developed proposals for a multi-level mausolea that features ramped structures to better facilitate visitation. Such design-driven solutions may well present pathways forward for expanded use of such structures—however, as discussed below mausolea may provide limited gains in terms of environmental impact and land-use efficiency.

This limitation reduces the potential land-use efficiency gains that might be associated with such structures. A further problem is that mausolea and other structures are extremely expensive, due to the upfront costs associated with constructing the infrastructure. Mausolea are significantly more expensive than other burial plots at present. Longevity is also a problem for mausolea: most of these buildings have a life of around 50 years, despite rights being purchased in perpetuity. This means that at around 50 years, cemeteries will need to exhume remains in order to maintain and rehabilitate the mausoleum, then re-inter remains. This relates to the broader concern regarding maintenance costs discussed elsewhere. Significant costs are associated with this process, but are not covered by the initial purchase price for the right, meaning cemeteries have no financially sustainable way to maintain mausolea. Research participants indicated that a more sustainable option might be to provide a 50-year interment tenure for mausolea, with remains to be transferred to an ossuary box at the end of this tenure. However, this does not address the high cost of construction which contributes to high costs for consumers. Mausolea, then, are likely to present only a limited and unaffordable option for addressing interment.

Mausolea are also generally constructed from concrete, stone or marble. Their construction and maintenance consumes natural resources, and paves over soils and permeable surfaces which can contribute environmental benefits. Therefore, while mausolea might seem at one level to be a more land-efficient response to burial, they offer few broader environmental benefits and may even be more impactful than conventional burial.

In European countries including Italy and Greece, it is common for interred remains to be exhumed after as little as 7-10 years and moved to an ossuary. These methods provide for burial as required by Catholic and Orthodox teachings and facilitate visitation in the years immediately following death. The removal of remains and relocation to an ossuary provides a space-efficient solution,

allowing the interment right to be reallocated. Ossuaries may be community spaces or family mausolea. Practical challenges to this method exist in NSW, similar to those discussed in relation to renewable interment: most cemeteries and cemetery staff do not currently possess the skills, training and infrastructure required to relocate remains from graves to ossuaries, and many cemeteries do not have ossuaries or mausolea, and so would need to build new infrastructure.

Figure 6: Brazil's Necropole Ecumenica, a high-rise mausoleum (source: Ryan Noth).

Our interviewees indicated that, in NSW, the Greek community is comfortable and familiar with the notion of ossuaries, as they are commonly part of interment practices in Greece. This may provide an option for facilitating renewable tenure. Although the Greek community tends to oppose the notion of 'dig and deepen' for renewable tenure, exhumation and placement of remains in an ossuary is acceptable. However, this is not currently common practice, due to the lack of incentives to take up renewable tenure. Some NSW ethnic groups, for example the Tongan community, use ossuaries as part of their traditional interment practices in their home countries but are unable to do so easily here (Wang, Han, & Forbes-Mewett, 2019). The Tongan community traditionally relocate remains to an ossuary to make a grave available for reuse by the family, but this practice is not easily facilitated with current regulatory arrangements in NSW (Wang et al., 2019), which have historically made exhumation an uncommon practice.

Due to the lack of mausolea and ossuaries in NSW, it is unlikely that their use in interment will necessarily reduce costs, because of the need to construct new infrastructure (Coutts et al., 2011). However, the ability to reuse burial sites within a family could help families avoid costs of purchasing new interment plots.

Vertical (including underground) cemeteries are a recent innovation in land-constrained contexts, providing for the interment of many hundreds or thousands of bodies without requiring space above-ground. In Jerusalem, for example, a multi-storied burial space is currently being built under the city, with 22,000 grave sites (Hasson, 2018). The underground cemetery includes a design that allows for gas treatments and which avoids necroleachate to minimise contamination of soil and water (Hasson, 2018). Graves in the cemetery are identified using an app which helps visitors to locate burial sites. In contrast to Jerusalem's underground vertical cemetery, Brazil is home to a skyscraper cemetery: a vertical cemetery 32 stories high.[12] The *Necropole Ecumenica* has vaults

[12] https://www.bbc.com/future/article/20171127-the-buildings-designed-to-house-the-dead

for storing urns of cremated remains and coffins, as well as family mausolea. Its 14,000 vaults were all occupied by 2017, prompting an expansion.

Figure 7: Jerusalem's vertical cemetery plans (source: Rolzur).

6.5 Lawn cemeteries

The lawn cemetery familiar to Australians is a relatively recent aspect of urban areas, emerging around the beginning of the 20th Century (Clayden et al., 2018a). Lawn cemeteries match cultural expectations of how a memorial park should appear, and support cultural and social expectations around how memorialisation and visitation might be performed.

Lawn cemeteries are associated with many environmental impacts—in addition to the inefficient use of space, mentioned above, the maintenance of turf and landscaping involves fuel for mowing, fertilisers, water to keep lawns green, pesticides and herbicides (Clayden et al., 2018a). A study commissioned by Adelaide Cemeteries Authority identified that mowing and burial site maintenance and watering demands contributes significantly to conventional burial's carbon footprint being higher than for cremation or natural burial (Adelaide Cemeteries Authority, 2011). Further, although these spaces are less-developed than other urban land-uses, cemeteries do a relatively poor job of supporting biodiversity, can contribute to flooding (through reduced vegetation cover), contribute to the urban heat island effect (through lack of canopy cover and vegetation) and provide fewer ecosystem services than would a more biodiverse forested area (Clayden et al., 2018a).

Alternative practices could be implemented to improve the impacts of lawn cemeteries. Practices to make cemeteries more environmentally sustainable include limited use of pesticides, fertilisers,

use of recycled water, herbicides, as well as electric and gas-powered lawn maintenance equipment.

A key challenge with lawn cemeteries is that, even areas that are infrequently visited still require intensive maintenance, especially to avoid them becoming dangerous (due to graves and memorials becoming unstable) or being vandalised. There exists a complicated relationship between cemetery trusts/owners and the items requiring maintenance: headstones and graves are the property of the family of the deceased. However, the family is rarely actively involved in upkeep and maintenance of sites and headstones, particularly many years after the death, when maintenance needs of crumbling headstones become more costly, and fewer still are prepared to contribute to the costs of maintenance required. Cemeteries are often unable to address maintenance issues because of these challenges, and further must find ways to meet costs for maintenance for properties that long ceased to provide income.

Responses to this challenge that might open up land for reuse include a cemetery renewal model that allows for reuse of cemetery spaces that does not require the dig-and-deepen method (e.g. transforming existing walkways/lawn areas/roadways in old and unused parts of cemeteries into burial plots) or extinguishing tenure and reusing graves over an identified age (e.g. 100 years) (Department of Lands, 2008). However, these decisions sit beyond the decision-making power of the consumer.

6.6 Multi-functional burial grounds

Some cemeteries and designers are beginning to recognise the possibilities for multi-functional uses within cemeteries. Multi-functionality is an important aspect of planning in other spaces and land uses. For example, residential streets are recognised as performing a range of functions from transport to community building to providing open space and opportunities for commercial development. Public open space is recognised as providing recreational opportunities in addition to providing green space, supporting biodiversity, social gatherings and cultural events etc. Cemeteries have, in recent decades, been considered to be single-purpose spaces. However, interest in multi-functionality of these spaces is growing.

The newly approved Macarthur Memorial Park, for example, is intended to be a multi-functional space. In addition to providing space for burials and services, it was planned to ensure consistency with the local Scenic Hills landscape and to be complementary with the Cumberland plain woodland found on the site. It will also provide recreational space for walking and cycling, a sculpture garden, spaces for reflection, meeting places and a café etc. Burial areas are designed to be visually unobtrusive (with small plaques laid on the lawn replacing large headstones), meaning that the visual effect is more that of rolling grassed hills than rows of concrete/stone headstones. Further, the Park is designed in such a way as to ensure that, from the exterior and from the main access roads, burial areas are largely out of sight, with wooded and vegetated areas comprising the majority of the site's views, minimising visual interruption of the Scenic Hills landscape.

In other jurisdictions, for example in Berlin, former cemetery sites have been repurposed to accommodate a range of new uses. A portion of a largely abandoned cemetery in Neukölln, Berlin, has been repurposed for community uses including growing vegetables, providing recreational space, and wild natural areas that cannot be developed in the future.[13] Implementing such projects in NSW would be accompanied by significant challenges. Anecdotal evidence provided to us in interviews suggests that, in addition to substantial heritage concerns, socio-cultural opposition to the repurposing of historical graveyards in NSW may make such projects challenging. Careful design, engagement and communications would be required in order to secure community support for such projects. Research participants indicated that, at present, regulation in NSW would likely require that repurposing cemetery grounds would involve exhumation and relocation of remains and memorials, even if these are very old. The costs involved in such an exercise have been calculated by one cemetery manager to run into the billions, making such an exercise prohibitively costly. However, precedent exists in Sydney for the repurposing of old cemetery land without exhumation and relocation: Camperdown Memorial Park, in Sydney's inner west, was transformed into a park after it had become a neglected and dangerous site in the 1940s. Headstones and memorials were removed and placed in a walled area adjacent to the St Stephen's Church, which remains a cemetery today. The buried remains were not exhumed but remain in situ. The area outside the cemetery walls was re-landscaped to become a public park. It remains unclear whether a similar repurposing program could be undertaken today, however research participants indicated that they felt heritage concerns would make such a project prohibitively expensive, if not impossible from a practical perspective.

Figure 8: Vegetable garden in a former cemetery in Neukölln, Berlin (source: Elena Ferrari).

Identifying opportunities for multi-functionality could have dual roles: help make available space that might be considered wasted as cemetery space and help reduce opposition to new cemeteries. A key reason for local opposition to cemeteries appears to be the perception of cemeteries as a sea of headstones, associated with traditional Victorian-era and Catholic cemeteries. Imagining cemeteries as parklands which include some burial spaces might help communities accept a new cemetery in their area, improving access to burial space. Macarthur Memorial Park was described to us as a 'parkland that happens to include a cemetery': a vastly different approach to planning burial space than many people associate with the urban cemeteries present throughout the Sydney landscape as a legacy of Victorian-era cemetery planning. Further, approaching cemeteries as multi-functional spaces will likely help ensure these spaces support biodiversity and provide green space for local communities, thus boosting the ways in which they contribute to the local

[13] https://www.domusweb.it/en/architecture/gallery/2019/09/11/in-berlin-a-cemetery-becomes-a-park-and-community-garden.html

environment. Multi-functional burial grounds could therefore provide a satisfactory alternative to lawn cemeteries.

Several research participants identified that virtual or augmented reality tools could assist with managing multi-functional burial grounds in future. Memorialisation and monuments could become virtual, rather than physical. This could allow visitors to identify and interact with a burial plot, to view monuments and memorials virtually, while leaving the physical space free for other recreational or conservation purposes. We discuss this further in digital memorialisation, later in this report.

6.7 Natural burial grounds

Natural burial grounds appear to offer perhaps the most promising alternative to traditional burial, in terms of social acceptability and environmental outcomes. Natural burial involves low-impact burial processes, though actual practices range widely. Generally, natural burial involves burial without a casket—or with a biodegradable casket—in a simple shroud, in biodegradable clothing, without embalming, with no burial vault, and often—though not always—in a more natural setting than the lawn cemetery (Michel & Lee, 2017). Natural burial has been growing in popularity globally, with around 8% of all UK now thought to be green or natural burials (Mayer, 2018).

Natural burials can either take place in hybrid burial grounds (conventional cemeteries with designated natural burial areas) or in specified natural burial grounds (Coutts, Basmajian, Sehee, Kelty, & Williams, 2018; Stewart, 2018) (we address conservation burial in the following section). Hybrid burial grounds, while allowing consumers to be buried in ways that may accord aesthetically with their values, may not necessarily achieve significant environmental improvements over conventional burial. Although some improvements may be secured through the use of an eco-coffin, the lack of chemical inputs and the planting of trees, ongoing problems associated with lawn cemeteries relating to maintenance and poor environmental practices (use of fertilisers etc) discussed elsewhere in this report are likely to persist. Thus, while hybrid burial grounds offer consumers greater choice, it remains unclear whether they deliver significant improvements upon conventional practice. However, natural burials may present opportunities to utilise spaces in lawn cemeteries that are unsuitable for conventional burials: for example, at Enfield cemetery in South Australia, a 30m-wide vegetated ring around the perimeter of the cemetery, which is retained to protect views and amenity for cemetery users and neighbours, has recently been used to facilitate natural burials. This strategy has allowed the vegetated area to be retained while also making available significant space for interment, and expanding consumer choice.

Natural burials in Australia are associated with significantly lower carbon footprints than conventional burials or cremations, emitting around 380kg of CO2 equivalent per burial (compared with conventional burial at around 780kg of CO_2 equivalent) (Adelaide Cemeteries Authority, 2011). The reduced use of chemicals and other inputs in natural burial is expected to reduce soil and groundwater contamination. Restricting the use of caskets and chemical inputs also reduces the resource footprint of the burial, minimising or completely eliminating the use of plastic, metals and timber (Clayden et al., 2018b). Further, the natural casket, lack of a burial vault, and lack of embalming mean that the body will break down more rapidly than in conventional burial, allowing nutrients to be reabsorbed into the soil more quickly. Natural burial also generally involves shallower grave depths, reducing the need for heavy earth-moving equipment and minimising the disturbance of the landscape (Gathered Here, 2017b). Shallower grave depths commonly practiced

in natural burial (attributable to the fact that heavy earth-moving machinery and concrete vaults are rarely used in natural burial) are also thought to be associated with reduced groundwater contamination, given a thicker buffer between the remains and the water table (Kowarik et al., 2016).

Additionally, conventional burial and cremation disrupt nutrient cycles. Under natural conditions decomposition releases a range of chemical elements contained within human or animal remains (e.g. nitrogen, phosphorus and potassium) to the surrounding soil environment (Carter, Yellowlees, & Tibbett, 2007). Depending on the depth of burial, these elements may be released through the action of soil micro-organisms and can be absorbed by plants (Pawlett, Rickson, Niziolomski, Churchill, & Kešner, 2019). Conventional burial and cremation may prevent the return of plant nutrients to the soil, constraining their release within the coffin in burial or, for some elements, emitting them to the atmosphere during cremation (Jenkins, Jenkins, & Carter, 2019).

Designers of cemeteries have worked with ecologists in recent years to develop ecologically sensitive designs for natural burial. These include working with structural root zones to ensure that burials do not impinge upon the viability of existing trees, allowing burials to co-exist with existing trees and facilitating the conservation of woodland and habitat. The newly approved Macarthur Memorial Park in south-western Sydney includes a natural burial ground which will utilise these ecological design principles. The use of these ecological design principles may help to mitigate the issues with hybrid cemeteries mentioned above. Due to expected low demand, the natural burial ground will be only a small component of the large site, however, with only 200-250 natural burials plots available of 80,000 planned plots.

Figure 9: Kemps Creek natural burial ground (source: Catholic Cemeteries).

Natural burial generally prohibits the use of memorialisation (as is the case in the Kemps Creek natural burial ground), though some grounds permit the use of a non-intrusive stone or shrub to mark a burial site. Kemps Creek (Sydney Natural Burial Park, 2019), facilitates memorialisation through an inscription at the entrance to the site, but prohibits memorialisation of the grave itself. Further, visitation of the grave site is prohibited at Kemps Creek after the initial interment has taken place, to facilitate rehabilitation of the natural vegetation (Sydney Natural Burial Park, 2019)—the terms and conditions provided by the Sydney Natural Burial Park specify that ‘pedestrian access to the natural burial area is strictly prohibited’ except for the placement of the coffin or container of remains. The lack of memorialisation and restrictions on visitation will likely present barriers for many consumers, for whom memorialisation is an important part of the grieving process (Stewart, 2018), being central

to western and other cultural conventions around burial. Memorialisation is also part of a search for permanency in a time of great upheaval, argues Clayden (2018b)—memorials provide a static point of focus for grief. Further, the physical site of the cemetery and the location of a physical memorial often serve to help minimise feelings of separation from the deceased (Bachelor, 2001). Thus, lack of memorialisation is likely to be a major barrier for many people's participation in natural burial, who would prefer more conventional methods of memorialisation.

However, in some places where non-intrusive memorialisation is allowed, new forms of memorialisation occur, involving sculptures made with natural materials, or headstones formed from fallen branches or rocks found at the site (Stewart, 2018).

Where visitation is allowed, natural burial grounds can provide a peaceful and natural setting for visitation: natural burials potentially increasing the bereaved individuals' well-being by exposing them to a natural or green place to grieve and reflect (Holden & McDonald-Madden, 2018), and can also provide a sheltered, private and intimate space for connection with the deceased (Clayden et al., 2018b). In Scandinavian countries, many cemeteries are designed with more natural elements—forestation etc—to provide a reflective and relaxing space for visitors (Nordh, Evensen, & Skår, 2017).

Natural burial tends to have a slightly lower mean plot density than conventional burial: one source suggests natural burial requires 1,478 graves per hectare compared to 1,975 graves per hectare for conventional burial (Kowarik et al., 2016), while our research participants indicated that natural burial potentially requires 3-4 times the land required for conventional burial (additional space is required to ensure the grave is retained without concrete, and to allow for tree roots etc). Thus, natural burial doesn't necessarily offer land-use efficiencies—or cost savings—over conventional burial in urban areas. However, the cultivation of vegetation and a more biodiverse setting provides significant benefits for supporting biodiversity and facilitating the enjoyment of ecosystem services. Further, once filled, many natural burial grounds will become reserves under the auspices of a trust to ensure protection in perpetuity (Rumble et al., 2014). Natural burial grounds may also be viable options in rural and regional areas where land availability is not pressured as in urban areas, or in forested urban or peri-urban areas, where green space may be retained while increased space for burial is realised.

Natural burial grounds appear to have been relatively popular in the UK due to consumers' affinity with the notion of 'returning to nature' (Rumble et al., 2014). The UK's Association of Natural Burial Grounds asks member grounds to sign up to a Code of Conduct about how natural burials should be conducted, providing consumers with a degree of certainty regarding the sustainability of these businesses.

For many people, to be returned to the soil reflects sustainable values they worked to uphold while living, and so feels a fitting end (Clayden et al., 2018b; Rumble et al., 2014). Zeng et al (2016) note that natural burials will have affinity for many Chinese people, many of whom value harmony between nature and humanity, especially at death. We were not able to attain data regarding numbers of natural burials performed in NSW to date, however our research participants suggested that uptake of natural burial has been low, with very few burials having taken place in Kemps Creek Natural Burial ground in the past decade.

A recent proposal for a natural burial model in peri-urban areas attempts to address multiple land-use issues through opening up space for natural burial. The Burial Belt[14] concept aims to address issues of urban sprawl and the impacts of livestock grazing in peri-urban regions by reforesting livestock grazing land for natural burial grounds. Through designating peri-urban lands as cemetery spaces, there is potential for limiting urban sprawl, a process which has historically resulted in a range of landscape types converted for residential development, causing loss of both food producing lands and valuable ecosystems. The Burial Belt proposal would see fees paid to purchase natural burial plots contribute towards the ongoing maintenance and conservation of the site in years to come. The Burial Belt—as with other natural and conservation burial grounds—provides potential for delivering multi-functional burial grounds, for example through providing recreational space and delivering conservation and biodiversity benefits while simultaneously providing space for burials.

6.8 Conservation burial grounds

We make a distinction here between natural burials and conservation burials. Conservation burials are a type of natural burial; however, they are on grounds with a specific conservation mission. Usually, in conservation burial, fees for burial are used to fund the purchase of more land to expand conservation areas or to cover the costs of rehabilitating and revegetating degraded areas. These burial grounds often work in conjunction with natural resource managers and ecologists to rehabilitate and revegetate the natural environment. Conservation burial provides all the benefits of natural burial (reducing resource inputs, low toxicity, minimal or non-invasive memorialisation) but also has the explicit intention to conserve or enhance ecosystems through revegetation and rehabilitation and native planting.

The Green Burial Council in the US provides certification for conservation burial grounds. The certification requires that grounds are engaged in active preservation, enhancement and restoration of a minimum of four hectares (Coutts et al., 2018). Further, conservation easements must be in place to provide a legally-binding mechanism to ensure conservation in perpetuity (Coutts et al., 2018). Burial and conservation tend to make for mutually beneficial land-uses, as, in many jurisdictions, lands used as cemeteries are protected in perpetuity (Kahn, 2019).

The US has witnessed a growth in conservation burial grounds. In New York State, burials have been used to fund conservation in the Adirondacks through the Split Rock Wildway Corridor—anyone who reserves a burial site in the grounds is asked to donate part of their estate to purchase more land to grow the corridor (burial spots can also be purchased without donations) (Kahn, 2019). The cemetery status works to ensure conservation in perpetuity as its use as a cemetery ensures that the land can never be developed for other purposes (Kahn, 2019). Similarly, in Ramsey Creek, South Carolina, grave sites are covered with endangered native plants to facilitate revegetation with native and endemic species (Klein, 2017). Klein estimates that if every American buried each year were to have a conservation burial, an additional $3.8 billion in funding could be channelled into biodiversity conservation (Klein, 2017).

In Australia, a ‘restoration’ burial ground has been proposed in New England, NSW. This site would allow natural burials in a regenerating area of former-agricultural land which is being revegetated to support biodiversity and function as a wildlife corridor.

[14] https://architectureau.com/articles/burial-belt/

Conservation burials have primarily been considered as viable in non-urban areas. However, in Australia, many threatened species live in urban areas, and much of our urban green space is under threat due to development pressures. Conservation burial could provide a mechanism for protection and enhancement of green space in urban and peri-urban areas in perpetuity through a dual function as a natural burial ground and a conservation site, improving urban amenity (Coutts et al., 2018).

Conservation burials are generally more expensive than other natural burial options, often requiring the deceased to leave a portion of their estate to conserve the landscape. While this may be a highly attractive option for higher-income groups, it does not present an option likely to achieve affordable outcomes for all.

Cemeteries may present a viable land-use option for addressing contaminated lands issues in urban and peri-urban areas. Australia has over 160,000 contaminated sites (CRC CARE, 2019), most of which present challenges for identifying suitable uses and managing the remediation of land for future repurposing. Other former industrial sites (e.g. quarries) present complex sites for managing future use for a range of reasons relating to physical structures on site as well as potential contamination issues. Some precedent exists for transforming former industrial and contaminated sites into cemetery grounds. For example, the Igualada Cemetery, near Barcelona in Catalonia, was constructed on a former quarry site (Clayden & Woudstra, 2003). The cemetery's design complements, rather than counters, the adjacent industrial landscape. Opportunities may exist for innovative designs for new cemeteries on contaminated lands or former quarry sites: in particular, design strategies which do not involve excavation but which involve constructing burial vaults above contaminated lands may help address remediation issues and challenges regarding finding adequate space for new cemeteries. Careful communication strategies may be needed to address public perceptions regarding burials on contaminated lands, however as is shown in the case of Igualada, design strategies can help alleviate such concerns by paying careful attention to site context and creating new expectations for what a cemetery might look like.

6.9 Burial at sea

Burial at sea provides an alternative to conventional burial which avoids the land-use challenges associated with burial. Burial at sea has a long history in many cultures and in several trades (e.g. sailors).

In Australia, a permit from the Commonwealth Government is required for sea burial (Australian Government Department of Environment and Energy, 2019). These permits cost over $1600 and, in practice, are usually only granted when the deceased has a strong connection to the ocean (e.g. a profession associated with the sea, for example a sailor) (Australian Government Department of Environment and Energy, 2019). The burial must take place in water more than 3,000 metres deep, must be in an area that will not conflict with other uses (e.g. trawling or shipping), and must be organised by a funeral home (Australian Government Department of Environment and Energy, 2019).

For Australian burials at sea, bodies must be un-embalmed and without a casket (bodies must be covered in a heavy canvas shroud) (State Library of NSW, 2002), there are arguably fewer resources and chemicals invested in the burial. However, although this research found no studies providing evidence, it would be reasonable to suggest that there is a limit to the scalability of burial at sea, especially given the restrictions on location. Large numbers of burials at sea are unfeasible,

given the stringent logistical requirements, and possibly undesirable from an environmental health perspective.

6.10 Non-urban cemeteries

In urban areas, the price of the land and the competition between land uses make the expansion of existing cemeteries or the development of new cemeteries more difficult and drive the costs of burial up. As a result, burial, which is a preferred practice for some cultural or religious groups, is becoming unaffordable. The lack of development of additional burial grounds in urban areas is already affecting some cultural and religious groups in cities. Several interviewees mentioned that the Jewish and Muslim communities in Sydney were already experiencing a lack of options to bury their deceased. In addition, it was also indicated by interviewees that councils in the Sydney area often do not have provisions for cemeteries in their planning instruments or are opposed to the development of cemeteries on their land, meaning that new urban cemeteries are likely to present a significant planning challenge. Land-owners reportedly harbour concerns that urban cemetery development will negatively impact nearby property values.

It is also important to note that, generally, our research participants perceived that people expect to be able to inter their loved ones' remains close to where they lived, though many groups have a strong preference for burying remains on grounds where their specific preferences will be accommodated, and may be willing to travel further to ensure their needs are met. For others, burial close to home and community is perceived as critical. Bachelor (2001) notes that visitation of cemeteries can provide vitally important opportunities for expressing and resolving grief, escaping the anguish of separation from the deceased, allowing some feeling of control over feelings of grief and loss, and can offer solace and a sense of well-being (p. 172). For certain cultural groups, expectations for both funerals and visitation likely require cemeteries located close to home. For members of the Islamic faith, due to the tradition of burying the deceased within 24 hours—though often just a number of hours—after death, there is a strong need for a cemetery to be within reach (Allam, 2019). Research participants involved in cemetery management related that for some cultural and faith communities where frequent visitation—especially for holidays and sacred occasions (interviewees suggested that this might be particularly relevant for Chinese and Muslim Australians) - is common, community members tend to expect that interment grounds will be in reasonable proximity to their home. Bachelor (2001) notes that many Catholic mourners (especially women) visit multiple times per week, or at least once a week on Sundays. It is unclear how these expectations may change over time, and whether second- and third-generation migrants may have different expectations to first generation migrants. Ease of access, through provision of public transport services to interment grounds, is also an important consideration for an aging population. As mentioned above, significant land availability issues are being faced in metropolitan NSW at present, complicating the state's ability to provide people with burial spaces within proximity of urban areas.

To respond to the lack of cemetery land available in urban areas and the high costs of burials, the option of developing cemeteries outside urban centres may need to be contemplated. This raises the question of the acceptability, for urban dwellers, of burying their family members at more distant locations. Interviews suggest that consumers usually do not want to have their deceased buried a great distance from where they live. However, other interviewees suggested that people are willing to be buried further from home if the cemetery is willing to accommodate their cultural or value-based preferences. For example, many Jewish people who lived in Sydney's Eastern Suburbs are

buried in Rookwood, due to their ability to accommodate religious and cultural preferences and practices.

Our interviews indicate that non-urban cemeteries will be acceptable for some people, who may be willing to be buried—and to bury their deceased—further from home if this means that their values and preferences can be accommodated. This option might be particularly suitable for individuals and groups for whom visitation is not a priority. However, our interviews suggested that non-urban cemeteries are thought to be unlikely to appeal to large segments of the urban population, as most people want to bury their loved ones close to where they live. Interviewees suggested non-urban cemeteries may be a viable option for natural burials and conservation burials, where consumers may be willing to compromise on proximity in order to have their personal values (e.g. environmental protection) accommodated. Design strategies which reimagine the cemetery space and the visitation experience may help people begin to reshape their expectations regarding cemeteries, opening up opportunities for rural/regional natural burial grounds to flourish. Further, the lower price of land in rural and regional areas may better facilitate the establishment of natural/conservation burial grounds than in urban areas, and conservation goals may be more easily achieved in non-urban areas.

Non-urban cemeteries would need to be relatively easily accessible, which means that the urban centres should be connected to the cemeteries by good public transport. Of course, many rural and regional communities may raise similar objections to urban communities to the siting of burial grounds in their community. A stakeholder consulted as part of this project suggested that facilitating community-led proposals for regional cemeteries could help avoid the sense that cemetery projects are being ‘imposed’ on regional communities. That is, communities could be invited to bid for cemetery projects to be brought to their community, rather than have them proposed by outsiders. Community consultation and engagement would be required to ensure that these projects have buy-in from local communities.

7 Findings: Cremation

In Australia, cremation is a popular option for the disposal of bodies with 66% of bodies cremated of the 50,000 deaths occurring per year in NSW (NSW Department of Primary Industries, 2015). This figure is comparable to other western nations such as the United Kingdom and Canada. During the cremation process the deceased person's body and coffin is combusted at temperatures ranging between 400 and 1000 degrees for several hours until all the organic matter has been consumed by heat or evaporation. The bone fragments that remain are removed from the chamber, along with any metal components, and the remains are processed into a fine particulate that resembles ash and placed in a temporary container or an urn.

Cremation has become increasingly popular in many countries (China, US, UK), and presented as a modern and cost-effective choice. Our research participants also reported that many consumers hold a perception of cremation as 'cleaner' than other body disposal options—an interesting perception given cremation's high energy consumption and resultant pollutant release. Cremation does have obvious environmental benefits over burial in terms of land-use efficiency. However, the practice uses large quantities of fossil fuel and creates greenhouse gases and airborne pollution (e.g. mercury from dental fillings) (Michel & Lee, 2017).

Many cultural groups (e.g. Hindus, Sikhs) require cremation as part of cultural and faith practices, while others prohibit it. The Catholic Church recently clarified its stance on cremation, and now emphasises that the practice is not inconsistent with teaching, so long as remains are not scattered but interred in a church or cemetery (Cella, 2018). Other Christian denominations, such as Baptists, also now allow cremation despite it not traditionally being part of their practice. While cremation does often require some land (for interment of ashes and memorialisation), the land intensity of cremation is up to 74 times less than that required for burial (Keijzer, 2017).

Cremation avoids many of the challenges of leaching that are involved in burial, but has other environmental impacts associated with the practice. The emission of greenhouse gases such as carbon dioxide from the use of petroleum or gas, are a significant source of pollution from cremation. Each cremation emits around 160kg of carbon dioxide into the atmosphere (Potter, 2019). Additionally, emissions from coffin finishes and fasteners, including mercury and carbon dioxide (Potter, 2019), and from bodily implants and treatments such as mercury from dental fixtures and a wide variety of metals and plastics in prostheses and implants, are a source of environmental pollution released during the cremation process.

7.1 Conventional (gas-powered) cremation

Socially, conventional cremation has a high acceptability and is generally perceived as 'clean' and connected to ideas of 'leaving the land for the living' (Yarwood, Sidaway, Kelly, & Stillwell, 2015).

Conventional cremations occur in a gas-powered cremator. These cremators are highly energy intensive, using approximately 285 kWh of gas per cremation, resulting in the release of 160 kg of carbon dioxide into the atmosphere (Potter, 2019; Tressider, 2015). Adelaide Cemeteries Authority research indicates that the total greenhouse impact, taking into account electricity, transport and resources inputs as well as natural gas, of a single cremation is around 430kg of CO_2 equivalent—a lower impact than standard burial, but higher than for natural burial (Adelaide Cemeteries

Authority, 2011). Consumption of natural gas in cremation represents the highest impact with regards to climate change from all interment practices (Keijzer, 2017). Cremation also has serious environmental impacts in terms of air pollution from emissions—though at present these are not well understood due to a lack of studies (Decker Junior, Cleister Lima Muniz, & Joseph Cruz, 2018). In the UK, mercury from dental amalgam released in cremations was found to be a major source of mercury pollution, with 3 grams of mercury emitted for each body cremated (though mercury levels in areas adjacent to crematoria were found to be within regulated levels) (Green, Crouch, & Zemba, 2014).

The Minamata Convention on mercury (a global UN Convention to address sources of mercury pollution) does not specifically address emissions of mercury from cremation. However, the Australian Government acknowledges that this is a contributor to mercury emissions (though small compared to other sources) (Australian Government Department of Environment and Energy, 2016). We were not able to identify any reports or information relating specifically to mercury emissions from crematoria in NSW, however a South Australian (SA) Environment Protection Authority report identified that no crematoria sites in SA had implemented measures to reduce or contain mercury emissions (Environment Protection Authority SA, 2016), and several of our interviewees indicated that the lower rates of dental fillings with amalgam containing mercury amongst the Australian population means that this remains less of a concern in Australia than in the UK context.

Cremation is also a source of pentachlorobenzenes, a toxic persistent organic pollutant regulated by the Stockholm Convention (Environment Protection Authority SA, 2016), as well as polychlorinated dibenzodioxins, polychlorinated dibenzofurans and strontium-89 from nuclear medicine (da Cruz et al., 2017). Cremations are also responsible for the release of nitrous oxide gas, however newer cremators tend to include technology which reduces emissions of nitrous oxide (Holder, 2020). A major contributor to nitrous oxide emissions is the burning of chipboard/MDF coffins (Holder, 2020).

Mobile crematoria have been proposed as a means of addressing the overloading of pollution in a single area, however on the whole these solutions fail to address or reduce the environmental outcome, and rather simply spread its impact across a broader area (Decker Junior et al., 2018). Further, given NSW's diffuse and relatively low-density population, as well as infrastructural inertia, it is unlikely that mobile crematoria pose a viable alternative to conventional cremation.

Upgrading old infrastructure is a key means of improving the environmental impact of cremations. For example, modern cremators use the equivalent of 40 litres of petrol per body, whereas older systems can use more than twice that input (Jeong, 2019).

More efficient cremators are available which significantly reduce both energy inputs and emissions. Facultative Technologies' FT3 unit facilitates lower impact cremations—reducing the time to about 70 minutes per cremation, and using 30-50% less gas than some existing cremators (Adelaide Cemeteries Authority, 2019). Further, FT3 has a unit for filtering and capturing NOx emissions, currently available to fit or retrofit to cremator systems with flue gas treatment (Adelaide Cemeteries Authority, 2019).

Elsewhere, the cremation industry has started to address these environmental impacts in three key ways:

- Recycling medical implants: such as titanium hip joint to increase resource efficiency and to reduce the combustion risk of metal devices and implants;

- Reducing air pollution: by scrubbing emissions especially mercury that can be released from the combustion of amalgam dental fillings (Rumble et al. 2014). For example, in the UK, by 2012, crematoria were required to reduce their mercury emissions from dental fillings by 50% and 100% by 2020. Crematoria emissions are cooled for the mercury to be liquefied and collected (Rumble et al. 2014).

- Recycling heat: the technology used to cool emissions can also be recycled to heat the crematorium or other neighbouring buildings (Rumble et al, 2014).

Interviews suggested that—at least in certain parts of the state—there is a need for improved crematorium capacity. This need to provide expanded infrastructure provides an opportunity to consider how cremations should be provided in future, and to build more sustainable practices into new infrastructure. Renewable energy sources (discussed further below) for supplying energy for cremation should be a key consideration in such infrastructure decisions. Infrastructure investment decisions also provide an opportunity to consider how changing cultural preferences might require alternative infrastructure in the future, and investment decisions should consider whether to simply provide expanded cremation capacity or to invest in the establishment of alternative practices, such as decomposition (discussed further below), which might divert some demand away from the stretched crematorium sector while providing expanded choice for consumers.

7.2 Direct cremation

Internationally, and especially in the UK, there is a trend towards the growth of direct cremation. Direct cremation involves a cremation without a funeral, with no treatment/embalming of the body and generally with the simplest allowable casket. Reportedly, the decision by David Bowie to have this kind of cremation has spurred public interest in the practice in UK, with direct cremation rates rising by 400% in 2018,[15] though the proportion of consumers using direct cremation remains low at 2% (Sunlife, 2018). Pure Cremation is a company which specialises in direct cremations, and reported a tenfold increase in interest in direct cremations in 2017. Sunlife reports that only 4% of consumers in the UK are aware that direct cremation is an option (Sunlife, 2018), despite 97% of funeral directors there claiming to offer the service. This suggests consumers are not being offered the option of direct cremation, perhaps because of its implications for providers' profits. It is unclear whether many Australian consumers are aware that direction cremation is an option here, and indeed few funeral providers appear to actively offer it (that is, to market it to consumers) apart from those specialising in direct cremation, mentioned below.

The decision to opt for direct cremation is reportedly driven by both a growing sector of the population who do not hold religious or cultural prescriptions or preferences, as well as by an interest in keeping costs to a minimum.

In Australia, a number of emerging providers, including not-for-profit providers, have begun providing direct cremation. Bare Cremation offers direct cremation for around $1,800 (prices vary depending upon location). Bare Cremation will collect the body, arrange cremation and deliver or post the remains, and offers pre-paid direct cremation options. Sydney Memorial Cremations offers

[15] https://www.theguardian.com/money/2018/sep/08/david-bowie-direct-cremations-cost-funeral

a number of packages including direct cremation, for which costs start at $1,700. Salvos Funerals, a not-for-profit funeral provider, says around 40% of their packages sold since their founding in 2015 have been direct cremations.

It is unclear what the precise extent of sustainability benefits may be for direct cremation. However, it appears there is some intersection between environmental interests and selection of direct cremation. For example, while sustainability is not a major focus of Pure Cremation's marketing, their standard direct cremation package includes what is described as a 'solid pine eco-coffin' and a 'biodegradable' urn for ashes. At present in NSW, direct cremations must use coffins, despite there being no viewing or service, due to the requirements of the Public Health Regulation 2012. This means that the only purpose of a coffin is to provide a vessel for transport, which could be easily substituted with a body bag or shroud. Salvos Funerals indicated that their default vessel for a direct cremation is an medium-density fibreboard (MDF) coffin—this is the cheapest option available. The cost and environmental impact of direct cremations would likely be significantly brought down if cremation without a coffin was permitted in NSW.

Direct cremations do not involve funeral services as part of the package purchased with body disposal. This represents a decoupling of the process of body disposal from that of memorialisation. This decoupling seems particularly relevant in the context of social trends which are moving away from what many increasingly feel to be the 'impersonal' and 'meaningless' traditions of liturgical and religious services (Holloway, Adamson, Argyrou, Draper, & Mariau, 2013, p. 31). Decoupling memorialisation from body disposal has been an emerging practice as cremation has gained popularity (see section on memorialisation for further on memorialisation of cremated remains) and decoupling funeral services from body disposal practices may well be the next step on this trajectory, especially with increasing numbers of secular consumers. Holloway et al (2013, p. 31) note that concerns have been raised by many that a move away from conventional services will prevent opportunities to properly grieve, however such concerns fail to recognise that personalised and DIY services in secular practices 'may constitute new forms of spirituality', which may provide valuable opportunities for healing and grieving. Of course, not all who choose direct cremation will also have a personalised or DIY service, and questions remain open about the impacts upon the grieving process for the communities of those who choose direct cremation without a service. However, conflating a conventional or commercial funeral service with a 'proper' opportunity to grieve risks diminishing the value of emerging and alternative practices which address consumers' desire for non-commercial and non-religious means of honouring and memorialising death.

7.3 Renewable energy for cremation

A key opportunity for improving environmental impact of body disposal practices is through making conventional methods more sustainable. An opportunity exists to improve the environmental footprint of conventional cremation through the use of renewable energy sources.

Solar power provides an opportunity for crematoria to meet their electricity needs through a renewable source. Several crematoria in NSW have installed or are planning to install photovoltaic solar panels.

A solar-powered crematorium has been established at the Chain O Ponds Memorial Park in Collombatti, NSW. This combines battery storage with solar photovoltaic panels (roughly 22kW system) to make the crematorium completely off-grid in terms of electricity (a back-up diesel generator is located on-site for emergencies, though has never been used), with renewable

sources providing enough energy to run the cremator and air-conditioning for the funeral home (Sutcliffe, 2015). Natural gas is used for fuel for the cremation, as is usual practice, but solar panels power the ventilation and bellows for the cremator, as well as all other electricity needs for the site. The decision to install solar was driven by the high cost of delivering the required three-phase power to the site,[16] solar panels were determined to be cheaper, and provides ongoing savings in terms of electricity costs.

The recent arrival on the market of fully-electric cremators[17] indicates that cremations might be powered entirely by renewable energy in future. DfW's electric cremator does not use natural gas for combustion, opening the possibility for future crematoria to be run entirely on renewable sources of energy.

In India, a solar-powered cremator has been built to ensure renewable energy replaces the 200-300 kilograms of timber conventionally used for open-air Hindu cremations (Scheffler, 2006). This facility uses a mirrored reflector to generate heat which combusts gas for cremations.

Co-generation also occurs in other jurisdictions. For example, a company in Halmstad, Sweden uses surplus heat from cremation to provide municipal heating to the homes in a neighbouring town (Tufnell, 2013). While a positive initiative, the lack of demand for municipal heat means this solution is unlikely to prove viable in the Australian context, there may be other (e.g. industrial) uses for cogenerated heat from the cremation process that could be identified.

[16] Three-phase power is a common method for transferring electrical power in grids, often used for powering large motors and heavy loads.
[17] See DfW: https://dfweurope.com/dfw-electric-launched

7.4 Open-air cremation

Cremation in NSW is limited to procedures in an approved cremator. Open-air cremation is not possible in NSW under existing regulations. Several interviewees suggest that open-air cremation or other models should be considered, in order to provide more choices and to address the needs of groups such as Hindus, who traditionally prefer open air cremation. Open-air cremation is common in India, and is legal in some states in America, though is not commonly carried out. There is only one operational open-air cremation facility in the US at present: the Crestone facility in Colorado. Groups in Maine and elsewhere are currently lobbying for approval of facilities to enable this option to be offered elsewhere.

Figure 10: Crestone open-air cremation facility (source: Eastcott)

The Crestone Open-Air Cremation[18] facility in Colorado provides open-air cremations for residents of Saguache Country. These cremations use a half-cord of wood (1.8m^3), a timber stretcher and a shroud. We came across no studies providing comparisons between the emissions released by wood-based open-air cremations and by conventional gas-powered cremators, and so cannot comment on relative impacts. However, the nature of this pollution source may mean that localised impacts on adjacent properties could be significant, though in the absence of studies the actual impact is difficult to estimate.

Figure 11: Crestone open-air cremation facility (source: David Wright).

A court in the UK approved the use of open-air cremations in at least one council area: Newcastle upon Tyne, after a challenge from a Hindu citizen who wanted to be cremated as per his religious preference.[19] The court granted permission for him to be cremated in an outdoor pyre. This established a legal precedent, however our review suggested that no open-air cremations have yet taken place in the UK—as despite the legal ruling allowing them, there appear to be no approved facilities established as yet.

[18] http://informedfinalchoices.org/crestone/services/open-air-cremation-site/

[19] https://www.theguardian.com/world/2010/feb/10/hindu-cremation-pyre-appeal

8 Findings: Emerging practices and alternatives

This section discusses a number of emerging alternatives which provide novel options for body disposal.

8.1 Promession/cryomation

Promession, also known as cryomation, uses liquid nitrogen to freeze the body to a point that it becomes crystalline and brittle (Funnell, 2019). The frozen body is then shattered into small pieces (roughly 1mm) through ultrasonic vibration (Rumble et al., 2014). The main benefits of this process are that the odourless remains can be buried in a shallow grave or soil where it rapidly breaks down into mulch (Kilvert, 2019; Rumble et al., 2014). It is expected that this method would reduce the impacts upon soil and water through minimising leachate (da Cruz et al., 2017). Promession remains can also be buried in a shallow grave (Tufnell, 2013), reducing environmental disturbance associated with heavy earth-moving equipment for deeper graves. It is expected to have a significantly lower carbon footprint than conventional cremation, as it avoids the need for fossil fuel inputs such as petroleum or gas, however studies on promession's energy footprint do not appear to be available currently. Promessa, a Swedish company, is the primary driver for this technology at present, and is campaigning to legalise the technology in a number of jurisdictions. A UK company, Cryomation, has similarly been researching and promoting cryomation as an alternative to conventional options.

This process is not yet commercially operational anywhere in the world. As a result, an accounting of the environmental impacts and social acceptability of this method is not available at present. A Brazilian study (da Cruz et al., 2017) found that freeze drying had a high acceptability when compared to more conventional forms of interment due to lower environmental impact. Keijzer (2011) finds cryomation/promession to have a lower environmental impact than cremation and burial, however a marginally higher impact than alkaline hydrolysis. The production of liquid nitrogen for use in the process, as well as the resource inputs for coffins etc and the disposal of remains are identified by Keijzer et al as the primary sources of environmental impact (2011). It is unclear whether consumers will perceive it as analogous to cremation, and whether it could achieve the same acceptability as cremation has presently.

An understanding of the cost per body is not yet available, however it appears that it will be more expensive than cremation, especially considering the costs of establishing new infrastructure (da Cruz et al., 2017). It is likely that the promession infrastructure will be prohibitively costly and very large, making it difficult for existing crematoriums to incorporate into existing infrastructure, and making establishment of promession facilities expensive, increasing the likely cost per body of promession funerals (Grundhauser, 2016).

Many of our interviewees indicated that they feel it is unlikely that promession will become mainstream, due in part to high costs of establishment and in part to low levels of social acceptance for this kind of technology.

8.2 Alkaline hydrolysis

Alkaline hydrolysis, also known as resomation or aquamation, provides a water-based alternative to conventional cremation. In the alkaline hydrolysis process, the body is placed in a solution of water and potassium hydroxide in a stainless-steel container. It is heated and the body is dissolved into liquid organic matter (da Cruz et al., 2017; Rumble et al., 2014). At the conclusion of the process, liquid and bones remain. The liquid remains contain no DNA, but are rich in nitrogen, phosphorus, proteins and amino acids, making them suitable as fertiliser (da Cruz et al., 2017). Bones are crushed in a process similar to that used after cremation, providing 'ashes' which can be kept for memorialisation or buried to become fertiliser for soil.

Historically, alkaline hydrolysis has been used primarily for disposal of livestock, laboratory animals and pets (Atkin, 2018). It is also used in research facilities and hospitals for the disposal of medical wastes.

The key benefits are that the remains become soil within a year (Rumble et al., 2014), that its energy cost is a fraction of that of conventional cremation—reportedly 5-10% of the energy requirements (Tressider, 2015), and it allows for recovery of mercury and other metals contained in the body, rather than their emission into the atmosphere as with conventional cremation (BBC News, 2017).

A Dutch study identified alkaline hydrolysis as having the lowest environmental impact in a comparison of four body disposal practices—cremation, alkaline hydrolysis, burial and the promession/cryomation method (Keijzer & Kok, 2011). The only category in which alkaline hydrolysis has higher impact than other methods is in regards to eutrophication[20] (Keijzer & Kok, 2011). However, the extent to which this might be a major environmental issue remains unclear, as this will be largely dependent on the way in which wastewater from alkaline hydrolysis is released and treated, as eutrophication impacts are dependent upon concentrations in waterways.

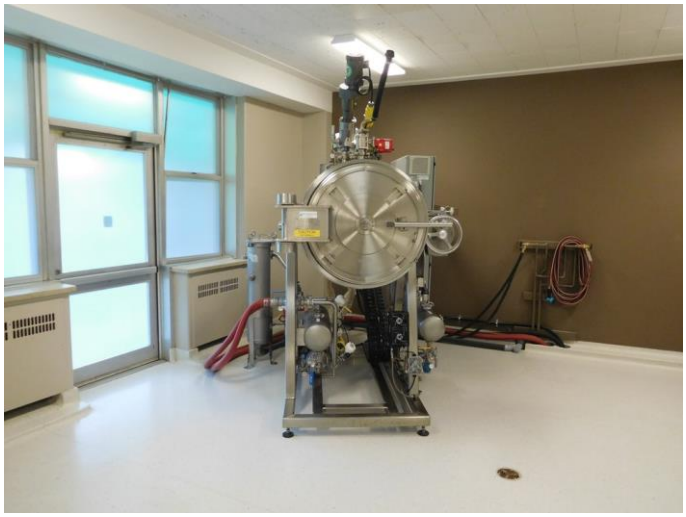

Figure 12: An alkaline hydrolysis facility (source: Bio Response Systems).

Alkaline hydrolysis uses only 90 kWh of electricity per body, roughly a quarter that of conventional cremation (Atkin, 2018). The practice uses 300 gallons (more than 1000 litres) of water per body (Palus, 2014)—roughly equivalent to the average daily water consumption for an Australian household. There is also an opportunity to use grey water to reduce use of town water, though perceptions around using 'dirty water' to dispose of remains may be problematic (Palus, 2014).

[20] Eutrophication is the loading of water systems with nutrients and minerals, which can contribute to algal growth and other imbalances.

Environmental impacts are also known to be present at plants which produce the alkaline required for resomation, including related to emissions of mercury and other pollutants (Atkin, 2018). The main barriers to its adoption to date appear to be primarily a lack of social acceptance in many jurisdictions, and environmental issues relating to contamination and pH levels of wastewater being higher than allowed, however liquid remains can be treated with carbon dioxide to correct this (Atkin, 2018).

The social acceptability of releasing human remains through wastewater systems is likely to remain a sticking point for this technology. Further, for many cultural and faith groups this practice will be deemed unacceptable as the body is 'cooked' (da Cruz et al., 2017). Alkaline hydrolysis is expected to have higher costs per body than conventional cremation (da Cruz et al., 2017), especially due to the cost of establishing new infrastructure in NSW.

Alkaline hydrolysis is allowed in 15 states in US (Atkin, 2018), but has faced difficulties in gaining approval in other jurisdictions. Sandwell Council, in the UK, was denied a permit to release water into sewers from its resomator, due to concerns about public perceptions and contamination (BBC News, 2017).

NSW is currently the only Australian state that allows alkaline hydrolysis under the Public Health Regulation 2012. Alkaline hydrolysis is the only method for which bodies are not required to be placed in a coffin. Sydney Water has not yet approved the release of alkaline hydrolysis remains into sewers and has not issued trade licences to operators, due to concerns over contamination, but liquid remains could, with an EPA licence, be used as fertiliser (Kilvert, 2019). However, our interviewees indicated that operators in NSW have been unable to obtain a licence from the NSW EPA to apply waste from alkaline hydrolysis to forestry, and have been unable to obtain a trade waste licence from Sydney Water, making operations difficult. Improved communication and engagement between agencies appears to be required to resolve regulatory inconsistencies which currently allow alkaline hydrolysis under certain regulations but not others.

As with promession (discussed above), some of our interviewees indicated that they feel alkaline hydrolysis is fairly unlikely to become a mainstream practice for body disposal in NSW. In the UK and other jurisdictions, citizens have indicated some reluctance to accept the flushing of human remains into the sewer system.

8.3 Composting

The composting of human remains is a new innovation emerging in response to demand for gentler and more environmentally friendly options for the disposal of bodies. The method emerges from the livestock industry, where composting has long been considered the best way to manage animal remains, including in response to disease outbreaks (e.g. avian flu) and other challenges.

Recompose is a company founded in Washington State, USA, which facilitates natural organic reduction or composting of human remains. The idea is intended to take the principles of natural burial—which allows the body to return gently to the soil—in a way that is appropriate for land-constrained urban areas. Recompose designed hexagonal composters for human remains which produce soil safe for application on gardens. Bodies are placed in the composters with woodchips,

alfalfa and straw—a relatively clean mix of organic wastes deemed acceptable for this purpose.[21] Decomposition of the entire body, including bones and teeth, takes around 30 days through combination of a mechanical mixing process and the microbial decomposition. Families can take home composted remains and leave some to fertilise memorial gardens at the Recompose site, or on conservation areas around the site. Each composted body produces around one cubic metre of soil (Recompose, 2019). The same rules apply to this kind of waste as to cremated remains, they can be released in public lands and on private lands with the express permission of the landowner. Testing found the remains to be within EPA limits for key pollutants and safe to apply to land, and the remains were deemed to be visually, chemically and microbiologically unrecognisable as human remains (Recompose, 2019).

Figure 13: Design for a Recompose facility in Washington (source: Recompose and Molt Studios).

The method will be legally available in Washington state from May 2020. It is not currently commercially operating anywhere in the world; however, Recompose is currently establishing patents for its method and anticipates licencing it for use in other jurisdictions, in addition to expanding its operations to other states. It is unclear what costs would be involved to establish facilities in NSW.

The expected cost per body in Washington is cheaper than that for burial, though more expensive than the average cremation and roughly similar to the cost for natural burial (Recompose, 2019). This process provides, then, a more affordable alternative to burial, presenting an option in particular for those who'd prefer not to be cremated but default to cremation for affordability reasons. The composting method may be suitable for people who like the notion of natural burials but who live in contexts where natural burial is not possible due to space constraints. It is unclear at present what the levels of social acceptability may be for the composting of human remains.

[21] Placing the body with mixed food waste, for example, was not seen as having high social acceptability, despite its significant potential for further improving sustainability outcomes.

Composting of human remains uses aerobic, rather than anaerobic (as in conventional burial), decomposition, improving emissions from the decomposition process (Golden, 2019). Recompose reports that composting of remains performed better than natural burial, conventional burial and conventional cremation across all four areas of environmental impact assessed in a study, and performed especially well in terms of contribution to climate change, due to composting's low carbon footprint and ability to return nutrients to the soil (Recompose, 2019). Given that the process involves carbon capture, rather than emissions, Recompose expects that the process will save around one metric tonne of carbon dioxide emissions per body compared to conventional burial or cremation (Recompose, 2019).

Composting of bodies was not previously allowable in Washington State; however recently became allowable through a legislative change making a wider number of options available to citizens (alkaline hydrolysis was also permitted through the legislative change). Rather than lobbying based on allowing the use of a specific practice or technology, lobbying was focused around expanding options available to consumers. In Washington, only two options—burial and cremation—were available to consumers prior to the legislative change. The amended legislation was passed on the basis that it opens up new alternatives for consumers whose needs were not met previously. Due to the emphasis on choice, Recompose's legislative change enjoyed broad support from legislators and community members across several sectors and faiths, many of whom supported an expanded range of post-life options, even if these weren't directly applicable to the members of their faith group or community.

9 Findings: Memorialisation and services

Memorialisation refers to any process or artefact used to mark the presence of the remains of a deceased person. Memorials provide important focal points for remembrance, allow for cultural/personal expression, symbolise the deceased, record family history and provide a physical marker for the remains (Bachelor, 2001). Common memorialisation practices for burials are head stones on lawn cemeteries. In the case of cremation, remains are sometimes memorialised using plaques situated on a niche that contains the remains. However, in many cases, formal memorialisation is not adopted by the families, and the ashes are, for example, scattered. Memorialisation options can be used in conjunction with conventional burial/cremation practices, as well as with innovative interment practices. For example, natural burial grounds often require the use of simple, natural markers, such as stones and trees. This is often combined with GPS markers for location of burial sites, so that the bereaved can have certainty about where their loved ones are buried.

Memorialisation can be a key part of the environmental impact of interment practices, particularly in the case of burial. As explained above, head stones, in addition to being resource intensive, are often strongly linked to relatively space-inefficient interment practices, such as lawn cemeteries or large parklands. Indeed, lawn cemeteries are often unused for other purposes and the memorialisation is often perpetual. As a result, once the cemeteries are full and the visitation rates drop, the cemetery loses its purpose and becomes a financial burden to manage. In addition, the rates for conventional memorialisation (e.g. headstones, plaques on a niche) can be high, and therefore not affordable for all segments of the population.

Many alternatives exist that provide lower-impact and cheaper memorialisation options. In the case of burial, the presence of natural markers and GPS markers has already been mentioned. In relation to cremation, urns can sometimes incorporate a seed to grow a tree or shrub for memorialisation. These practices do not avoid the impacts associated with conventional cremation, however, provide an alternative that allows unconventional memorialisation, and may be aligned with people's values. Those alternative memorialisation artefacts/processes might be welcomed by a segment of the population, however, some people can struggle with the absence of conventional markers, such as headstones (Stewart, 2018). Anecdotal evidence suggests that body disposal options that prohibit or limit memorialisation may not be favoured by many in the Australian public, who prefer to be able to identify a particular geographic site as the focusing of grief and memorialisation, and to identify this place as a final resting place. Natural and conservation burials, and other methods which limit opportunity for memorialisation, may be barriers for segments of the public who value opportunities for memorialisation.

Visitation rates in conventional cemeteries vary widely depending on a range of factors. Our interviews suggested that visitation rates have declined somewhat in recent decades, but that visitation continues to perform a highly important role for many cultures and social groups. Profiles of visitation vary substantially depending on the cultural/religious group in question and their customs and rituals. Anecdotal evidence suggests visitation tends to be most frequent in the first five years post-death, declining significantly in the 5-10 years after death and steadily thereafter. However, for some cultures, including the Chinese, regular (e.g. weekly) visitation may not

necessarily be an important ritual, however visitation on certain holidays is a highly important cultural custom. Thus, visitation rituals may persist for many years or decades in some cultures, despite these groups not being characterised by regular visitation.

Here, we consider the environmental impacts of memorialisation as distinct from the interment practices they memorialise—that is, memorialisation practices are considered here in isolation from impacts relating to cremation or burial.

9.1 Services and events

A key distinction between traditional/conventional and contemporary practices around memorialisation and body disposal is an emerging decoupling of these two activities: increasingly, consumers appear to view the service/event as somewhat separate from the process of body disposal. This is demonstrated in particular in relation to emerging practices. As mentioned previously, the recent rise of direct cremation points to an interest decoupling the process of body disposal with the act of commemorating and memorialising the deceased. This may arise from more secular communities in particular, where individuals may not hold strong beliefs around the treatment of the body—and so be comfortable with direct cremation—but may still wish to commemorate the deceased. Salvos Funerals, who offer direct cremation and work predominantly with low-income communities, indicated that they often encourage families to organise a wake or service that is self-organised, due to this being an inexpensive alternative.

The rise of personalised and DIY memorial services is indicative of this trend. It was not possible to secure data regarding the trends around formal/conventional funeral services held in a funeral home or religious site and the rise of personalised/DIY services, however research participants indicate that there is growing interest in eschewing formal/commercial funerals in favour of community-organised and led services. A range of reasons reportedly influence the decision to decouple the service from the disposal of the body, including: timing, allowing the service to be held several weeks after the death, rather than in the immediate aftermath, providing time for travel plans to be made and adequate time for organising the event; cost, as many prefer an event in a community hall or other hired venue rather than paying high fees for the use of a funeral home; personalisation, as with the trend towards personalised memorialisation discussed throughout the remainder of this section, there appears to be an increasing desire for services and events to be personalised and more reflective of an individual's values and life than a conventional funeral service might provide. The rise of third sector (not-for-profit) funeral providers may be a key influence for this trend, as such providers do not have the same vested interest in coupling the funeral service and body disposal as do commercial funeral providers, who make most of their profit from the sale of services and products related to the service/event as well as from coffin sales.

The increasing use of digital aids such as livestreaming to allow remote participation in a funeral service is also an indication of shifting expectations regarding funeral services. Some operators have begun upgrading IT infrastructure to facilitate improved livestreaming of funeral events to allow people to participate in events remotely. This may become an increasing trend, and could have sustainability implications, allowing individuals to participate without undertaking air travel.

9.2 Headstones on graves

Memorialisation practices are heavily driven by cultural and social expectations and understandings of certain practices and rituals. Socio-cultural understandings of what memorialisation should look like are major drivers for the continuation of the lawn cemetery and other familiar practices and arrangements.

Many cultures and groups have an expectation that interment will be accompanied by physical memorialisation of some kind. For various cultures, this may be more or less elaborate, but is generally understood to involve some kind of physical marker of a grave or site of cremated remains. For many cultures, this memorialisation facilitates visitation and provides a geographical focus for grief and remembrance, while for others this is merely part of social expectations around what occurs after a burial or cremation.

Memorialisation contributes substantially to the heritage values of conventional cemeteries. Memorialisation itself produces a unique and significant type of landscape. Further, particular graves (e.g. of notable people, local personalities etc) may hold heritage value and consequently their markers—memorials—also hold substantial heritage value. Heritage values become important many decades after interment—often 50-70 years or more—and are therefore difficult to plan for. This timeframe tends to coincide with the period in which genealogical interest in memorials arise, around five or six decades after a death, when the grandchildren of the deceased may themselves be ageing.

Many cemeteries are now creating searchable digital records of burials and memorials, in order to allow people to identify ancestors and the deceased online. In some places, these digital records may replace physical markers as cemeteries are renewed over time. In NSW, however, anecdotal evidence gathered in our interviews suggests that, due to a range of complex issues including cultural sensitivities and heritage concerns, widespread renewal of cemeteries is unlikely to occur in the near future. Thus, digital records will likely serve as a complement to, rather than a replacement for, physical memorialisation in NSW.

Headstone production comprises a significant component of the environmental impact of burial practices, contributing through stone quarrying and transportation to both climate change and ozone depletion (Keijzer & Kok, 2011).

The materials associated with conventional memorialisation practices are associated with major workplace health impacts. Silicosis, a debilitating and often-fatal lung condition, is associated with the manufacture of headstones. Silicosis results from inhaling crystalline silica, particularly that found in manufactured stone products, such as kitchen benchtops and headstones. It is often fatal, and highly disabling for those suffering. Headstones are today increasingly fabricated from manufactured, rather than mined, stone products, which produce high levels of crystalline silica when cut and shaped. Hundreds of stonemasons nationally have been diagnosed with silicosis, resulting in a significant industrial health crisis.[22] Improved safety measures such as use of wet cutting machinery and improved safety masks may help reduce impacts.

[22] https://www.abc.net.au/news/2019-04-30/stonemasons-get-out-of-industry-as-silicosis-epidemic-strikes/11057592

9.3 Plaques and memorials for cremated remains

Conventionally, cremated remains have been memorialised either through a plaque placed on a niche holding the cremated remains in a cemetery or other memorial park, through the use of urns for home memorialisation, or through the scattering of ashes. Today in NSW, anecdotal reports suggest only around 30% of those who opt for cremation choose to have formal memorialisation in cemeteries, likely due to the cost of interment.

Plaques for cremated remains in lawn cemeteries and memorial parks are more land-efficient than memorialisation for burial, however, still rely upon the lawn cemetery model which, as discussed above, is unsustainable due to land-use inefficiencies and environmental impacts associated with maintenance of such spaces.

A common practice associated with cremated remains is the scattering of ashes. There appears to be a lack of clear evidence regarding the environmental impact of this practice. However, many agencies have expressed concern over the scattering of ashes in certain locations (Vidal, 2009). Popular locations have included historic houses, sporting arenas—several of which, including Old Trafford, the home club of Manchester United, have requested that fans no longer scatter ashes at their stadium, due to a high concentration of cremated remains being deposited there (Vidal, 2009). Other sites, such as the home ground of Manchester City, have created memorial gardens for the scattering of remains to prevent them being scattered on sporting fields. Sikhs traditionally scatter ashes over running water—and this practice is now becoming increasingly popular outside the Sikh community. Vidal (2009) reports that several charter boat companies specialise in providing charters for the scattering of remains. A problem has also emerged in particularly scenic spots, with the Mountaineering Council of Scotland and Wales requesting people to stop scattering ashes from mountain tops because the added phosphate in the soil was overstimulating plant growth in fragile areas (Vidal, 2009).

Generally speaking, in NSW, permission is required to scatters ashes on private land, in parks, beaches or playing fields and other public places (Ministry of Health NSW, 2013). Scattering of ashes is often perceived as a low-impact practice, one which returns to the earth the body of the dead. However, as suggested above, there is little evidence at present that this practice is low impact.

9.4 Planted memorialisations

A recent and growing trend has emerged around the use of trees for memorialisation. Much of this appears to stem from a desire to have memorialisation that reflects the values of the deceased—for example, a love of nature. These planted memorialisations have taken two key forms: urns for ashes implanted with seeds and planted grave markers and memorials for natural burials. Several companies offer these urns for sale online, including:

- Spiritree—a biodegradable urn which facilitates growth of plants or trees from ashes
- Bios Urn—biodegradable urn with a capsule for seeds, that allows for a tree to grow with cremated remains

- Capsula Mundi—in addition to the burial egg mentioned previously, Capsula Mundi offers a biodegradable urn into which ashes are placed. The urn is then buried beneath a new or existing tree.

While these urns provide a means of have a lower impact memorialisation, and one which potentially reflects the values of the deceased, these options do not generally involve a lower environmental footprint than other methods of interment, as they still require that the body undergo conventional cremation. Within cremation practices, planted memorialisation of cremated remains is one of the practices with lower environmental impact, and so while these urns are likely a relatively lower-impact option than, say, memorialisation in a lawn cemetery, they do not necessarily mitigate any of the major environmental impacts of interment.

Figure 14: Planting process for the Spiritree urn (source: thespiritree.com)

Trees are commonly used as markers in natural burial. Trees as grave markers generally fit with the intention and purpose of a natural burial ground and tend to be aligned with the values of those who choose to be buried there. However, it is noted that not all natural burial grounds allow memorialisation or grave markers, and some prohibit any kind of memorialisation.

Let Your Love Grow notes that the pH level of cremated remains is extremely high, preventing the release of the 'good' nutrients contained within the remains. Further, the sodium levels in cremated remains range from '200 to 2000 times' what plant life can tolerate (Let Your Love Grow, 2019). Let Your Love Grow is a company producing biodegradable urns sold with an 'organic mixture' designed to lower the pH and dilute the sodium in the cremated remains. It is unclear whether other planted memorialisation companies account for sodium and pH in their products, and the degree to which this problem presents an issue for plant life in cemeteries or other contexts.

9.5 Digital memorialisation

Some natural burial grounds, especially where memorialisation is prohibited, use GPS to help people locate burial sites. Natural burials have also involved attaching a GPS tracker to the burial shroud to allow GPS location of the burial site in future (Brenoff, 2017). Sites such as Resting Place by Heaven Address allow people to find the location of burial sites, as well as other digitised information such as details about the deceased, photos of the burial site, and offers the opportunity to attach online memorials to listings.

Many cemeteries are also beginning to digitise records of burials, through creating digital archives of those interred as well as images of headstones and other memorialisation. Canberra Cemeteries has been creating a digital record of all burials in its cemeteries to provide a searchable online archive. Anecdotal evidence suggests some cemeteries are using digitisation as a strategy to prepare for cemetery renewal or renewable interment, providing a means through which to retain records of burials and interment while facilitating more efficient land use.

Websites have begun offering templates for creating online memorials. Websites such as Forever Missed, Gathering Us, iLasting, Memorial Haven and Never Gone provide templates—some free, others with pricing plans or one-off fees—which allow users to create personalised online memorials for loved ones.

Research participants also identified the potential for digital memorialisation and virtual reality monuments to replace conventional memorialisation. This was suggested in particular as a way to facilitate multi-purpose cemetery spaces and natural burial grounds, without clashing with consumers' expectations around memorialisation. A reported reason for resistance to natural burial grounds is the lack of memorialisation and monuments associated with these sites—the lack of physical markers apparently jars with consumers' expectations regarding memorialisation. Augmented or virtual reality experiences, including digital monuments which could be experienced via virtual reality technology (e.g. the Oculus Rift), could provide opportunities for mourners to interact with memorials and monuments while keeping the site free of physical monuments and facilitate multi-use or conservation outcomes. This would also make memorials and monuments highly personalisable and interactive, and could provide opportunities for multi-media memorialisation (e.g. videos, photos, audio recordings etc). It could allow visitors to interact with the monument or memorial, leaving messages, videos or recordings to build a virtual memorial that is also physically linked to the site. Research participants were not yet able to identify examples of this that are presently available.

9.6 Other alternatives

A range of other alternatives are currently on offer internationally. Several of these claim to be associated with lower environmental impacts than conventional options, however it is unclear that they actually offer improvements over conventional methods.

Algordanza is a Swiss company which produces synthesised diamonds from cremated remains. Customers can ship a minimum of 500 grams of cremated remains to their lab where they will be transformed into a diamond for memorialisation (McDonald, 2019). The process takes 5-8 months due to the complexity of synthesising a diamond. Costs are not listed on the Algordanza website, however it is assumed that they would be prohibitively high for most consumers. No data was found on the environmental costs of this method. However, given that the method involves conventional cremation, international transport of remains, high-tech treatment of synthesised remains and then return international transport, it is difficult to imagine that this method of memorialisation offers any environmental benefits over other methods. Further, as carbon comprises only around 1-5% of cremated remains, little of the remains are actually used to produce the memorial (Algordanza, 2019).

Reef incorporation of cremated remains is an alternative currently offered in the US. Multiple providers offer a service that combines a cremation urn, ash scattering and burial-at-sea into a single memorialisation option. Artificial reefs are constructed using cast concrete which incorporates cremated remains which are then placed in the ocean to facilitate the growth of reefs (Eternal Reefs, 2019). This memorialisation alternative also provides opportunities for the involvement of families and friends in the production of the memorial, and for personalisation (Eternal Reefs, 2019). According to Eternal Reefs, there are more than 1,800 reef memorialisations

off the coast of the US (Eternal Reefs, 2019). We have not found evidence of this alternative being offered outside the US.[23]

As with other alternatives, this memorialisation alternative does little to mitigate the environmental impacts of the body disposal. Firstly, it relies on conventional cremation, which involves a significant environmental impact and the use of concrete, the production of which is a major source of greenhouse gas emissions. There is a lack of evidence available at present about the ecosystem benefits of these artificial reefs or their long-term viability in a changing climate, casting doubt on whether any of the purported benefits of this practice can be realised. As with other alternatives, rather than providing a truly sustainable alternative practice, this approach to memorialisation simply appears to offer a means by which people can be interred in a way that they feel reflects their values—for example, a love of the ocean.

9.7 Donation of bodies to science

Each year, around 2,000 Australians donate their bodies to science.[24] Unlike organ donation, donation of bodies to science is not regulated by a national program. State legislation governs the donation of bodies, and programs are administered individually by universities. Universities use these bodies for the purposes of research and education, ranging from the education of medical students to research regarding decomposition rates of bodies, for example through UTS' Australian Facility for Taphonomic Experimental Research. Donation is regulated under the NSW Anatomy Act (1977) and the Human Tissue and Anatomy Legislation Amendment Act (2003).

Donors must arrange with a specific university to donate their body. Bodies are generally embalmed using formalin, a formaldehyde solution, in order to preserve the bodies for continued use. As mentioned earlier, formalin is a harmful substance, both a carcinogen and a respiratory irritant, and can cause skin irritation also. Universities may keep bodies for up to four years. After the program has no further use for the body or at the end of the four-year period, remains are generally cremated, though can be buried upon request, usually at cost to the donor's family.

Donors tend to be non-religious, and often work in health or health-related industries or education (Bolt et al., 2010). Motivations regarding donations of bodies to science tend to relate to a desire to be 'useful' after death by contributing to medical knowledge, education and science—but also to a negative attitude towards funerals, the funeral industry or conventional methods for body disposal (Bolt et al., 2010). Donation thus provides an alternative that is both useful and avoids engagement with the mainstream funeral and interment industry.

From a sustainability perspective, evaluating donations of bodies to science is not straightforward. While prolonging the 'useful' life of the body, donation to science still holds sustainability implications. Firstly, the body is embalmed, usually using formalin, a toxic substance. Secondly, the body is kept in refrigeration for up to four years, with a resulting energy footprint relating to electricity use. Finally, at the cessation of its use in anatomy labs, the body is then cremated in a conventional cremator or buried—meaning that its overall environmental impact is generally not less than that of a body disposed of immediately after death—and may, in

[23] Some media articles reported that the company Reef Ball Australia planned to offer this product in Australia, however websites for this company are no longer accessible and no contact details were available.
[24] https://www.gatheredhere.com.au/how-to-donate-your-body-to-science/

fact, be higher.[25] However, the ‘usefulness’ of the body to medical knowledge and education cannot be easily weighed in an assessment of environmental impact. It is perhaps most useful to note here that donation of bodies to science does not present a solution to environmental impacts, but presents a means by which individuals can feel that they will be ‘useful’ after death and can contribute to medical knowledge and education. If emerging alternatives which facilitated lower-impact body disposal were allowed in NSW, these alternatives could be coupled with donation of bodies to both prolong a body’s useful life and to minimise the impact of body disposal.

[25] Alkaline hydrolysis has been used in the US in some jurisdictions for disposal of body tissue in hospitals and research facilities, but not for whole bodies. In general, conventional cremation is used for disposal of donated bodies.

10 Findings: Advocacy and certification

In the USA, as well as in the UK, various charities or non-profit business organisations provide information and advice to consumers to increase their awareness of their options and rights. Some of these organisations, such as the Funeral Consumers Alliance in the United States, focus mostly on affordability issues, while still providing information on more sustainable options. Others specifically focus on sustainable issues, particularly green burials (e.g. Natural Death Centre, Green Burial Council and the Green Burial Project).

There is no equivalent of these charities or non-profit business organisations in Australia. The only charity identified in Australia, is the Natural Death Care Centre, which provides training on the whole experience/process of dying and funeral. A website (Gathered Here) compares prices between funerals, but does not provide information or price comparison about sustainable options more specifically.

10.1 Natural Death Centre (UK-wide)

The Natural Death Centre (NDC) in the UK, was created in 1991. It is a charity which advises consumers regarding dying and funerals, to increase consumers' awareness of their options and rights. The NDC has a focus on environmentally friendly funerals and is providing advice to consumers regarding natural burials. It provides a directory of the natural burial grounds in the UK. It runs the Association of Natural Burial Grounds which developed a Code of Conduct by which all its members have to abide, providing assurance to consumers that best practices are being implemented on the site.

10.2 Green Burial Council (US-wide)

The Green Burial Council (GBC) is a non-profit business organisation created in 2005, which aims at providing information on green burials to service providers and the public. The GBC is structured in two non-profit business organisations. The first one focuses on the certification of cemeteries, product providers and funeral directors providing green services. The second one on developing outreach and educational programs to raise awareness about natural burials.

The GBC provides registries of burial grounds and cemeteries, including green cemeteries, GBC certified cemeteries, conservation burial grounds, natural burial grounds and hybrid cemeteries, certified product providers including shrouds, caskets, urns and embalming chemicals, and funeral homes. They also provide a range of educational material about green burials, as well as information about the process of becoming certified by GBC.

10.3 Green Burial Project (North Carolina, US)

The Green Burial Project (GBP) is an organisation focusing on educating the public on green burial options. The GBP provides advice regarding home burial and green burials. The website also provides information about the different interment options, as well as a directory of green burial grounds, funeral homes providing green services and green products (shrouds, coffins etc).

10.4 Funeral Consumers Alliance (US-wide)

The Funeral Consumers Alliance (FCA) is a non-profit organisation aiming at protecting consumers' rights, particularly the right to an affordable funeral. The FCA provides information and advice on how to finance a funeral. It also provides a range of advice and information on green burials, such as the reasons why a green burial might be a good choice (sustainability, cost etc), green burial grounds in the USA, how to make a funeral 'greener', how to choose a funeral director for a green burial and the costs. The Funeral Consumers Alliance has local affiliates in the United State and Canada.

10.5 Natural Death Care Centre (NSW, Australia)

The Natural Death Care Centre (NDCC), based in the Byron Shire in NSW, aims at empowering people by informing and educating them about their legal rights regarding funerals. More generally, the NDCC claims to have a holistic approach to death based on the demystification of the experience/process of dying. The main activity of the NDCC is to provide a three-days training ('deathwalker training') which focuses on exploring and embracing death, preparation and advocacy, and caring for and being with the dying. The second element ('preparation and advocacy') provides training regarding the planning of the funeral and the importance of preparing the funeral, the various options/services available as well as the legal dimensions.

10.6 Gathered Here (Australia)

Gathered Here is an Australian website where consumers can compare the prices of funerals, funeral celebrants, headstones and wills and probate. For each funeral home, Gathered Here provides an estimate of the price according to the type of interment (burial or cremation) and services chosen, as well as an indicative price list for each product. No information is provided regarding sustainable options. Gathered Here is simply a price comparator, which does not provide any information/advice on consumers' rights and options.

The lack of an advocacy or certification body for sustainable interment services in Australia is likely both a product of and a contributor to the lack of consumer choice regarding sustainable interment options in Australia. An advocacy body could help provide guidance for consumers, certify products or services, and provide a repository of information that would help consumers in researching their interment purchase or planning decisions.

11 Discussion: A comparison of options

To provide a summary of our findings, we have created a table comparing the methods and practices described in the sections above. This table (Table 3) is based on the findings of the research methods undertaken in this project. The table is for comparative purposes only, and should not be regarded as definitive advice regarding the environmental impacts of these products and services. The lack of comprehensive life-cycle analyses available in the literature meant that we were not able to develop concise estimations of the environmental impact of these practices. The values indicated in the table are therefore relative or comparative indications of the impacts of various practices and products. They were developed using our analysis of both the literature and our interviews with stakeholders, as well as our expert knowledge as sustainability researchers. More research would be required to identify the precise contributions of various practices and products, and the exact potential of these practices to minimise environmental impacts.

This table is intended to provide a high-level indication of the potential of various options to address environmental sustainability, social and financial issues and its likely fit (or otherwise) within the NSW regulatory and operating environment. We also provide some indication of the likely viability of this option in NSW going forward.

A key (Table 1) is provided below to explain the categories used in the table, and the criteria used to allocate practices to these categories

Table 2) are also described below. The baseline for comparison of these categories was conventional burial, cremation and memorialisation practices—again, we note that this is for comparative purposes only, without a lifecycle analysis of these baseline practices and of emerging practices, we are unable to definitively identify environmental impacts.

Table 1: Key applicable to Table 3

Colour	Description	Explanation
	Poor	E.g. poor potential to address environmental issues
	Moderate	E.g. moderate potential to address affordability issues
	High	E.g. high degree of fit with current regulatory environment
	Insufficient information available	
	Not applicable	

Table 2: Criteria used to develop Table 3

Issue		Criteria
Environment	**Land-use**	Is this option relatively land-efficient compared to the conventional practice?
	Resources	Does this method improve sustainability of outcomes with regards to resource inputs into interment (quantity of inputs, sourcing of inputs, and associated toxicity from production)?
	Pollution	Does this method reduce pollution levels compared to the conventional practice (including leachate, emissions, carbon dioxide etc)?
Social acceptability		What is the likely level of social and cultural acceptability of this method (at the population level)?
Regulatory environment		Would this method be easily adopted in the existing regulatory environment?
Infrastructure and operations		Would this method be easily adopted in the context of existing operations and infrastructure?
Affordability		Is this method affordable (relative to other methods and for the average Australian)?
Viability		Is this method likely to be commercially viable in NSW (considering any establishment costs and expected demand)?

Table 3: Comparison of the interment practices and products discussed throughout this report.

Category	Practice/ Product/ Process	Potential to deliver environmental improvements			Social acceptability	Fit with regulatory environment	Fit with current interment operations / infrastructure	Affordability	Viability in NSW
		Land-use	Resources	Pollution					
Preparation of the body	Conventional embalming								
	Eco embalming								
Vessel	Conventional coffins								
	Rental coffins								
	Eco coffins								
	Shrouds								
Burial	Perpetual tenure								
	Renewable tenure								
	Single occupancy graves								
	Multiple occupancy graves								
	Vertical cemeteries								
	Above-ground mausolea								
	Ossuaries								
	Lawn cemeteries								
	Multi-functional cemeteries								
	Natural burial								
	Conservation burial								
	Burial at sea								
	Non-urban cemeteries								

Category	Practice/ Product/ Process	Potential to deliver environmental improvements			Social acceptability	Fit with regulatory environment	Fit with current interment operations / infrastructure	Affordability	Viability in NSW
		Land-use	Resources	Pollution					
Cremation	Conventional cremation								
	Direct cremation								
	Renewable cremators								
	Open-air cremation								
Emerging alternatives	Promession/ cryomation								
	Alkaline hydrolysis								
	Composting								
Memorialis-ation	Headstones on graves								
	Plaques for cremated remains								
	Natural burial: minimal memorialisation								
	Planted memorialisations								
	Digital memorialisations								
	Diamonds								
	Reefs								

11.1 Identifying pathways forward

As illustrated in Table 3, the findings of our research indicate that there is no silver bullet when it comes to making body disposal and memorialisation practices more sustainable. Many options present advantages in certain areas but not in others: for example, some options might be land efficient or reduce the input of resources, but may have low social acceptability or be associated with high costs for consumers.

This suggests that a multi-pronged approach to addressing sustainability in the sector is required. A consistent theme throughout our engagement was the need for improved choice. At present, consumers in NSW have very limited choices for body disposal. These limited choices are further exacerbated by a lack of information, poor awareness by consumers regarding the options available to them, and limited understanding of the regulatory requirements. Consumer decisions around memorialisation and disposal are rarely well informed or thoroughly researched, and it appears providers rarely offer consumers a wide range of options—especially when it comes to more sustainable choices.

The above table identifies that a number of practices/products may be particularly feasible as pathways for minimising the environmental impacts of body disposal and memorialisation practices. These include:

- Eco coffins and the use of shrouds for burials and cremations
- The installation of renewable energy for crematoria
- Natural burial, including conservation burial, which while far from a perfect solution may provide opportunities to serve those populations who require burial, offering a less impactful alternative to conventional burial
- Composting of bodies
- The adoption of a range of memorialisation alternatives which reduce environmental impact and are likely to be more land efficient than conventional memorialisation.

The greatest challenge for emerging alternatives and other sustainable options and products is likely to be around gaining social acceptance and combating inertia within the industry. Little is known at present regarding the level of social acceptance for emerging alternatives such as composting of bodies, indicating more research is required to understand how this model may be accepted in Australia.

Shifting towards a more sustainable future for this sector in NSW requires, then, multiple steps that address challenges on several fronts. The aim of such efforts should be to significantly widen consumer choice, rather than to simply advance a single more sustainable option. Consumers should be able to select from an array of options that correspond with various values and beliefs, and which offer improvements on environmental impacts as well as affordability. The methods, products and practices that will appeal to various groups will vary widely, hence the need to enable a range of activities and services, and not merely one or two emerging alternatives.

While some stakeholders believe that consumers are ultimately conservative around interment decisions, experience over recent decades in NSW suggests that, in fact, consumers are relatively quick to embrace change—as evidenced by the rapid shift towards cremation in the last 40 years. Many of the stakeholders engaged throughout this research indicated that, should consumers be given improved choices and empowered with adequate information regarding making more sustainable choices, many consumers would readily change their choices.

In the final section below, we identify a number of opportunities for future steps that could be taken by stakeholders across the industry in order to pave the way for a more sustainable future in NSW. We also enumerate the challenges identified, in order that the barriers to sustainable practice be well understood before we identify opportunities for enabling change towards more sustainable futures.

12 Discussion: Key challenges and opportunities

12.1 Challenges to sustainable practices

In this section, we report on the challenges to sustainable practice that we identified throughout our research.

12.1.1 Regulation and planning

Public health focus in regulation

- The current focus on public health frames bodies as contaminants or hazards, which determines their subsequent treatment. This significantly restricts opportunities for innovation or more sustainable practices, as it frames post-death care and interment practices in risk management terms. Several regulations appear to be unnecessarily restrictive (e.g. requirements mandating that all burials and cremation must utilise a coffin), creating requirements that ultimately perpetuate unsustainable practices within the industry. While there is a need to ensure public health is protected, regulatory reform may be required if NSW is to realise a more sustainable range of options in future. If exceptions for the use of shrouds can be made for some members of the public, it is assumed that the level of risk arising from this practice is acceptable, and that this practice could be expanded to be offered for all consumers who would like to elect for this.

Limited choices due to legislative restrictions

- At present, burial and cremation are the only two allowable methods for disposal of bodies in NSW under public health regulations. Consumer choice is, then, constrained heavily by regulation. In Washington, Recompose and others lobbied to secure legislative change that provides more options at end of life. NSW may need to consider how legislation could be amended to facilitate more consumer choice.

Some inconsistency across regulations

- Inconsistencies across legislative and regulatory areas create uncertainty for operators. For example, alkaline hydrolysis is permitted under the Public Health Regulations 2012, however regulatory hurdles relating to the management of wastewater have prevented implementation. Better coordination may be required to ensure that options enabled under certain regulations are not then prohibited by others, as this creates operating uncertainty and hinders the ability for emerging alternatives to become established.

Lack of planning for cemeteries

- Cemeteries are not a priority planning issue in strategic metropolitan planning in NSW's urban areas. Cemeteries are rarely actively planned for, and our research indicated that significant political and public opposition tends to arise regarding the development of new cemeteries and memorial parks in NSW. In addition to expanding options to provide

alternatives to conventional burial, burial grounds including natural and conservation burial grounds should be actively planned for. Improved public consultation and engagement, and engagement with local political players, could help reduce opposition through presenting cemeteries as opportunities to advance regional development and conservation.

Lack of carbon pricing/regulation

- In the absence of a national carbon pricing/taxation scheme, few financial incentives or penalties exist to shift cemeteries, crematoria and other operators to adopt practices with lower carbon intensity. A national carbon pricing/taxation scheme would help shift operators to more sustainable practices. However, in the absence of national regulation, operators could be encouraged to shift practices by being exposed to examples relating to cost-saving from shifting to renewables, such as through sharing the example of the Chain O Ponds cremator throughout the industry.

12.1.2 Industry inertia

Profit-driven industry

- At present, the mainstream industry is focused on sales of products—embalming services, caskets, funeral add-ons etc—rather than as a care or service industry. Profits in the industry, as a result, have been primarily driven by the sale of coffins/caskets and embalming services. This creates direct disincentives to change practice or reform regulations to support sustainability as such moves may threaten commercial viability of funeral businesses.

- The growth of not-for-profit providers, especially in the funeral services sector, promises to help shift the focus from sales-driven towards a more community-oriented approach to funeral and body disposal services. Not-for-profit providers tend to see themselves as providers of services to their customers rather than focusing on product sales. Not-for-profit providers tend to offer cheaper alternatives and a range of options that allow family and community members to become more actively involved in the care of and decisions regarding the deceased. Sustainable options are a more natural fit with the not-for-profit sector, that is more focused on providing choice and affordability than commercial operators tend to be, and these environmentally-friendly options do tend to be frequently offered by providers in this space. However, not-for-profit providers represent only a tiny proportion of the total sector in NSW at present.

- Research participants representing the mainstream operators in the sector claim that the sector is consumer driven, and that the lack of consumer demand is a major factor inhibiting innovation or the offering of more sustainable options. However, as mentioned below, other actors, including consumer groups and not-for-profit providers, argue that consumers have very little influence and choice in this sector. Empowering consumers and raising awareness of alternatives—and encouraging consumers to actively demand a wider range of options—will help address this industry perception that consumers are not interested in alternatives or in more sustainable options.

Lack of choice and consumer disempowerment

- The sector involves a particularly vulnerable and disempowered consumer profile. These consumers are often encountering the process for the first time and find themselves required to make decisions about expensive purchases often in difficult emotional circumstances and with time pressures. Consumers do not often undertake research as they might in other decisions, are not provided clear and adequate information about their choices, nor about the costs or full range of products available.

- Many people appear to choose cremation only because it is the cheaper of the two options presented in NSW at present. Our interviews suggest people do not select cremation because it is particularly aligned with their values or preferences, but because it presents a more affordable option than burial. More choices are required to allow consumers to be empowered to make choices that reflect the broader spectrum of affordability, values, interests and preferences.

- Consumers are rarely presented with a wide range of options when they reach the decision point, and this constrains their ability to make more sustainable choices. Anecdotal evidence gathered through interviews suggests that when consumers are given greater choice, they are more likely to select more environmentally friendly options—even if for aesthetic reasons—e.g. wicker coffins. However, for a range of reasons but especially driven by a desire to maximise profit margins, consumers are rarely offered a range of options that include more sustainable choices.

No incentive for innovation or change

- The sector will never be short of customers: people die every day, meaning that there is little need to innovate in order to maintain their customer base, especially with a growing and ageing population in NSW. At present, innovations emerging overseas (e.g. natural burial, decomposition, direct cremation) are not yet being adopted at scale in NSW, reflecting the fact that there is little incentive for the industry to improve practices.

- Several of our interviewees that are currently engaged in innovative or alternative practices had backgrounds outside the industry. Many of these people had experienced the sector as consumers making decisions following the deaths of loved ones, and were prompted by their experiences to take action to change things. The lack of choice, lack of affordability and lack of power held by consumers were described as motivators for the involvement in the industry of these stakeholders.

- Regulation at present perpetuates the inertia, for example through requiring the use of coffins/caskets for both cremation and burial, except with express permission for the latter. Regulation is currently serving to prevent operators with an interest in change from initiating any new or more innovative practices.

- While some players in the industry are pushing for change, the big operators have a great deal of power in NSW, controlling a huge proportion of the market and creating a great deal of inertia. These larger operators have direct incentives to maintain the status quo, and little incentive to innovate or push for more sustainable practices, so little change appears to be on the horizon.

- Our research participants indicated that the current high cost of land and pressures upon land-use mean that securing areas for innovating, whether through offering new/experimental models or conducting research, is very difficult. Some operators are interested in conducting research or in testing market demand for alternatives (e.g. natural burial) but financial and land availability pressures mean that the business case for innovation and experimentation does not stack up.

- Research participants also indicated that the sector has struggled to secure research and development grants or tax breaks for looking into innovative practice and research, due to the sector not being perceived as a site for innovation. This inhibits operators' ability to undertake research and development.

12.1.3 Social and cultural factors

Cultural and religious factors

- Clearly, longstanding cultural and religious beliefs will continue to ensure traditional practices will remain largely unchanged. However, our findings above demonstrate that small changes within these practices—which will not impinge upon adherence to cultural/religious requirements—may help improve the interment sector's sustainability. Cultural and religious practices need not be seen as a hindrance to sustainable practice, and indeed, as is the case with Islamic burials, may already be strongly in line with more sustainable practices.

- Presently, those represented by the dominant religions tend to have their cultural/religious preferences well catered for—an exception to this is the Hindu community, whose preference for open air cremations is not permitted. However, many of those in minority groups or who do not belong to mainstream religious or cultural groups find it difficult to select funeral and interment options that reflect their values and preferences. A more sustainable future for the industry would help enable a wider range of options to facilitate improved choices made available to all, not just those whose cultural and religious practices are currently catered to.

- Some anecdotal evidence (though our interviews suggested stakeholders are far from arriving at a consensus on this question) indicated that many 'baby boomers'—Australians born between 1946 and 1964—have been unsatisfied with the options available to them as they have made decisions about body disposal for their parents' generation. This, several stakeholders indicated, is likely to result in change as this generation agitates for improved choices. However, other stakeholders are less convinced that baby boomers will be the source of change, believing that such wide-scale changes will not be realised until younger generations—who tend to hold more secular values and are familiar with environmentally-conscious practices—are more engaged in interment decision making.

Cost and affordability

- Cremation is often chosen as a default option because of affordability factors. If other alternatives were offered at similar price points, our research indicates that people would likely be willing to take them up: for many secular people who may not have strong preferences regarding body disposal, cost is the major factor influencing their choice.

- The high cost of land in metropolitan NSW is likely to inhibit widespread uptake of natural and conservation burial in urban areas, which will likely remain at a high price point given current land values and pressures upon burial space. However, opportunities exist for natural and conservation burial to be implemented in rural and regional areas, where it may contribute to regional development and provide sustainable alternatives at a lower price point than is possible in urban areas.

- Despite potential for sustainable practices to offer more affordable options for consumers, at present sustainable options tend to be offered as 'luxury' options, rather than as affordable alternatives. This is partly due to the way they are marketed by commercial providers, and due to low rates of uptake, which makes such products niche and therefore more expensive to provide. Growing demand for such products should see these sustainable options move from luxury options to affordable alternatives to conventional practices.

Social acceptability and resistance to new methods

- Evidence suggests people tend to become more conservative when making choices regarding body disposal. The social acceptability of new methods will be a major factor in their success and rates of uptake, and could present a barrier to emerging alternatives. Burial and cremation have become entrenched as the 'only' acceptable options in Western culture. However, it is worth remembering that the growth of cremation has been a relatively recent phenomenon, growing rapidly in the last 3-4 decades, from comprising a tiny proportion of all deaths to the vast majority in NSW, indicating that preferences regarding body disposal can shift significantly over relatively short timeframes.

Information and decision making

- A lack of choice was repeatedly mentioned by interviewees as a major problem in NSW—and recognised as being a problem in jurisdictions worldwide. One of our interviewees indicated that upwards of a dozen choices for body disposal methods—rather than the two options presented currently—would be ideal, indicating we have far to go in empowering consumers to make choices they feel comfortable with. The prohibitive cost of burial means that cremation emerges as the only viable option for many, with many citizens choosing it by default, rather than because of any values or preferences.

- Although some sustainable options are currently available in NSW, these are often not presented to consumers. Funeral directors have a vested interest in selling less sustainable options as they tend to be associated with higher profit margins. Finding information online about more sustainable options proved difficult, even when we conducted searches specifically looking to identify them, for this research. There is a lack of independent information provided from sources that are not commercial enterprises.

- In other countries, peak bodies and advocacy organisations provide consumers with guidance regarding more sustainable interment options—in addition to representing the needs of organisations and companies involved in provision of more sustainable alternatives. In Australia, access to adequate information is sorely lacking, and useful information about having a more sustainable funeral is not easy to come across.

12.1.4 Infrastructure and commercial viability

Relatively small market

- Relative to other jurisdictions, for example major US cities, China, urban areas in south-east Asia, the concentration of population in NSW is relatively low. Given a strong preference for conventional interment (burial and cremation) at present, the market for sustainable alternatives to conventional options is quite small. While this may grow over time, the NSW market appears to present limited opportunities for commercial operators looking to establish alternative interment practices.

High cost of and resistance to new infrastructure

- Operations within this sector tend to be associated with very high upfront infrastructure costs (for example, the construction of a cremator, designation of land as a cemetery site etc). This results in a great deal of capital tied up in maintaining the status quo—operators have invested significantly in current technologies and systems, and expect a reasonable return on investment.

- The high cost of establishing new infrastructure, coupled with the relatively small market mentioned above, may inhibit the development and implementation of emerging alternatives (e.g. promession/cryomation or the Recompose model) in NSW.

- Our research indicated that new interment facilities (crematoria and cemeteries were discussed, but it is likely that alternative facilities would face similar issues) are commonly met with high levels of opposition from local residents and local politicians. Gaining planning approval at the council level for establishing new interment infrastructure appears to be challenging and costly in NSW, potentially inhibiting the development of new options for NSW consumers.

12.2 A transformed interment sector: opportunities

Our research primarily focused on identifying the range of practices available around the world, and providing a preliminary overview of their relative potential for improving the sustainability of the sector. Throughout our research, a number of opportunities were identified for how the NSW sector could be transformed to better support more sustainable alternatives.

In this final section of the report, we identify opportunities for enabling more sustainable practice in NSW. Table 4 summaries the identified opportunities thematically. We recognise that the stakeholders who might hold responsibility for implementation of these initiatives are varied, and do not attempt here to assign responsibility for the implementation of these actions. These opportunities are presented as possible pathways forward for a more sustainable future for NSW, rather than as recommendations for CCNSW to take forward directly.

Table 4: Identified opportunities for enabling sustainable outcomes for body disposal practices in NSW

Theme	Opportunities for enabling sustainable practice
Preparation of the body	• Undertake research regarding safer alternatives to formaldehyde for embalming; ascertain fit with regulatory requirements regarding embalming • Provide clear guidance to funeral directors regarding the use of safer alternatives to formaldehyde and their fit with regulatory requirements • Ensure communication and engagement campaigns with consumers highlight that embalming is strictly optional and only required in very specific circumstances • Engage with training programs for embalming/funeral directors around possibilities for including education around safer alternatives to formaldehyde within qualifications for embalming • Consider removing from Public Health Regulation 2012 the time limit on how long bodies can be kept at home (with appropriate measures, such as cold plates, in place) before being transferred to a funeral home. Bring regulation in line with other states and make provisions for those who wish to care for the body in the home.
Vessel	• Undertake research (life cycle assessment or similar) to identify most sustainable vessels for burial and for cremation • Raise consumer awareness of the environmental impacts of coffins and caskets, raise awareness of alternative options available and elevate consumer understanding of their choice in this purchase decision • Undertake research to identify what role design and communication could play in stimulating consumer demand for more sustainable products • Consider regulatory reform to facilitate more widespread use of shrouds, including enabling their use for cremation, and to remove requirements that coffins be 'watertight', using the review of the Public Health Regulation 2012 • Raise consumer awareness around their choices relating to vessels for cremation (for example, promoting re-useable coffins with removable inserts for cremation and raising awareness of the option to use a shroud) through a communication and engagement campaign • Consider opportunities for the introduction of minimum standards for coffins which prevent the use of plastic liners, chemical preservatives (formalin etc) and other polluting inputs, to improve the environmental impact of coffins, especially those imported into Australia.

Burial	• Consider addressing gaps in strategic planning which overlook cemetery planning; engage with planning stakeholders to ensure cemetery planning considered at metropolitan, regional and local levels • Engage with government and political actors at state and local levels around the need for improved cemetery planning and the allocation of additional cemetery space, work to understand opposition to cemetery proposals and to identify strategies to address this • Engage with rural and regional councils regarding establishment of natural burial grounds as multi-pronged regional development, jobs and conservation program • Undertake research to identify the role that design could play in reimagining cemeteries, particularly in relation to peri-urban and regional options and natural/conservation burial grounds, and how design and communication could help reshape consumer expectations around cemeteries and interment • Identify opportunities to designate parcels of land for experimentation, research and innovation to assist operators interested in innovating to provide alternative models for consumers and to conduct research and development, possibly through research funding • Identify appropriate possible locations for natural burial grounds in regional and rural NSW, liaise with councils and engage with local communities regarding opportunities and barriers to establishing natural burial grounds • Encourage consumers to consider multiple occupancy graves as both cost saving and land-efficient strategy • Consider regulatory reform around the requirements relating to mausolea in NSW, to facilitate more uptake of practices such as burial in vertical cemeteries or in mausolea, which may be more space-efficient • Raise consumer awareness regarding natural burial as alternative to conventional burial • Consider whether regulatory changes to renewable tenure arrangements could be made to better facilitate reuse of burial plots by the same family members, potentially increasing uptake of renewable tenure and reduce social opposition to the practice. The upcoming scheduled review of the Cemeteries and Crematoria Act provides an opportunity to have input regarding this issue.
Cremation	• Undertake research to identify pathways to transition existing crematoria facilities to renewable energy sources

	• Undertake engagement campaign for crematoria operators regarding potential for transition to renewable energy; identify barriers and opportunities • Identify funding sources, for example, grants and funding for renewable energy upgrades, that might be leveraged to fund retrofits for crematoria to transition towards renewable energy sources • Undertake pilot program when new crematoria facilities planned in NSW: develop a 100% renewable crematoria as pilot
Emerging alternatives	• Undertake research to understand social acceptance in NSW for specific emerging technologies (e.g. promession, alkaline hydrolysis, the Recompose model) • Attain clarity regarding regulatory status of emerging alternatives in NSW; develop understanding of how these emerging alternatives could be facilitated through regulatory review • Engage with SydneyWater and EPA regarding emerging alternatives to understand how these could be safely enabled and facilitated in NSW • Engage with Recompose Washington regarding introducing their model and technology in NSW to understand barriers and opportunities
Memorialisation	• Raise consumer awareness regarding lower impact memorial methods (e.g. those not using manufactured stone) and ensure consumers are aware of choices available with regards to memorialisation • Improve consumer awareness of alternative memorialisation methods (e.g. biodegradable grave markers, GPS locators for grave sites etc)
Advocacy	• Support development of a community of practice, peak body or advocacy group regarding alternative funeral and interment practices and operators within NSW • Consider a program/campaign to provide consumers with certainty when making body disposal and commemoration decisions about sustainable services, products and options—differentiating between sustainable practices and greenwashing • Support the growth of the not-for-profit funeral sector in NSW • Address issues regarding the lack of funding for research and development within this sector and actively pursue opportunities to have this sector recognised as a potential site of innovation and sustainable action

- Develop guidance or a code of conduct for operators of sustainable funeral and interment options, similar to the Association of Natural Burial Grounds' Code of Conduct in the UK.

CCNSW may find opportunities to work with the industry to prompt and facilitate improved practice. These are mentioned above, but we highlight a number of specific opportunities for CCNSW here. These include:

- Advocating for sustainability to be a key consideration in reviews of relevant policy, regulation and legislation, including the Public Health Regulation 2012 and the Cemeteries and Crematoria Act 2013;
- Advocate for funding for research and innovation within the sector, liaising with other government agencies at both state and federal levels of government to ensure organisations within the sector have access to innovation funding;
- Where within CCNSW's remit, implement actions to improve consumer awareness of environmental impacts of body disposal practices and to improve consumer choice and knowledge;
- Engage with other relevant agencies (including EPA and SydneyWater) to understand how barriers to alternative practices could be reduced, with a view to improving consumer choice around body disposal options in NSW;
- Identify opportunities to work with crematoria operators to transition towards renewable energy use, including through use of federal and state funding for projects;
- Consider CCNSW's possible role in facilitating development of natural burial grounds in regional/rural areas.

We note that the review of two relevant pieces of regulation and legislation in 2020 provides an excellent opportunity for facilitating improved outcomes in this space in future. The review of the Public Health Regulation 2012 and the Cemeteries and Crematoria Act 2013 are both opportunities to seek amendments which could vastly improve outcomes, both relating to consumer choice and to environmental outcomes. Below, we provide recommendations emerging from this research regarding both strategic approaches to these reviews and specific amendments and revisions which might be sought.

Public Health Regulation 2012

A strategic approach to the review of this regulation could help facilitate improved outcomes for consumers and the environment. We suggest that the following are required:

- An approach to the regulation focused not on risk management framing, as the existing regulation appears to be, but rather on balancing public health risks with consumer choice, environmental impacts and affordability concerns;

- Involvement of a wide range of stakeholders in consultation on the review. This needs to include smaller and community-based not-for-profit operators, as well as more mainstream players in the industry. This is because mainstream providers have a vested interest in maintaining the status quo, regardless of outcomes for the environment or consumers. Emerging not-for-profit providers and consumer advocacy groups will have critical input that may help re-frame regulations to better balance consumer (choice and affordability, in particular) and environmental concerns with public health management. CCNSW's Community and Consumer Consultative Group should play a role in having input in such reviews;

- A review of the evidence base underpinning existing regulations. Evidence gathered through this research indicates that many regulations are based on outdated practices or evidence and place undue requirements which increase both costs for consumers and environmental impacts (e.g. the requirement to use a coffin for all burials and cremations, except where exemption is expressly granted in relation to burial). Given that exemptions exist for this requirement, and given that this requirement is not consistent across Australia, there is a need to review the evidence regarding the actual public health risk and the need for this requirement. This could be extended to a range of other requirements under the regulations.

A number of specific issues might be addressed through the review, including:

- The requirement to use a coffin for all burials and cremations, as identified above, should be reviewed with regards to the ways in which it inhibits choice and prevents more sustainable alternatives from being adopted. This requirement increases costs for consumers, restricts consumer choice and increases the environmental impact of these practices. Exemptions are possible for burial, but not easily accessible, and are not currently available for cremation. Evidence suggests that the perception of a real public health risk relating to the use of shrouds or other alternatives is misplaced, and many other jurisdictions use only a shroud or other covering rather than a coffin. Relaxing this requirement could help improve consumer choice, affordability and environmental impact.

- Revise the requirement that coffins be 'watertight' (clause 65) for transportation—engagement with research participants indicated that there is generally no public health risk presented by bodies, and that proper mortuary care should prevent the leakage of bodily fluids throughout transportation. The requirement that coffins be watertight encourages the manufacture of coffins with plastic liners, significantly increasing the environmental impact of these products. Removing the requirement—in addition to introducing Australian standards for coffin manufacture which minimise the use of plastics, as discussed elsewhere—will help improve the environment impact of coffins used in NSW, without introducing public health risks.

- Restrictions on the ability of families to care for a body at home and prepare it for burial/cremation prevent the uptake of alternative, community-based practices and force consumers to take up mainstream options which provide them with little choice, may not reflect their preferences and values and which are generally very costly. Regulations might be revised such that a range of alternative practices could be undertaken, with appropriate considerations for public health management. At present the regulations

prohibit anyone except a funeral director keeping a body for more than five days, despite technologies (cold plates etc) being available which could facilitate preparation of the body at home without creating a public health risk.

- Consider opportunities to expand the allowable methods of body disposal in NSW. At present, only burial, cremation and alkaline hydrolysis are allowable (though as discussed elsewhere, implementation of alkaline hydrolysis is made difficult through securing licences for disposal of outputs). Emerging alternatives such as the Recompose model for composting are not permissible in NSW, inhibiting scope for innovation and restricting consumer choice. The review could consider whether there is scope to expand the range of allowable methods in NSW to involve new and emerging practices allowed in other jurisdictions.

- Considering removing the requirement to embalm bodies which are to be placed in mausolea or other above-ground crypts. This requirement compels the use of toxic chemicals, and also prevents decomposition. There may be potential for renewable tenure to be applied to mausolea, where remains can be transferred to an ossuary after a designated period. However, the use of embalming fluids, required through the Public Health Regulation, prevents decomposition of the body and also makes exhumation more hazardous. This requirement could be relaxed, bringing requirements more in line with other states such as Victoria, where embalming is not required for interment in mausolea. Other appropriate measures such as ventilation, drainage and improved vault design could be used to better manage the process of decomposition in above-ground vaults.

Cemeteries and Crematoria Act 2013

As above, we've identified both strategic approaches and specific aspects for review in regards to this legislation. At a strategic level, the review needs to involve a wide range of stakeholders representing a diversity of views. The review needs to address the specific concerns arising in relation to the practical implementation of renewable interment in particular, acknowledging that the legislation in its current form is unlikely to facilitate widespread uptake of renewable tenure (as indicated by the IPART review (IPART, 2019b). CCNSW's Community and Consumer Consultative Group as well as the Industry Consultative Group should be key informants in any consultation undertaken as part of the review.

With regards to specific aspects for review:

- In alignment with the findings of the IPART review, we suggest that coordinated, state-level strategic planning for the identification and acquisition of new land for cemeteries is required. This may be a role for which CCNSW is uniquely placed. Given ongoing challenges in securing adequate land for future interment, a clear and coordinated strategic direction is needed, preferably with a single agency (CCNSW) given responsibility for this.

- Revision of details regarding renewable tenure appears to be required. At present, renewable tenure appears unlikely to make any significant contribution towards alleviating land shortages for interment in NSW, due to low rates of uptake. However, as detailed earlier in this report, some changes to the way renewable interment is handled could better support implementation. For example, an option for a renewable interment right to be handed on through a family for subsequent interments could help improve social

acceptance. Interment rights could remain within a family to be used for subsequent interments, rather than being passed to a stranger if the right is relinquished. Families may be required to pay annual fees to sustain the right beyond the 25-year term, but could exercise the option to subsequently bury other family members in the same plot. Beyond the regulatory review, public education and ongoing engagement with operators will be required to help build buy-in and to familiarise the public with these new options.

- A review regarding whether maintaining perpetual tenure for very old (>100 years) burial plots is viable may be required. At present, all existing burial plots excepting those sold specifically with renewable tenure rights are treated as perpetual. However, these very old plots are associated with significant ongoing maintenance costs for cemeteries, and effectively 'lock up' space for the future. Considerations regarding heritage and consumer protection must of course be made.

- Consider including a requirement that cemetery operators could be compelled to report on their land-use efficiency. Holding cemetery operators accountable to their land-use efficiency could help prompt greater innovation and creativity, as well as strategic planning, to deliver improved land-use efficiency in future.

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Appendix 1: List of relevant regulation and legislation

The report discusses a number of pieces of legislation and regulation relevant to the governance of body disposal, interment and other relevant matters. In particular, the Public Health Regulation 2012 and the Cemeteries and Crematoria Act 2013 were discussed due to their direct relevance to matters raised throughout this research. Here, for reference, we provide a list of all relevant regulation and legislation at State and Federal levels relating to cemeteries, crematoria, body disposal and other relevant concerns. We thank CCNSW for providing this comprehensive overview of relevant acts and regulation.

- *Public Health Act 2010* and Public Health Regulation 2012*:* transportation and disposal of bodies
- *Cemeteries and Crematoria Act 2013* and Cemeteries and Crematoria Regulation 2014: Crown cemeteries and crematoria as well as private, church, local government and community operators.
- *Funeral Funds Act 1979* and Funeral Funds Regulation 2016: financial products relating to funerals
- *Births, Deaths and Marriages Registration Act 1995* and Births, Deaths and Marriages Registration Regulation 2017: registration of deaths
- *Crown Lands Management Act 2016* and Crown Lands Management Regulation 2018: management of Crown lands (many cemeteries in NSW are situated on Crown land)
- *Life Insurance Act 1995* (Commonwealth): funeral insurance
- *Local Government Act 1993:* A number of issues including mortuary approvals and exemption of public cemeteries from rates
- *Fair Trading Act* 1987 and Fair Trading Regulation 2019: regulates the funeral industry
- *Environmental Planning and Assessment Act 1979* and Environmental Planning and Assessment Regulation 2000*:* Provides that an environmental planning instrument may make provision for reserving land for use for the purpose of a public cemetery. Generally, any use of land for cemetery and crematoria would require development consent under this Act. Various environmental planning instruments make specific provision for cemeteries and crematoria
- *Environmental Protection (Sea Dumping Act) 1981* (Commonwealth): burial at sea
- *National Parks and Wildlife Act 1974*: protects Aboriginal cultural heritage including cemeteries

- *Summary Offences Act 1988:* relates to damage of protected places (including interment sites)
- *Aboriginal Land Rights Act 1983, Native Title Act 1993* (Commonwealth) and *Native Title (NSW) Act 1994:* relevant to cemeteries on Crown land
- *Land Acquisition (Just Terms Compensation) Act 1991:* relevant to revocation of burial rights under compulsory acquisition of land
- *Western Sydney Parklands Act 2006:* allows the parkland Trust to establish or permit a cemetery or crematorium
- *Sydney Water Act 1994* and *Water Management Act 2000:* relates to water charges for public cemeteries
- Local Land Services Regulation 2014, *Land Development Contribution Management Act 1970, Land Tax Management Act 1956*: relate to rates, taxes, contributions and levies for cemeteries
- Independent Commission Against Corruption Regulation 2017: defines each reserve Trust for cemeteries/crematoria as a "public authority"
- *Public Works and Procurement Act 1912*: public cemeteries are deemed to be public works and undertakings
- Work Health and Safety Regulation 2017: *Excavation* means a trench, tunnel or shaft, but does not include a trench for use as a place of interment
- *Fire and Emergency Services Levy Act 2017.*