

Cemeteries and Crematoria NSW

METROPOLITAN SYDNEY CEMETERY CAPACITY REPORT

Analysis of remaining cemetery capacity in the Sydney metropolitan area (the Central, South, North, West, West-Central, and South-West planning regions).

November 2017

Cemeteries and Crematoria NSW Metropolitan Sydney Cemetery Capacity Report

Abstract: Analysis of remaining cemetery capacity in the Sydney metropolitan area.

Cemeteries and Crematoria NSW (CCNSW) surveyed operators of all active metropolitan Sydney region cemeteries in respect of:

- cemetery land areas already used for interments
- land areas not already used for interments as at 1 Jan 2015, but which can be used for interments (new interments only, not second interments)
- land areas not already used for interments, and which cannot be used for interments (infrastructure, roads, curtilages, etc.).

This report presents and analyses cemetery capacity information provided by metropolitan Sydney region operators. The analysis identifies that if current cremation and 'grave occupancy' rates continue, burial space in Sydney cemeteries will be exhausted around 2051, with likelihood of unavailability of burial plots where no pre-purchase was undertaken from ten or more years before that time. The report finds that urgent action is required to provide for the future burial needs of the Sydney community. The report will be of significant value to industry and government in planning for future community needs, particularly in relation to potential cemetery developments. This analysis is informed by current cremation and grave occupancy rates published in the Cemeteries and Crematoria NSW 2014-15 and 2015-16 Activity Reports.

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MESSAGE FROM THE MINISTER

Sydney today benefits from the foresight of previous generations, through our many remarkable and historic cemeteries, which are valued as special community places. Cemeteries provide essential services to the community, often at very stressful and difficult times.

Many of Sydney's cemeteries have very limited remaining capacity for future burials. The Sydney population is projected to grow from 4.68 million in 2016 to 6.42 million in 2036. Delivering on the infrastructure needs of Sydney's communities is critical to maintaining the city's status as a liveable, sustainable, and productive global city.

The NSW Government is delivering on the planning and research actions needed to inform key infrastructure decisions. The Plan for Growing Sydney establishes a framework for decisions that provide for Sydney's future productivity and liveability, and deliver a legacy for future generations. Actions to provide for the cemetery and crematoria needs of our metropolitan community are clearly identified in the plan.

In terms of cemeteries, the Sydney community expects that an individual's right to a dignified interment will be respected and that religious and cultural practices will be protected and supported. Community members expect to be able to access cemeteries reasonably close to their home, so they can regularly visit these special places for remembrance and reflection.

Commencing in 2012, the NSW Government has delivered a range of reforms to the planning and delivery of cemeteries and crematoria services across the state, demonstrating the government's commitment to meeting these community expectations. A new act governing cemeteries and

crematoria commenced in 2014, with objectives to recognise the right of all to a dignified interment and treatment of their remains with dignity and respect, to ensure that the interment practices and beliefs of all religious and cultural groups are respected and provision is made for all, and to ensure that sufficient land is acquired and allocated so that current and future generations have equitable access to interment services.

The government established Cemeteries and Crematoria NSW (CCNSW), and assigned responsibilities to the agency to assess current and future interment needs and provide recommendations to the government in relation to the sustainable use of cemetery and crematorium space and capacity.

The CCNSW Metropolitan Sydney Cemetery Capacity Report is a notable achievement for CCNSW, and delivers an objective assessment and projection of current and future cemetery land needs, as key evidence to help inform Sydney land use planning.

I am pleased to present this report as another significant milestone in the NSW Government's reform of this critical sector for the people of our state and the communities of metropolitan Sydney.



The Hon. Paul Toole, MP



MESSAGE FROM THE CHAIR

On behalf of the Board, I am very pleased to present the Cemeteries and Crematoria NSW (CCNSW) Metropolitan Sydney Cemetery Capacity Report.

Cemeteries and crematoria are critical community infrastructure and provide essential services to the people of NSW. Among the serious challenges facing the interment industry is the growing awareness that cemetery space in metropolitan Sydney is fast running out.

In 2015 CCNSW published its strategic plan, identifying priority actions to be completed over the current five years. The plan includes priority actions in respect of land availability, to ensure that sufficient and suitable cemetery land is available to meet future community needs for interment services. CCNSW undertook to build and publish an evidence base regarding future demand for cemetery space at a local and regional level, commencing with the Greater Sydney area.

This CCNSW Metropolitan Sydney Cemetery Capacity Report delivers on that commitment, identifying cemetery capacity remaining in Sydney's cemeteries, projecting the exhaustion of existing cemetery space over the years through to 2056, and identifying the regions facing a critical shortage and requiring urgent action to provide future cemetery space.

The report could not have been prepared without the support and cooperation of metropolitan Sydney cemetery and crematoria operators, and I thank them warmly for their engagement with this important work.

Operators provide information that allows CCNSW to maintain the NSW Cemeteries and Crematoria Register, to collect and analyse annual industry activity information, and to gather and analyse information on current cemetery capacity. This report relies on each of these types of industry information, and also upon the domain knowledge and facility-specific expertise of Sydney cemetery operators.

The report identifies that urgent action is required to provide for the future cemetery needs of the metropolitan Sydney community.

In progressing such action, CCNSW will continue to work with the Department of Planning and Environment, the Greater Sydney Commission, councils and others in the planning process, to ensure that cemeteries and crematoria are considered in Sydney's land use planning. Actions to address Sydney's future cemetery needs necessarily involves multiple parties, as councils, Crown cemetery trusts, churches and private sector operators are all active in the region.

I look forward to working with our partners in industry, with planning authorities, potential cemetery proponents and industry experts to provide the cemetery capacity the future Sydney community requires.

Dr Stepan Kerkyasharian AO

1.0 EXECUTIVE SUMMARY

NSW has a long history of setting aside significant areas of land for public cemeteries to ensure that the right to a dignified burial is afforded to all members of the community. NSW is also unique among Australian jurisdictions with its mix of Crown, local government and private cemetery sectors.

In 2012 the NSW Government commenced a program of reforms to bring a coordinated, strategic approach to management of the interment industry, to address the critical shortage of burial space and to ensure the full range of interment options is accessible and affordable to everyone. The reforms provided for the *Cemeteries and Crematoria Act 2013*, and the establishment of Cemeteries and Crematoria NSW (CCNSW), an agency with functions including to collect information about cemetery capacity and needs, usage and performance; and to deliver evidence from which to identify planning and policy issues, and develop and implement collaborative, sustainable solutions.

In 2016 CCNSW published its inaugural Activity Report, which analysed activity information from cemetery and crematoria operators statewide for the 2014–15 year. More recently CCNSW published a summary of statewide cemetery and crematoria activity for 2015–16¹. Data analysed included activity in respect of burial, second and renewable burial, cremation, and ash interment, for cemeteries and crematoria across NSW. The activity analysis identifies that for 2015–16:

- there were 54,336 burials and cremations in NSW, with around half in metropolitan Sydney
- the Sydney cremation rate (65.4%) is consistent with the rest of NSW (66.3%); and given the ease of access to cremation facilities in Sydney (by comparison with rural and regional NSW), reflects an orientation to burial for many communities in the Sydney area
- In the metropolitan area, where cemetery space is at a premium, the rate of second or subsequent interment is 27.7% of all burials, suggesting a 'current' grave occupancy rate of 1.38².

The 2014–15 and 2015–16 activity information provides for the first time a well evidenced indication of the rate of cemetery land consumption, particularly for metropolitan Sydney. Using a standard of 2,800 graves per hectare, around 2.3 hectares of cemetery burial land was consumed by burials in new grave plots in 2015–16.

Is there a problem with available cemetery space for the Sydney community?

A finite amount of space exists in the cemeteries of metropolitan Sydney, with all major cemeteries having been in operation for fifty or more years.

The population of metropolitan Sydney is projected to grow from 4.286 million in 2011 to 6.421 million in 2036, and to continue increasing thereafter. The number of persons who die in metropolitan Sydney each year is also projected to increase from around 24,330 in 2011 to 37,700 per annum by 2041, and to continue at least from the 37,700 per annum level beyond 2041³.

Prior to 2015, the most recent substantive survey of the Sydney region cemetery capacity, conducted in 2002–05, projected exhaustion of available cemetery capacity before 2050. The analysis detailed in this report also projects exhaustion of current cemetery capacity around 2050, with unavailability of plots 'at need' for burials well prior to 2050⁴.

The 2002 survey relied upon a sample of cemeteries, and on operator estimates of grave plot yields remaining in surveyed cemeteries, but did not capture past practice yields or densities. The survey also did not have access to whole of industry activity information including cremation volumes, and relied on estimated cremation rates, and assumed a 1:1 grave occupancy rate.

The 2002–05 work was a sample, relying on estimated remaining stock as primary capacity information, and using conservative cremation and grave occupancy rates in the absence of more substantive information.

The data and methodology detailed in this capacity report replaces sampling and estimates with reliable whole-of-industry information, and projects the consumption of burial land year on year from 2015. The survey findings are consistent with previous work, identifying the probable exhaustion of burial land in metropolitan Sydney by 2051, if not before.

¹ CCNSW 2014–15 and 2015–16 Activity Reports are available at www.crownland.nsw.gov.au/crown_land/cemeteries/planning-and-reporting.

² Grave occupancy rate is an inferred ongoing rate for the no. of interments per grave plot, at the current rate of second interment. The figure is derived by dividing the number of burials completed in the term by the number of burials in new plots completed for the term. The CCNSW approach to calculation of grave occupancy rates is explained in the CCNSW 2014–15 Activity Report, at pages 25, 28 and 44–45.

³ NSW Planning and Environment, Demography Team, bespoke research (2016), projected deaths per year for metropolitan Sydney are detailed at Attachment D, Projected deaths per planning region from 2015 through to 2056.

⁴ NSW Government, Report of the Cemeteries Interdepartmental Committee 2005 (unpublished document).

CCNSW metropolitan Sydney cemetery capacity survey

In 2015 CCNSW commenced a refreshed survey of cemetery capacity in the Greater Sydney area (Sydney, Hunter, Central Coast and Illawarra planning regions) as a priority project. The work was planned to follow and benefit from the 2014–15 activity survey, with that work providing authoritative current cremation and grave occupancy rates across NSW; and planned to reference actual grave plot densities for buried out cemetery lands, in projecting foreseeable densities for greenfields burial lands.

Cemetery land area information gathered from NSW operators in 2015–16 provides a reliable primary evidence base for a refreshed determination of available cemetery land capacity. Whole-of-NSW activity information reported by operators for 2014–15 and 2015–16 provides reliable primary evidence for application of key variables including the cremation rate, grave occupancy rate, and rate of use of land for ash interments, in making projections of future rates of cemetery land consumption, and of exhaustion⁵.

The metropolitan Sydney cemetery capacity survey relies on four primary data inputs:

- CCNSW Cemeteries and Crematoria Register, to identify facilities for sourcing of activity and cemetery capacity information
- NSW Government projections of population and mortality by local government area
- cemetery operator activity survey information captured for 2014–15 and 2015–16
- cemetery operator 'cemetery capacity survey' response information, sourced from operators during 2015–16.

Capacity survey information captured from operators includes information in respect of 133 cemetery facilities, from 31 operators. Data types provided by cemetery operators included:

- total land area (hectares)
- area used for interments (hectares)
- area available for interments (hectares)
- area un-usable for interments (hectares)
- carrying capacity of land available for interments (in grave plots)
- count of unused perpetual sites available

- future capacity—estimated density in grave plots per ha of land area available for interments
- total number of interments to date (in each cemetery).

Cemeteries in the metropolitan Sydney region that contributed cemetery land area, burial and available capacity information for the CCNSW metropolitan Sydney cemetery capacity survey are detailed in the table at Attachment A. CCNSW also researched information on potential cemetery developments in the Sydney region, to allow consideration of these in the context of projected consumption of cemetery land through to 2056. Information on sites for which a development consent for cemetery land use has been achieved is provided at section 4.2 and at Attachment B.

This report includes information, analysis and findings on cemetery capacity and projected exhaustion applicable to metropolitan Sydney. A separate report is issued to present information, analysis and findings on cemetery capacity and projected exhaustion applicable to the Hunter, Central Coast and Illawarra regions.

An MSEXcel download of the spreadsheet workings referenced in the reports is available from CCNSW at www.crownland.nsw.gov.au/crown_lands/cemeteries/planning-and-reporting.

Scenarios used to model outcomes over time

The amount of cemetery land consumed for burials over any period is affected most by three primary factors: the number of persons who die and require burial or cremation; the cremation rate; and for burials, the 'grave occupancy rate', which allows projection of the use of new grave plots (as opposed to second or subsequent interment in an existing grave).

Projecting cremation and occupancy rates that may apply in future periods involves a level of uncertainty.

CCNSW commenced collection of whole-of-industry activity information for NSW in 2015. Analysis of activity information collected by CCNSW for the 2014–15 and 2015–16 years identifies that:

- in 2014–15 the metropolitan cremation rate was 66.3%, and the aggregate grave occupancy rate was 1.45, with 8,730 burials completed, 6,013 of those in new grave plots
- in 2015–16 the cremation rate was 65.4%, and the aggregate grave occupancy rate was 1.38, with 9,058 burials completed, and 6,554 of those in new grave plots.

⁵ CCNSW analysis of cemetery and crematoria activity information for the 2015–16 year identifies cremation and grave occupancy rates which are consistent with the rates for 2014–15 as published in the Cemeteries and Crematoria NSW 2014–15 Activity Report, accessible at www.crownland.nsw.gov.au/crown_lands/cemeteries/planning-and-reporting. The analysis presented in this report applies 2014–15 cremation and grave occupancy rates as 'commencing' rates for each of the scenarios in which consumption of new grave plots in future periods is modelled.

1.0 Executive summary

While rates for 2015–16 appear marginally lower than those for 2014–15, a trend cannot reasonably be determined from existing information. More data will be required to differentiate year-on-year standard deviation, from trends which provide reliable guidance to future requirements. Price influences may also be anticipated over time, with potential that the lower barriers to entry for cremation service providers as versus cemetery operators may contribute to future cremation rates⁶. The commencement of ‘renewable tenure’ burial arrangements (as enabled by Part 4

of the *Cemeteries and Crematoria Act 2013*) may also contribute to future ‘grave occupancy’ rates, by enabling the non-exhaustive use of grave plots.

Given this uncertainty, to provide for modelling of future cemetery land consumption in this context of uncertainty, the eight scenarios described in Table 1.1 were determined for analysis.

Scenario	Rationale	CREM RATE RANGE	OCCUPANCY RATE RANGE	CREMATION RATE AVERAGE	OCCUPANCY RATE AVERAGE
Scenario 1: Starts from aggregate 2014–15 Sydney & H-CC-I ⁷ cremation & occupancy rates ⁸ , no change to cremation & occupancy rates	Use of aggregate data for metropolitan Sydney and Hunter, Central Coast and Illawarra, providing a larger dataset; however, note that aggregate data does not reflect the significantly lower cremation rate in metropolitan Sydney. Cremation and grave occupancy rates are projected to average at current aggregate rates for the term from 2015 to 2056.	0.704	1.473	0.704	1.473
Scenario 2: Starts from aggregate 2014–15 Sydney & H-CC-I cremation & occupancy rates, +0.5% pa to each through 2056	Use of aggregate data for metropolitan Sydney and Hunter, Central Coast and Illawarra, as per Scenario 1. Cremation and occupancy rates are projected to rise incrementally at +0.5% per year, in expectation that pricing, accessibility and renewable tenure factors influence interment service preferences.	0.704–0.858	1.473–1.795	0.781	1.634
Scenario 3: Starts from aggregate 2014–15 Sydney & H-CC-I cremation & occupancy rates, -0.5% pa to each through 2056	Use of aggregate data for metropolitan Sydney and Hunter, Central Coast and Illawarra, as per Scenario 1. Cremation and grave occupancy rates are projected to incrementally decrease at -0.5% per year over the term from 2015 to 2056, reflecting continued community orientation to traditional perpetual burial arrangements.	0.704–0.575	1.47–1.203	0.64	1.338
Scenario 4: Starts from differentiated 2014–15 Sydney & H-CC-I rates, no change to cremation & occupancy rates	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as differentiated from Hunter, Central Coast and Illawarra rates, reflecting the lower cremation rate in Sydney compared with proximate but less diverse regions. Cremation and occupancy rates are projected to remain steady, in the absence of trend data justifying changes, and in expectation that interment service preferences are unaffected by community changes, price or accessibility changes, or renewable tenure.	0.663	1.45	0.663	1.45
Scenario 5: Starts from differentiated 2014–15 Sydney & H-CC-I rates, +0.25% pa change to cremation & occupancy rates, applied in 5 year bundles	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as per Scenario 4. Cremation and occupancy rates are projected to rise incrementally at +0.25% per year, in expectation that pricing, accessibility and renewable tenure factors influence interment service preferences.	0.663–0.732	1.45–1.602	0.696	1.526
Scenario 6: Starts from differentiated 2014–15 Sydney & H-CC-I cremation and occupancy rates; +0.5%pa change to cremation & occupancy rates, applied in 5 year bundles	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as per Scenario 4. Cremation and occupancy rates are projected to increase steadily at +0.5% per year, in expectation that pricing, accessibility and renewable tenure factors strongly influence interment service preferences.	0.663–0.808	1.45–1.767	0.736	1.609
Scenario 7: Starts from differentiated 2014–15 Sydney & H-CC-I cremation and occupancy rates, -0.5% pa change to cremation rate, and +0.5% pa change to occupancy pa, applied in 5 year bundles	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as per Scenario 4. Cremation rate is projected to incrementally decrease at -0.5% per year over the term from 2015 to 2056, reflecting continued community orientation to burial arrangements. Grave occupancy is projected to increase at +2.5% per year to reflect the use of double-depth perpetual burials and the take-up of renewable tenure burial arrangements.	0.663–0.541	1.45–1.767	0.602	1.609
Scenario 8: Starts from differentiated 2014–15 Sydney & H-CC-I cremation and occupancy rates, -0.5% pa change to cremation rate, and -0.5% pa change to occupancy rate, applied in 5 year bundles	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as per Scenario 4. Cremation and grave occupancy rates are projected to incrementally decrease at -0.5% per year over the term from 2015 to 2056, reflecting continued community orientation to traditional perpetual burial arrangements.	0.663–0.541	1.45–1.184	0.602	1.317

Table 1.1 Eight cremation and occupancy rate scenarios provided in the capacity analysis

6 Barriers to entry to the marketplace are considered to be lower in economic terms for potential cremation market participants than for potential cemetery market participants. This reflects the greater no. of land areas in which Crematoria are permitted within Industrial zonings under metropolitan Sydney Local Environment Plans, by comparison with land areas for which Cemetery is a permitted use; the greater pool of Industrial zoned properties compared with properties for which cemetery is a permitted land use, the relative time and cost to achieve planning approval for the respective land uses, and the lower capital costs for establishment of a cremation business, by comparison with a broad-acre cemetery business. For information on barriers to entry generally, see “Barriers to entry”, Wikipedia, The Free Encyclopedia., Date of last revision: 30 August 2017, Date retrieved: 12 September 2017, en.wikipedia.org/w/index.php?title=Barriers_to_entry&oldid=797949830.

7 The abbreviation H-CC-I is used (where necessary for space reasons) to refer to the Hunter, Central Coast and Illawarra regions.

8 The analysis presented in this report applies 2014–15 cremation and grave occupancy rates as ‘commencing’ rates for each of the scenarios in which consumption of new grave plots in future periods is modelled.

Cremation and grave occupancy rate trend lines 2015–56

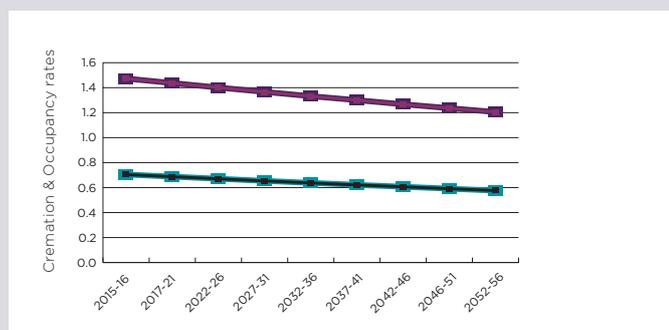


Chart 1.1 Scenario 3, minus 0.5% pa from 2015-56

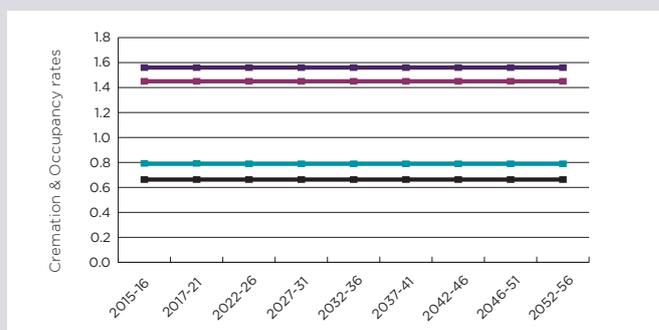


Chart 1.2 Scenario 4, no change to rates from 2015-56

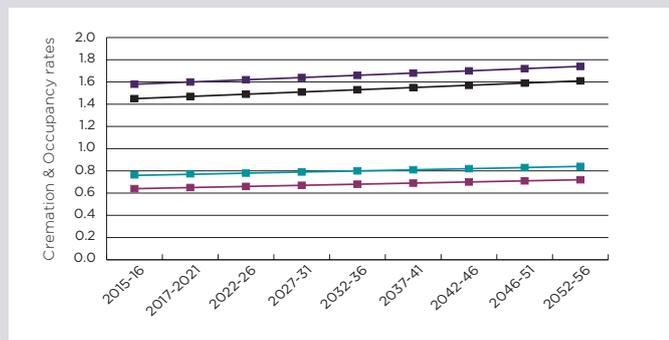


Chart 1.3 Scenario 5, plus 0.25% pa to rates from 2015-56

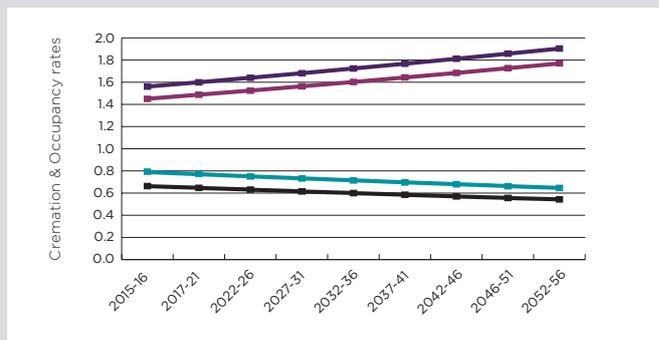


Chart 1.4 Scenario 7, minus 0.5% to cremation & plus 0.5% to occupancy pa from 2015-56

■ SYD - Cremation ■ SYD - Occupancy ■ HCCI Cremation ■ HCCI Occupancy

As detailed in the CCNSW 2014–15 and 2015–16 Activity Reports, the ‘commencing’ cremation rate for metropolitan Sydney is significantly lower than the rate for the adjoining Hunter, Central Coast and Illawarra regions. Those regions have cremation rates around 80%, while the Sydney rate is around 66%.

Three of the scenarios (scenarios 1–3) consolidate activity for metropolitan Sydney with the Hunter, Central Coast and Illawarra regions, on the premise that the larger dataset may provide a more robust basis for future projections. The three variants include ‘no change’, a ‘rates go up’ scenario, and a ‘rates go down’ scenario.

Five of the scenarios (scenarios 4–8) differentiate the commencing cremation and grave occupancy rates for metropolitan Sydney from the other regions, to reflect the current interment choices of the Sydney community. The variants modelled include ‘no change’ (scenario 4), ‘rates go up’ (scenarios 5 and 6), and ‘rates go down’ (scenario 8); and a scenario under which the cremation rate falls, while grave occupancy rises (scenario 7).

On information currently available, CCNSW hold most confidence in scenario 4 of the analysis, which projects that cremation and grave occupancy rates similar to those of 2014–15 can be expected for future periods. Given existing information, the next most probable scenario appears scenario 5 of the analysis, which projects incremental increases in cremation and occupancy rates through time.

Key findings for metropolitan Sydney

Analysis identifies approximately 301,000 grave plots were available in metropolitan Sydney at 1 Jan 2015. The analysis uses a standard for the yield of ‘new grave plots’ of 2,800 graves per hectare. Approximately 140 hectares of unused burial land was available in Sydney cemeteries as at 1 Jan 2015.

The Australian Bureau of Statistics (ABS) reports the number of deaths in metropolitan Sydney for 2015 was 28,84⁹. ABS data on deaths in 2016 is expected later in the 2017 year. The CCNSW Activity Report for 2015–16 identifies that 26,211 burial and cremation services were delivered in metropolitan Sydney in 2015–16¹⁰. The metropolitan cremation rate was 65.4%, with 9,054 persons buried, and 17,153 persons cremated. The aggregate grave occupancy rate was 1.38, with 6,554 of the 9,054 burials undertaken in new grave plots, and 2,500 burials being second or subsequent burials undertaken in existing plots. Around 2.3% of capacity available as at 1 January 2015 was consumed by burials in new grave plots.

The capacity analysis finds that if there is no change to existing cremation and grave occupancy rates (scenario 4 in the analysis), cemetery capacity in metropolitan Sydney would be exhausted by 2051, with negative effects to availability of at-need grave plots expected well in advance of that period. By 2056, around 11,800 new grave plots would be consumed in Sydney per annum, requiring around four hectares of cemetery burial land.

⁹ See ABS, Greater Sydney: Region Data Summary (population, births and deaths data, viewed 24 Aug 2017); accessible at stat.abs.gov.au/itt/r.jsp?RegionSummary®ion=IGSYD&dataset=ABS_REGIONAL_ASGS&geoconcept=REGION&datasetASGS=ABS_REGIONAL_ASGS&datasetLGA=ABS_NRP9_LGA®ionLGA=REGION®ionASGS=REGION.

¹⁰ The CCNSW 2015–16 Activity Report is available at www.crownland.nsw.gov.au/crown_lands/cemeteries/planning-and-reporting.

Balance of plots by 2056, all scenarios

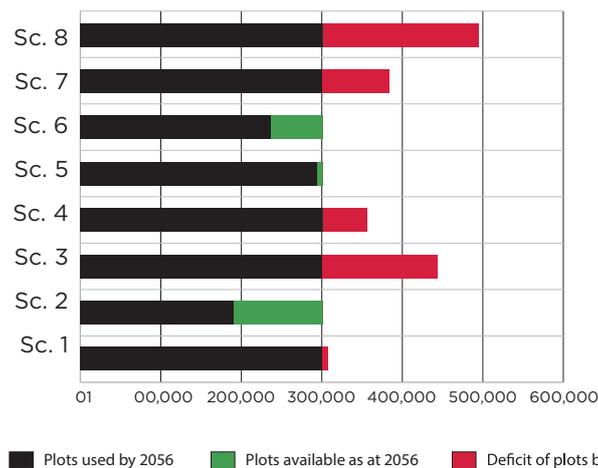


Chart 1.5 Balance of metropolitan Sydney new grave plots remaining by 2056 for all scenarios

In Chart 1.5, areas in red represent numbers of grave plots projected to be required by 2056, which were not available in metropolitan Sydney cemeteries as at 1 Jan 2015. Areas in green represent grave plots available as at 1 Jan 2015 and which are projected to be 'not consumed' by 2056. For Scenario 4, a deficit of 54,652 grave plots is projected by 2056.

Alternatively, if there are incremental increases to the cremation and grave occupancy rates from 2015 to 2056 (scenario 5 in the analysis), cemetery capacity in metropolitan Sydney would be exhausted by 2057.

In the event the cremation rate for Sydney for future periods is lower than the current rate (as projected in scenarios 3, 7 and 8), exhaustion of cemetery capacity can be expected well prior to 2051¹¹.

Projected year of exhaustion of capacity

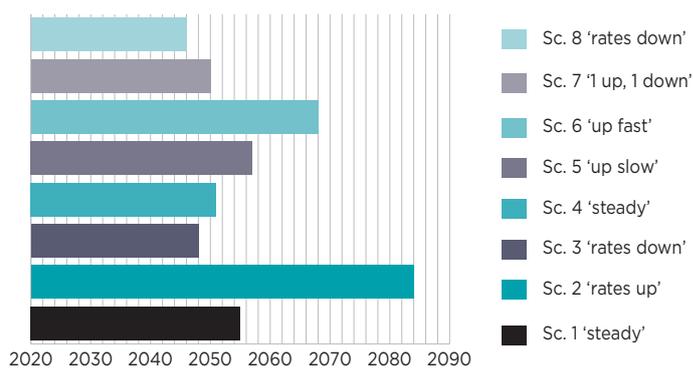


Chart 1.6 Projected year of exhaustion of metropolitan Sydney cemetery capacity for all scenarios

Under either scenario, such capacity as remained by 2046 would be very concentrated by location and operator, with the majority of the Sydney population lacking proximate access to burial space, and potential that significant communities lack access to at-need, culturally appropriate or feasibly priced burial capacity.

Under either scenario, capacity in the central, south and north planning regions of Sydney would be exhausted well before 2056, with known shortages potentially disrupting service arrangements well before that date, and access equitability issues arising for communities in those regions.

Under any scenario of apprehended exhaustion, perverse outcomes may be expected well in advance of any actual exhaustion date, with community awareness of shortages driving demand for the pre-purchase of available stock, with consequent negative effects to equitable, timely, proximate, or affordable access for many communities. Negative outcomes would also be concentrated by geography and cultural orientation.

Given the time required to identify, acquire, gain planning approval for, and commence operation of new greenfield cemetery sites, and the already intense competition between land uses for affordable greenfields land in western Sydney, **urgent action is required to provide for the future burial needs of the Sydney community.**

¹¹ Summary results of the analysis for all scenarios are appended to this report at Attachment H: Summary table of outcomes for metropolitan Sydney, all scenarios.

Key Findings

- **Capacity for around 301,000 grave plots was available** in metropolitan Sydney cemeteries as at 1 January 2015, with a prevailing cremation rate around 66%, and a grave occupancy rate around 1.4.
- **There is insufficient trend information** to be confident of cremation and grave occupancy rates in future periods.¹²
- **Over 1.5 million persons are projected to require burial or cremation** in metropolitan Sydney between 2015 and 2056, with over 355,000 grave plots projected to be required from 2015 to 2056.
- **By 2056, around 11,800 new grave plots would be consumed** in metropolitan Sydney per annum, requiring around four hectares of cemetery burial land.

- If there is no change to existing cremation and grave occupancy rates, **cemetery capacity in metropolitan Sydney would be exhausted by 2051 if not before.** Unavailability of 'at-need' grave plots can be expected well in advance of that time.
- **Pre-sale of grave plots may mean that graves may become unavailable for 'at-need' purchasers.** Unavailability can be anticipated in some regions from around 2026, and generally from around 2036.
- **Unavailability of grave plots in 'at-need' circumstances will particularly disadvantage:**
 - families with insufficient resources to pre-purchase
 - communities with cultural and religious commitments to burial rather than cremation.

- **Even in the event incremental increases in cremation and grave occupancy persist from 2015 through to 2056 (scenario 5), capacity would be exhausted by 2057.**
- Under scenarios 4 or 5, such capacity as remained by 2046 would be very concentrated by location and operator, with the majority of the Sydney population lacking proximate access to burial space, and potential that significant communities lack access to at-need, culturally appropriate or feasibly priced burial capacity.
- Under any scenario of apprehended exhaustion, adverse outcomes may be expected well in advance, with community awareness of shortages driving demand for the pre-purchase of available stock, and negative effects to equitable, timely, proximate, or affordable access for many communities.
- Negative outcomes would be concentrated by geography and cultural orientation, disproportionately affecting the communities of the central, north and south regions.
- Under either scenario 4 (persistence of current cremation and occupancy rates), or scenario 5 (these rates increase incrementally from 2015 through to 2056):
 - the central, north and south regions of Sydney are projected to be exhausted of capacity before 2036.
 - pre-sale of grave plots is likely to mean that graves may become unavailable for 'at-need' purchasers in the north and south regions from around 2026
 - urgent action is required in north and south regions to provide for the future burial needs of the central, north and south region communities.

¹² The CCNSW 2015–16 Activity Report is available at www.crownland.nsw.gov.au/crown_land/cemeteries/planning-and-reporting. The cremation rate for metropolitan Sydney for 2015–16 is marginally down on the 2014–15 year, but an insufficient number of years of activity data has been collected to be confident whether the variation is standard deviation, or an ongoing trend. See Table 4.6 within this Report, and summary cremation and grave occupancy rate information in the CCNSW 2015–16 Activity Report

2.0 BACKGROUND AND CONTEXT



Cemeteries are critical community infrastructure and provide essential services to the people of NSW. They are vital places for remembrance and reflection, a rich source of cultural and environmental heritage and provide valuable open spaces. The rich diversity of our community means there are a wide range of needs and expectations for burial and cremation services.

Information compiled by Multicultural NSW shows that NSW is home to more than 200 languages, over 125 religions, and some 300 ancestries. There are currently over 50,000 deaths a year in NSW, around 50% of those in metropolitan Sydney, and a further 20% in the adjoining planning regions of the Hunter, Central Coast and Illawarra. Many religious and cultural communities sustain a strong orientation toward burial of mortal remains.

Sydney's largest and most strategically important cemetery is Rookwood Cemetery, established in 1867. The last major commitments of greenfields land to cemetery use in the metropolitan area were all made 50 and more years ago. A study of metropolitan cemetery capacity completed between 2002–05 projected that land available for burial would be exhausted before 2050.

The lead time for approval and development of new cemeteries is significant, and competition between land uses in the metropolitan area is increasing. This report presents and analyses the cemetery capacity information for metropolitan Sydney, and projects exhaustion of current stock by year and planning region. This will be of value to industry and government in planning for future community needs, particularly in relation to potential cemetery developments.

Cemeteries and Crematoria NSW

Cemeteries and Crematoria NSW (CCNSW) is the statutory body with strategic and regulatory oversight of the interment industry and responsibility for administering the *Cemeteries and Crematoria Act 2013*.

The objects of the *Cemeteries and Crematoria Act 2013* include:

- to ensure that sufficient land is acquired and allocated so that current and future generations have equitable access to interment services (object c)
- to provide for the operation of a consistent and coherent regime for the governance and regulation of cemeteries and crematoria (object d)
- to ensure that the operators of cemeteries and crematoria demonstrate satisfactory levels of accountability, transparency and integrity (object e)

- to promote environmental sustainability of the interment industry, including provision for natural and private burial (object g).

CCNSW is led by an independent expertise-based board responsible to the Minister for Lands, the Hon Paul Toole MP. The agency collects information about cemetery capacity and usage, future cemetery needs, and cemetery and crematorium performance. It uses the evidence to identify planning and policy issues and develop and implement collaborative, sustainable solutions.

CCNSW carries forward the government's commitment to recognise and take account of the right of all individuals to a dignified interment and the respectful treatment of their remains. This includes ensuring that the beliefs of all community groups are respected and equitable and affordable access to interment services is adequately provided, irrespective of religious or cultural heritage.

CCNSW published a Strategic Plan for 2015–20, to articulate our role and priorities to the community and industry partners¹³. The plan describes how CCNSW will deliver the NSW Government's commitment to ensuring community needs and expectations are met. The plan also sets out a blueprint for implementing the new regulatory framework for the interment industry. CCNSW is responsible for ensuring that planning and acquisition of cemetery capacity is sufficient to provide for the needs of the NSW, and land is acquired as necessary to meet the service needs of communities.

Population and mortality data developed by the NSW Department of Planning and Environment (DPE) projects the number of persons who die each year in NSW will increase from around 50,160 in 2011 to 73,270 by 2041 (+46%)¹⁴. In the greater metropolitan area, including metropolitan Sydney, Hunter, Central Coast and Illawarra regions, the number of persons who die each year is projected to increase from around 35,390 per annum in 2011 to 53,070 per annum by 2041 (+50%).

¹³ Information about CCNSW and the CCNSW Strategic Plan 2015 may be accessed at www.crownland.nsw.gov.au/crown_lands/cemeteries.

¹⁴ Projection of expected deaths per annum in NSW 2011–2041 is provided at Attachment D below, and further explained at Section 4.6 of the report.

2.0 Background and context

CCNSW metropolitan Sydney cemetery capacity survey

Communities benefit from well-planned, efficient cemeteries, proximate to population centres. Cemetery planning processes will benefit from availability of independent analysis of available cemetery capacity, and projection of exhaustion.

The lead-time for establishment of new cemeteries is significant, and cemeteries do not provide a business model well-suited to short-term recovery of capital outlaid for acquisition and development.

Authoritative and independent information on remaining cemetery capacity and projected future community requirements for cemetery land will benefit the planning system generally, planning for Sydney's growth regions, and planning authorities and cemetery proponents considering particular developments.

In mid-2015, CCNSW commenced work on a refreshed survey of cemetery capacity in the Greater Sydney area as a priority project. The survey provides an evidence base for planning and securing the cemetery and crematoria facilities that will be required in coming decades. From 2018, CCNSW plans to extend survey work to regional areas to identify where future cemetery capacity is at risk, so that appropriate actions in planning and securing land for cemetery usage may be carried forward.

For the purposes of the survey, Greater Sydney was defined to include the planning regions of metropolitan Sydney, Hunter, Central Coast and Illawarra. Cemetery capacity reports for metropolitan Sydney (this report) and for the Hunter, Central Coast and Illawarra regions are issued as deliverables from the research.

Metropolitan Sydney is currently serviced by 48 active cemeteries, the great majority of these established 100 and more years ago, with only 10 cemeteries servicing over 100 burials per annum, and only 10 cemeteries having capacity for 10,000 or more new grave plots as at 1 January 2015.

The last substantive survey of cemetery capacity in the metropolitan Sydney region completed in 2002–05, projected exhaustion of available cemetery capacity in the metropolitan Sydney area before 2050. Some population centres in regional NSW are also understood to be approaching exhaustion of cemetery capacity.

The cemetery capacity research relies on four primary data inputs:

- NSW Government projections of population and mortality by local government area
- CCNSW Cemeteries and Crematoria Register, to identify facilities for sourcing of activity and cemetery capacity information
- cemetery and crematorium operator activity survey information captured for 2014–15 and 2015–16
- cemetery operator 'cemetery capacity survey' response information, sourced from operators during 2015–16.

DPE's demographic branch maintains population projections for NSW for use in the planning of service and infrastructure delivery to the community. Demographic projections also provide the basis for assessing future requirements for residential and commercial land, housing, public utilities, and the provision of a wide variety of services. Bespoke projections of deaths per local government area were provided by DPE to support the capacity survey¹⁵.

Capacity survey information captured from cemetery operators for the Greater Sydney area includes information in respect of 133 cemetery facilities, from 31 operators. The process commenced with CCNSW framing data and methodology parameters for the survey, and issuing aerial images and land area data for each cemetery to operators, with survey information and data collection forms.

Data analysed identifies that some 2.2 million deaths are projected for the metropolitan Sydney, Hunter, Central Coast and Illawarra regions through 2056, with around 30% expected to be interred as mortal remains, and around 70% of persons cremated. The rates of cremation between metropolitan Sydney and adjoining regions are quite different, with the cremation rate for Sydney around 66%, and the rates for Hunter, Central Coast and Illawarra regions around 80%¹⁶.

The number of grave plots required to service community needs in future is dependent upon the number of persons who die each year, the rate of cremation versus burial, and the rate of grave occupancy (i.e. the number of burials completed per grave).

¹⁵ NSW Planning and Environment, Demography Team, bespoke research (2016), projected deaths per year for metropolitan Sydney are detailed at Attachment D, Projected deaths per planning region from 2015 through to 2056, below.

¹⁶ See the Cemeteries and Crematoria NSW 2014–15 and 2015–16 Activity Reports, accessible at www.crownland.nsw.gov.au/crown_lands/cemeteries/planning-and-reporting.

The amount of burial land required is dependent upon the topography of specific sites, the infrastructure required on the site, the approach to cemetery precinct design, and the number of grave plots that can be realised per hectare.

Cemetery operators in metropolitan Sydney, the Hunter, Central Coast and Illawarra planning regions

Over 230 cemetery and crematorium operators provide interment services across NSW. The following service providers are active in the Sydney region:

- Four large **Crown cemetery trusts** provide services in Sydney, conducting around 70 per cent of burials for metropolitan Sydney.
- **Local Councils** manage the great majority of cemeteries in NSW, but do not operate the major metropolitan cemeteries, conducting approximately 10 per cent of burials in metropolitan Sydney.
- **Private operators** manage the majority of crematoria statewide; and there are major privately operated cemeteries in metropolitan Sydney and Hunter/Central Coast regions.
- **Community operators** oversee many small, closed cemeteries, including many churchyard cemeteries in Sydney, but conduct less than one per cent of metropolitan burials.

A map image of the cemeteries in metropolitan Sydney included in the survey is provided as Chart 4.1.

CCNSW 2014-15 and 2015-16 activity surveys

Activity surveys were undertaken with NSW cemetery and crematoria operators for the 2014-15 and 2015-16 years, to contribute to the evidence base for planning for future service and cemetery space requirements.

Part 4 of the *Cemeteries and Crematoria Act 2013*, scheduled to commence in 2018, will establish a consistent regime of interment rights for NSW cemeteries, including a regime for renewable interment rights. Implementation of renewable interment rights will be an option available to cemetery operators, in addition to perpetual rights, which is expected to have the effect of increasing the efficiency of cemetery land usage by allowing for increased numbers of interments in individual grave plots¹⁷. With the view to tracking the efficiency of grave plot use in future, activity survey parameters include sourcing from operators information in respect of the number of interments of bodily remains in perpetual interment sites in which

one or more previous interments had taken place (i.e. where an existing grave was re-opened)¹⁸.

The analysis provided in this report makes substantive use of the cremation and grave occupancy rates detailed in the CCNSW 2014-15 Activity Report, using these rates as a benchmark for projection of cremation and grave occupancy rates for future periods. Rates calculated from activity reported by operators for 2015-16 are marginally different from those for the preceding year, but are insufficient for reliable determination of trends.

Continued annual activity reporting by cemetery and crematoria operators will provide for visibility of increased mortality volumes and efficiency of cemetery land use in the years ahead, with annual mortality volumes projected to double between 2011 and 2051. Activity reporting will provide an evidence base of actual rates of cremation, mortal remains interment, and second and subsequent interments, to inform planning for future community infrastructure requirements.

Capacity survey sensitivity analysis and scenarios

Projecting future rates of cremation, burial and second or subsequent burial necessarily involves a deal of uncertainty. Eight 'what if?' scenarios have been developed to model future burial volumes and grave plot consumption, with different rates of cremation and grave occupancy used to reflect potential interment service choices through to 2056. The scenarios include models where rates stay constant through time; where rates rise or fall through time; where all the regions included in the survey are considered together; and where metropolitan Sydney is considered separately from the Hunter, Central Coast and Illawarra regions.

Future rates for cremation and grave occupancy cannot be predicted with high levels of accuracy. The cremation and grave occupancy rates used are based on assumptions in respect of likely future choices. The higher and lower rate projections and the different scenarios show a range of possible grave plot consumption futures. The projection scenarios show what would happen if there were changes to current rates. The higher and lower rate scenarios should not be interpreted as an upper and lower bound for potential future choices in respect of burial and cremation. They are designed to provide a plausible range of future rates of burial land consumption, and associated cemetery land requirements.

¹⁷ Many cemeteries in NSW allow double-depth perpetual interments as at 2015, i.e. a first burial at an increased depth, and a subsequent burial above the initial burial in the same grave plot. As a result there is already an 'occupancy rate' of interments per grave which is higher than one.

¹⁸ At an appropriate point in future, it will become necessary for activity survey parameters to include information in respect of the number of interments of bodily remains in renewable interment sites in which one or more previous interments had taken place (i.e. where an existing renewable grave was re-opened for a subsequent interment). This may not be until 25 years following commencement of Part 4 of the *Cemeteries and Crematoria Act 2013*.

2.0 Background and context

Key variables in projection of consumption of burial land

Key variables that affect the consumption of burial land in cemeteries, and the amount of burial land required over the long term, are the projected number of deaths, the rate of cremation versus burial, the rate of grave occupancy (how many burials are completed per grave), and the yield of grave plots that may be realised for each hectare of burial land.

To best provide for management of these variables in the analysis, data sourcing and treatment arrangements were determined as shown in Table 2.1.

Other factors relevant to the availability of grave plots, but which have not been accounted for in the survey, are:

- pre-sales of grave plots, which reduce the availability of plots when required 'at-need'
- use of cemetery land for ash interments, which may reduce land area available for burials.

CCNSW may undertake follow-up work in respect of pre-sales of grave plots following completion of the metropolitan Sydney and Hunter, Central Coast and Illawarra capacity reports. Discussions with industry participants have identified that up to 50% of currently developed grave plot stock in metropolitan Sydney may have been pre-sold.

CCNSW considered development and application of a standard factor to reflect the use of cemetery land for ash interments for use in the analysis. Ash interments in cemeteries are typically undertaken in columbaria, niche walls and memorial gardens. Current rates of ash interment are identified in the 2014-15 and 2015-16 activity reports. The general practice for major cemetery operators undertaking ash interments is for development of interment infrastructure in cemetery land areas unsuited to burial land use, and to adopt designs which provide for large numbers of ash interments in the land area that would be consumed by one or two grave plots.

It was considered that modelling of consumption of burial land by ash interments in metropolitan Sydney cemeteries as part of this capacity analysis was not appropriate.

VARIABLE	SOURCING AND TREATMENT
projected number of deaths	DPE's demographic branch maintains population projections for NSW, and bespoke projections of deaths per local government area were provided by DPE to CCNSW to support the capacity survey. Projected death data was provided by DPE for the period 2011 to 2041; with advice from DPE, CCNSW has projected death volumes for the following periods from 2041 to 2056. Figures used for the period 2041 to 2056 are considered as likely to be conservative.
rate of cremation versus burial; and rate of grave occupancy	The CCNSW 2014-15 and 2015-16 Activity Surveys for the first time provide complete and authoritative burial and cremation information for operational facilities in NSW. Facility-specific primary information was aggregated to planning region level for analysis. The figures identify cremation rates and grave occupancy rates by planning region, allowing projections commencing from current actual rates. The cremation rate for metropolitan Sydney as at 2015-16 is 65.4%; higher rates are in operation for the Hunter, Central Coast and Illawarra regions. There is insufficient data to be confident of clear trends in respect of cremation or occupancy rates.
yield of grave plots per hectare	Cemetery operators provided survey response information identifying remaining burial precinct capacity in hectares and in projected grave plots. This primary information was aggregated to planning region level for analysis. This analysis has used a standard figure of 2,800 grave sites per hectare in projecting the carrying capacity of burial areas with capacity remaining as at 1 Jan 2015. The figure is based on analysis of current and historical data in NSW, and a review of relevant literature.

Table 2.1 Data sourcing and treatment arrangements for key variables in the analysis

3.0 PURPOSE AND SCOPE

Given projected population increases through to 2056, and associated increases in deaths per annum, additional facilities and additional cemetery capacity will be required in metropolitan Sydney to provide the services required by the Sydney community.

Many of the operational cemeteries in Sydney and NSW generally were established in the 19th and early 20th centuries. While a number of private cemeteries were established in greater Sydney later in the 20th century, the last major commitment of land to Crown cemetery usage in greater Sydney was in 1937. In 2013 the NSW Government committed the 'lot 10' adjoining land area to Rookwood cemetery¹⁹, but further opportunities to add 'incremental' adjoining land areas to existing cemeteries are limited.

Proposed and new cemetery developments that had not become operational as of October 2107 were not considered in the analysis carried out for this capacity report. The reasons for this are set out at Attachment B.

A review of cemetery capacity available in metropolitan Sydney was last completed in 2002–05, and identified that cemetery capacity may be exhausted by 2050, if not before²⁰.

Strategic review of community needs in relation to burial and cremation, and remaining cemetery capacity is increasingly a function performed by governments in Australia. In Victoria the Cemeteries and Crematoria Regulation Unit published a report estimating the remaining capacity of Victorian cemeteries in 2012²¹, and a number of NSW Councils active as the primary service provider for their communities have undertaken cemetery strategic planning in recent years²².

In metropolitan Sydney cemetery services are provided by the private sector, and by Crown cemetery trusts, council, church and community operators, with no sector holding overall service or planning responsibility.

The specific purpose of this CCNSW Metropolitan Sydney Cemetery Capacity Report is to identify the burial capacity remaining in operational cemeteries in the densely populated Sydney planning regions, and to model its consumption in future years. Identification of those regions which face near-term and medium-term exhaustion of burial capacity can then inform appropriate responses by cemetery operators, development proponents and planning authorities.

Reporting by cemetery and crematorium operators in Greater Sydney on the consumption of cemetery land, and on cremation and interment services by operators in all regions of NSW, provides essential evidentiary material to inform planning for the future provision of service capacity for the community of NSW.

Planning regions used for the analysis

To avoid disclosure of individual operator activity information, data capture and analysis has been premised on bundling to NSW Government planning regions.

In 2016 the NSW Government introduced a Stronger Councils, Stronger Communities initiative, which informed the formation of some new councils and amalgamation of other councils²³. The analysis of metropolitan Sydney cemetery capacity reported in this document is based on the planning regions and local government areas current as at July 2017 and shown in Table 3.1.

Region	Local Government Areas
Metro Sydney—Central	Bayside, Burwood, Canada Bay, Inner West, Randwick, Strathfield, City of Sydney, Waverley, Woollahra
Metro Sydney—West Central	The Hills, Blacktown, Parramatta, Cumberland
Metro Sydney—North	Hornsby, Hunters Hill, Ku-ring-gai, Lane Cove, Northern Beaches, Mosman, North Sydney, Ryde, Willoughby
Metro Sydney—West	Blue Mountains, Hawkesbury, Penrith
Metro Sydney—South West	Camden, Campbelltown, Fairfield, Liverpool, Wollondilly
Metro Sydney—South	Canterbury-Bankstown, Georges River Sutherland

Table 3.1 Metropolitan Sydney region planning regions and local government areas, at the time of report compilation

19 A media report on the commitment of the Lot 10 area may be viewed at www.smh.com.au/nsw/muslims-jews-on-common-ground-in-cemetery-squeeze-20130508-2j7ul.html, viewed 24 Aug 2017.

20 NSW Government, Report of the Cemeteries Interdepartmental Committee 2005, page 4 (unpublished document)

21 Victoria Department of Health, Estimation of the remaining capacity of Victorian cemeteries, January 2012, www2.health.vic.gov.au/getfile/?sc_itemid=%7B7F523243-5D13-4C90-B5FB-D15182535149%7D&title=Estimation%20of%20the%20remaining%20capacity%20of%20Victorian%20cemeteries

22 Councils known to CCNSW to have completed Cemetery strategic planning work include Cessnock, Maitland, Shoalhaven and Wingecarribee, and relevant work is understood to be progressing in Orange, Queanbeyan and other LGAs. Council cemetery strategic plan links accessible online include www.cessnock.nsw.gov.au/resources/file/Cemetery/Cemetery%20Strategy%204.pdf; doc.shoalhaven.nsw.gov.au/Displaydoc.aspx?Record=d12/274413; www.maitland.nsw.gov.au/UserFiles/File/MCC%20Cemetery%20Strategy%20Updated%20February%202013%20v5.pdf.

23 See the NSW Government Stronger Councils, Stronger Communities information available at www.strongercouncils.nsw.gov.au/.



Chart 3.1, Metropolitan Sydney districts (or planning regions)²⁴

24 Map image based on data from the Greater Sydney Commission, Greater Sydney Draft District Plan Map Atlas, November 2016, accessible at www.greater.sydney/maps.

4.0 METHODOLOGY AND ANALYSIS

The methodology of the analysis has involved the following steps, with application explained in the subsequent sections.

Step 1—Identify facilities

Step 2—Estimate land area available for future burial use

Step 3—Project logical yield (in grave plots) for available land area

Step 4—Calculate capacity (in grave plots) for each planning region, as at 1 January 2015

Step 5—Project the number of deaths in the regions through to 2056

Step 6—Determine scenarios for projected rates of burial

Step 7—Project the number of cremations and burials (in each region through to 2056)

7.1 Evidentiary basis for projection of cremation and grave occupancy rates

7.2 Summary of cremation and occupancy rates for each scenario

7.3 Cremation and occupancy rates for each period for scenarios 4 and 5

7.4 Projection of the numbers of deaths, cremations, burials and first burials (scenario 4)

7.5 Projected consumption of new grave plots by first burials 2015–56 (scenario 4)

7.6 Remaining balance of new grave plots as at key dates 2036 and 2056 (scenario 4)

7.7 Projected outcomes of the analysis for all scenarios

7.8 Projected outcomes for Sydney’s regions

STEP 1—IDENTIFY FACILITIES

Step one of the approach required identification of the facilities to be included in the analysis.

The NSW Cemeteries and Crematoria Register is maintained by CCNSW in accordance with Section 27 of the *Cemeteries and Crematoria Act 2013*. A register is maintained to provide public access to information about cemetery and crematorium facilities in NSW. A public version of the register is made available at www.crownland.nsw.gov.au/crown_lands/cemeteries/register.

Operators are required to notify CCNSW of information for inclusion in the register, including:

- the name and location of the cemetery or crematorium
- the name and address and telephone number of the cemetery or the crematorium and operator
- any other information required by the regulations to be included in the Register.

The following table summarises data maintained in the register in respect of operational cemeteries and crematoria in metropolitan Sydney at the time of the survey.

Metropolitan Sydney district	No. of cemeteries	No. of crematoria
Central	4	1
West Central	10	4
North	10	2
West	22	2
South West	10	1
South	1	2
TOTAL	57	12

Table 4.1 Number of operational cemetery and crematorium facilities within metropolitan Sydney, by district

Cemeteries in the metropolitan Sydney region which contributed cemetery land area, burial and available capacity information for the CCNSW metropolitan Sydney cemetery capacity survey are detailed in the table at Attachment A.

4.0 Methodology and analysis

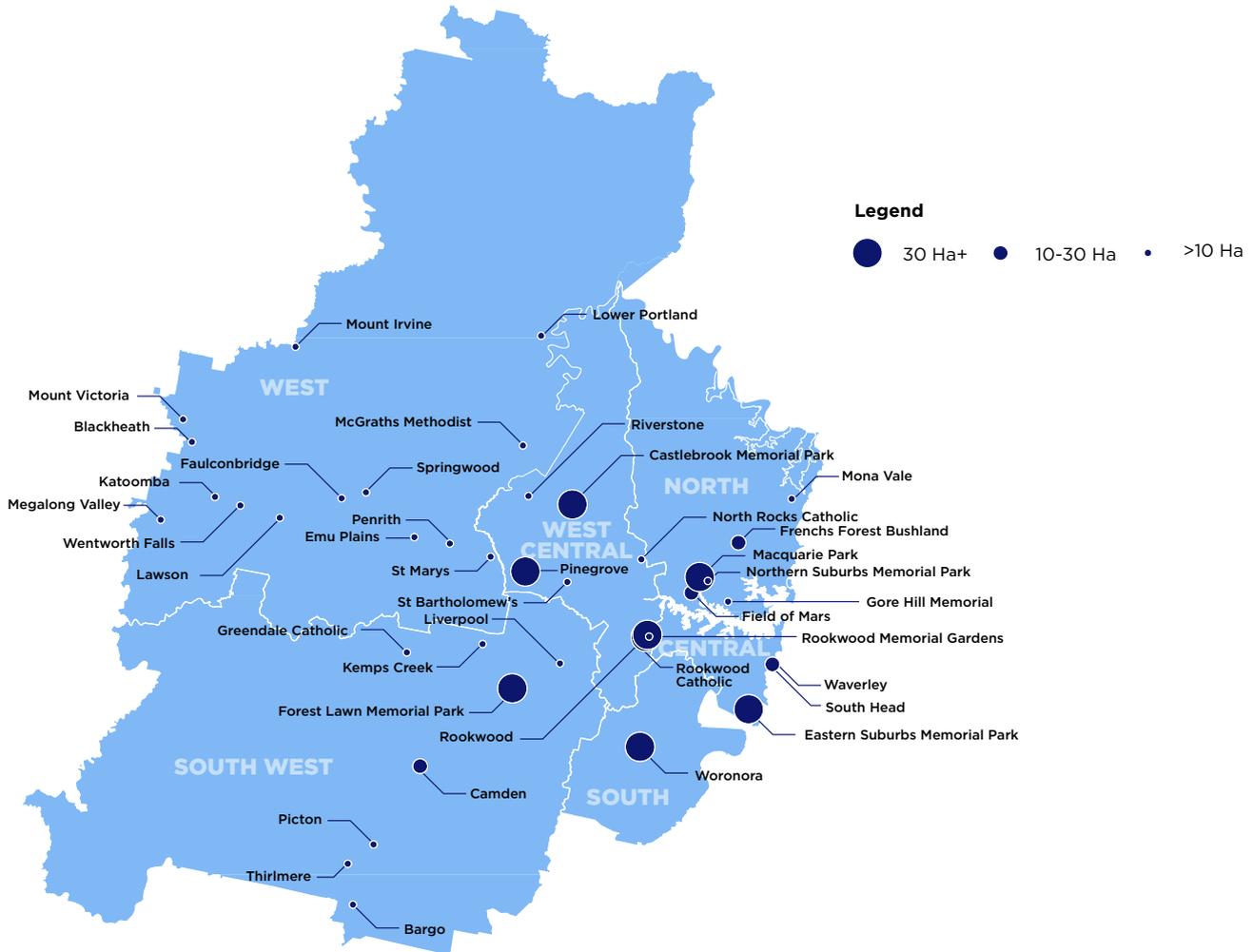


Chart 4.1, Cemeteries and Crematoria in metropolitan Sydney

Operators for each operational cemetery in the survey area were provided with reference information in respect of those facilities, and asked to provide response information regarding land area and interments.

To allow for a standardised approach to modelling of grave plot consumption in future decades, cemetery capacity information as at 1 January 2015 was sourced from operators including:

- land area of cemetery (in hectares)
- approximate percentage (or land area) of the cemetery already used for interments
- approximate percentage (or land area) of the cemetery not already used for interments, but which can be used for interments
- approximate percentage (or land area) of the cemetery that cannot be used for interments (roads, buildings, lakes, environment preservation areas, set-backs, etc.).
- for the land area available for new interments, the projected carrying capacity (i.e. approximate number of grave plots of the available land area)

- for the land areas already used for interments, the total number of graves in which burials have been completed in cemetery from commencement of operation to 31 December 2014.

Information received in relation to these parameters allowed CCNSW to identify:

- the number of hectares of burial land that was unused at 1 January 2015
- average figures in respect of cemetery land extents that are committed to infrastructure and environmental purposes, the yield of grave plots per hectare that has been achieved in metropolitan Sydney in the decades to 2016, and projected projected yields for burial precincts planned for development.

CCNSW also researched information on potential cemetery developments in the Sydney region, to allow consideration of these in the context of projected consumption of cemetery land through to 2056. Information on sites for which a development consent for cemetery land use has been achieved is provided at section 4.2 and at Attachment B.

STEP 2—ESTIMATE LAND AREA AVAILABLE FOR FUTURE BURIAL USE

Step two of the approach required estimation of the land area available for future burial use.

Cemetery capacity survey questions were issued to operators of operational cemeteries in the survey area. The date for which operators were asked to report land area available was 1 January 2015. Operators were asked to estimate future capacity both in land area (hectares) and in estimated volume of grave plots.

Response information received from operators was reviewed by CCNSW, and followed up with further enquiries as necessary. Response information was reviewed for completeness and consistency with land area information developed by CCNSW using desktop resources.

Information relied upon for the estimation included survey information provided by CCNSW to operators (which included total land area), survey response information provided by operators, CCNSW desktop review of response information, use of resources including the Department of Finance and Services' spatial information portal SIX²⁵, and facility-specific follow-up enquiries with the operators of major facilities.

The survey identifies that as at 1 January 2015, approximately 750 hectares of land in total was included in the bounds of metropolitan Sydney cemeteries. Around 505 hectares of the total has already been 'buried out', without capacity for future interments, other than where a 'second burial' within an existing plot may be permitted. Around 107 hectares of cemetery land is unavailable for use for interments, being used for roads and pathways, buildings and infrastructure, setbacks, heritage or environment reservations, or other purposes. Approximately 140 hectares of land remains available for burial use in metropolitan Sydney cemeteries—land either currently developed for burial use, or capable of future development for burial use.

CCNSW made adjustments to 'land area available' information where necessary, to avoid reliance upon design-specific or operator-specific potential yield information, given uncertainty about factors including future planning approvals and consumer preferences. The net effect of adjustments made to area information was a minor reduction in the land area accepted as 'available for future burial use', by making provision—based on averages for major facilities generally—for land areas which may be required for access, infrastructure or set-back areas.

The land area projected as being available for future burial use in each planning region is detailed at Table 4.2.

CCNSW is aware that for various cemeteries, initiatives with the aim to add incremental capacity, by gaining access for use of adjoining land areas, are underway as at July 2017. These land extents, which carry potential to become cemetery land available for burials in future, have not been included in the analysis. In any case, these opportunities carry potential to provide local 'tactical' capacity, but not to provide the strategic and general cemetery capacity projected to be required for the Sydney community.

Sites that are not currently cemeteries but for which a development approval for cemetery use has been achieved are considered further at Attachment B.

STEP 3—PROJECT LOGICAL YIELD (IN GRAVE PLOTS) FOR AVAILABLE LAND AREA

Step three of the approach required projection of the logical yield (in grave plots) for available land area.

As noted above, to avoid reliance upon design-specific or operator-specific potential yield information for larger land areas, CCNSW reviewed aggregate information for greater Sydney region cemeteries generally, and completed a literature survey, with the view to determination of a standard number of grave sites per hectare for projection purposes²⁶.

A pilot cemetery capacity survey had been completed for the South West district of Sydney in 2013–14. The pilot cemetery capacity survey sought information from operators including:

- number of interments (2013)—bodily remains
- number of interments (2013)—cremated remains
- remaining cemetery capacity (by count of new/unused interment sites available).

²⁵ Accessible at maps.six.nsw.gov.au; tools accessible on the SIX portal include aerial imagery, cadastral boundaries, and distance and land area calculation functions.

²⁶ The standard yield per hectare and associated rationale for the approach are detailed at Attachment C. The Bibliography appended at Section 10 details literature review references relevant to grave plot yield per hectare.

4.0 Methodology and Analysis

The 2013–14 work provided a useful test of data and analysis parameters required for metropolitan Sydney. It identified that differentiated information in respect of ‘first interments’ versus subsequent interments would be required to model consumption of new grave plots. Also, a standardised approach considering unused burial land areas by hectare and using a standard approach for grave plot yield would be required to avoid variable assumptions in respect of future land use and design.

There is no Australian Standard or equivalent regulation that sets a maximum figure for the number of grave sites which may be developed per hectare. A review of international literature identifies a general rule of thumb for the burial capacity of cemetery land areas of 1,000 plots per acre, which equates to 2,470 plots per hectare. At the extreme, it may be contended that a standard grave requires a land area of only 2 metres by 1.25 metres, and that 4,000 plots may be realised per hectare. (note that such an approach does not commit any land area to pathways, infrastructure, etc., and may be infeasible without significant works).

Data collected for the CCNSW capacity survey included the land areas of cemeteries that have been ‘buried out’ and the volumes of burials undertaken in those areas. For the metropolitan Sydney facilities included in the survey, 505 hectares of burial land were identified as buried out in the years to 2015. Operators reported 1,257,897 burials having been undertaken in the 505 hectares of buried-out cemetery land. Deficiencies of aged records for some facilities required the use of estimates, rather than authoritative numbers. Data was not generally available in respect of ‘grave occupancy’ for aged graves. Nonetheless, the data provides an average of 2,489 burials per hectare in those ‘buried out’ areas of existing Sydney cemeteries.

This analysis has used a maximum figure of 2,800 grave sites per hectare in projecting the carrying capacity per hectare of burial areas with capacity remaining as at 1 Jan 2015. The rationale for the approach is detailed at Attachment C. The figure is intended to take account of factors including contemporary design approaches moving away from large-scale monumentation, and that the yield of ‘burial areas’ excludes large-scale ‘infrastructure’ areas of cemeteries (road networks, buildings, carparks etc.).

Considerations relevant to determination of a standard carrying capacity per hectare include:

- general standards for cemetery design, including carrying capacity
- metropolitan cemetery land use information, as collected from cemetery operators during the capacity survey by CCNSW

- contemporaneous cemetery designs and plans
- conditions identifiable in planning authority consents.

The net effect of adjustments made to projected grave plot yield information as provided by operators was a minor reduction in the number of plots projected as available as at 1 January 2015. Projected yields higher than 2,800 per hectare were generally adjusted down, while areas with projected yields below 2,800 were generally accepted, with expectation that capacity in grave plots as reported by the operator reflects known, actual site-specific constraints.

The land area available for future burial use in each planning region, and the projected carrying capacity in grave plots used in the survey (using the standard approach for larger land areas), are detailed at Table 4.2.

CCNSW holds facility-specific cemetery land area response information from each cemetery operator included in the report. This information is aggregated up to planning region level for publication in this report. Facility-specific capacity information is generally regarded as commercial in confidence, and is not published with the report, or available upon enquiry, other than where specifically authorised for release by an operator.

STEP 4—CALCULATE CAPACITY (IN GRAVE PLOTS) FOR EACH PLANNING REGION, AS AT 1 JANUARY 2015

Step four of the approach required calculation of the capacity (in grave plots) for each Sydney planning region, as at 1 January 2015.

As described above, a capacity in grave plots for each planning region was calculated from a combination of operator survey information, and survey information adjusted by CCNSW in respect of future yield.

Cemetery specific information was then aggregated up to planning region level, to (wherever possible) avoid disclosure of operator- or facility-specific information.

The land area available for future burial use in each planning region, and the projected carrying capacity in grave plots used in the survey, as calculated by CCNSW, are shown in Table 4.2.

Metropolitan Sydney district	Land area available (in HA)	Carrying capacity (in grave plots)
Central	3.6	6,600
West Central	54	144,009
North	16.25	31,309
West	20.28	18,420
South West	39.37	94,319
South	9.98	6,500
TOTAL	143.48	301,157

Table 4.2 Land area available for future burial use in each planning region

Overall the carrying capacity of the 143.48 hectares in grave plots averages to 2,098 graves per hectare. This figure reflects use of the 2,800 plots standard for undeveloped greenfields areas, and the actual carrying capacity of areas planned for development (as reported by operators), reflecting site-specific yield constraints.

The available capacity figure for each planning region is the 'starting figure', from which projected burials in new graves for time periods subsequent to 1 January 2015 (as modelled in the analysis) are to be deducted.

The heat-map shown in Chart 4.2 illustrates the disproportionate distribution of grave plot capacity (as at 1 January 2015) between metropolitan Sydney's regions.

Treatment of potential cemetery developments in western Sydney

The capacity survey has necessarily focussed on land available in operational cemeteries as at 1 January 2015.

Land for which a planning authority has provided consent for a cemetery development (consequent to a development application or other planning proposal), with potential to become operational cemetery land in future, has not been included in the analysis.

The reasoning for this treatment (discussed further in Attachment B) is that approval of a development application (DA) means that it is open to a landholder to proceed with the form of land use permitted by the DA consent. Whether a landholder proceeds with that form of land use is a discretionary commercial decision for the landholder.

Of a number of development approvals in metropolitan Sydney achieved since 2012, only one site of 10 hectares has proceeded to cemetery development.

Number of grave plots available in each region as at 1 Jan 2015

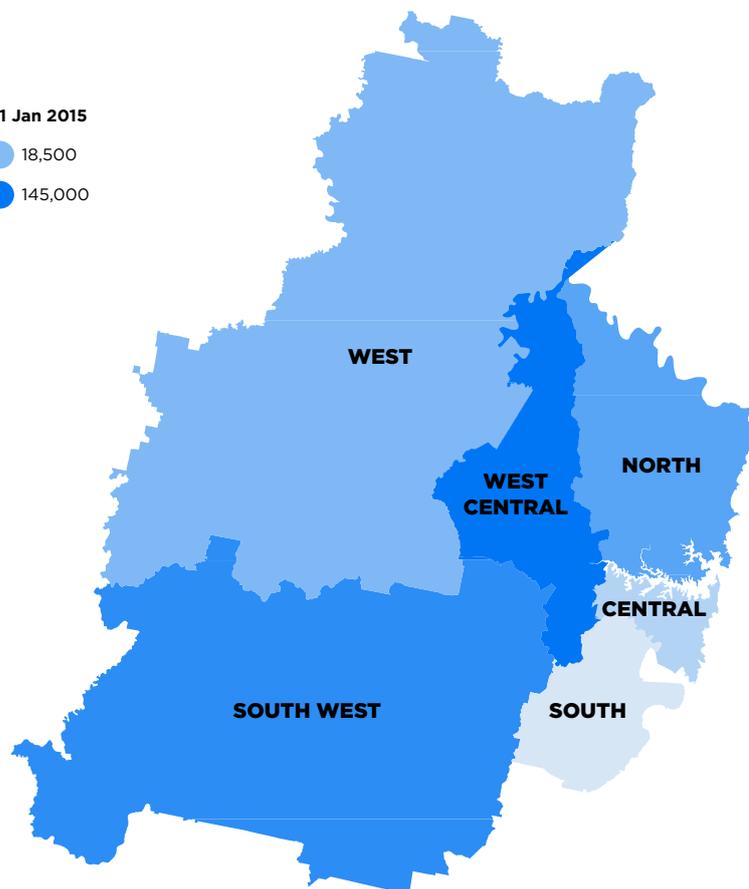


Chart 4.2 No. of plots available per region 2015-56

Treatment of ‘pre-sale’ of burial plots and interment rights

Anecdotal information from metropolitan cemetery operators suggests that around 30%–40% of sales revenues for cemeteries derives from ‘pre-sales’, i.e. the sale of the right for a future burial in a grave plot, prior to the time of need. Sales that are undertaken once a person has died and burial is already required are termed as ‘at-need’.

In the event that 30%–40% of grave plots ‘available for use’ at any time have been pre-sold, the time when grave plots are unavailable for ‘at-need’ scenarios is necessarily brought forward. If (as projected by Scenario 4) grave plots generally are to be exhausted by 2051, pre-sales could mean that grave plots would be unavailable for ‘at-need’ customers, without a pre-purchased site, from ten or more years before that time. Community awareness of a looming exhaustion of grave plot stock could also be expected to considerably increase interest in pre-sales, and bring forward the time where ‘at-need’ stock is unavailable.

A substantive further cycle of data collection with operators would be required to quantify the impact of pre-sold burial rights on ‘at-need’ grave availability, on a per-region basis. CCNSW may prioritise the issue for follow-up action following publication of the metropolitan Sydney and Hunter, Central Coast and Illawarra region reports.

Nonetheless, it would be reasonable to expect that grave plots would become largely unavailable ‘at-need’, due to pre-purchase of grave plots stock, 10 or more years prior to the exhaustion date under any scenario.

STEP 5—PROJECT THE NUMBER OF DEATHS IN THE REGIONS THROUGH TO 2056

Step five of the approach requires projection of the number of deaths in the planning regions included in the survey through to 2056.

The Australian Bureau of Statistics publishes retrospective mortality information in the Australian deaths dataset 3302.0²⁷. DPE’s demographic branch maintains population projections for NSW, for use in the planning of service and infrastructure delivery to the community²⁸. Projections also provide the basis for assessing future requirements for residential and commercial land, housing, public utilities, and the provision of a wide variety of services.

These projections include projected deaths for future periods, per local government area. Bespoke projections of deaths were provided by DPE to CCNSW to support the capacity survey²⁹. Projected death data was provided by DPE for the period 2011 to 2041. With advice from DPE, CCNSW has projected death volumes for the periods from 2041 to 2056.

Number of deaths projected for each planning region 2017–41

Region	2017–21	2022–26	2027–31	2032–36	2037–41
Metro Sydney—Central	21700	22900	24600	26850	31800
Metro Sydney—West Central	29250	31900	35200	39500	44350
Metro Sydney—North	31700	33150	35100	38200	39400
Metro Sydney—West	9550	10800	12200	13900	15650
Metro Sydney—South West	17750	20200	23050	26450	30350
Metro Sydney—South	20700	21450	22750	24650	26950
TOTAL	48660	130650	140400	152900	169550

Table 4.3 No of deaths projected for each planning region 2017–41

CCNSW has projected the same numerical increase for each five-year period after 2041, as was projected by DPE for the period 2036–2041. Projected deaths for each period through to 2056 are provided at Attachment D.

Figures used for the period 2041 to 2056 are considered as likely to be conservative, given underlying factors including total population, and total aged population, applicable during those terms. However, other factors including rate of mortality, health service accessibility and standards, environmental conditions, etc. are not known beyond 2036 and are assumed to be consistent with the period 2036–2041.

Figures for each region and time period are detailed in Attachment D.

For metropolitan Sydney, the total projected number of deaths in the Sydney planning districts from 2015 through to 2056 is 1,530,910.

STEP 6—DETERMINE SCENARIOS FOR PROJECTED RATES OF BURIAL

Step six of the approach required determination of scenarios to be modelled, including rates of cremation and ‘grave occupancy’, to inform projected rates of new grave burial through to 2056.

The number of grave plots required to service community needs in future is dependent upon the number of persons who die each year, the rate

27 See Australian Bureau of Statistics, 33020D0006_2015 Deaths, Australia, 2015, www.abs.gov.au/ausstats/abs@.nsf/mf/3302.0.

28 NSW Department of Planning and Environment, Population projections, accessible at www.planning.nsw.gov.au/Research-and-Demography/Demography/Population-projections.

29 NSW Planning and Environment, Demography Team, bespoke research (2016), attached as Attachment D. Data provided is based on bespoke research conducted for Cemeteries and Crematoria NSW. It is based on current assumptions used for NSW population projections. However, the time horizon has been extended to 2041 on request. The numbers presented are indicative of overall trends and should be treated as such.

of cremation versus burial, and the rate of grave occupancy (i.e. the number of burials completed per grave). Future rates of cremation and grave occupancy are not known, and community preferences may vary over time. CCNSW activity reports for 2014–15 and 2015–16 have established current rates for cremation and grave occupancy for metropolitan Sydney³⁰.

Analysis of activity information collected by CCNSW for the 2014–15 and 2015–16 years identifies that:

- in 2014–15 the metropolitan cremation rate was 66.3%, and the aggregate grave occupancy rate was 1.45, with 8,730 burials completed, 6,013 of those in new grave plots
- in 2015–16 the cremation rate was 65.4%, and the aggregate grave occupancy rate was 1.38, with 9,058 burials completed, and 6,554 of those in new grave plots.

The NSW and metropolitan Sydney cremation rates appear neither particularly low or high in relation to comparable jurisdictions³¹. In the United Kingdom a

cremation rate of 76.4% is reported for 2015³², in Canada a rate of 68.4% for 2009, and in the United States rates vary widely between states, with an average of 47%. A rate of 70% is reported for New Zealand for 2008, and a substantive review of cremation in Victoria undertaken in 2004 identified a cremation rate for metropolitan Victoria of around 54%.³³

CCNSW considers it is not reasonable to draw conclusions regarding trends for cremation and occupancy rates based on two years' worth of data. Changes between 2014–15 and 2015–16 may reflect routine year-on-year standard deviation. Occupancy rate data is known to be incomplete, as not all operator systems can readily report on 'first burials' as versus second or subsequent interments.

To take account of potential changes in cremation and occupancy rates through to 2056, the survey analysis includes eight scenarios (detailed in Table 4.4), including scenarios where rates for these variables remain constant through time, and also where rates rise or fall through time.

Scenario	Rationale
Scenario 1: Starts from aggregated 2014–15 metropolitan Sydney plus H-CC-I cremation & occupancy rates; no change to these rates from 2015 through 2056	Use of aggregate data for metropolitan Sydney and Hunter, Central Coast and Illawarra, providing a larger dataset; however, note that aggregate data does not reflect the significantly lower cremation rate in metropolitan Sydney. Cremation and grave occupancy rates are projected to average at current aggregate rates for the term from 2015 to 2056, steady, in the absence of trend data justifying changes, and in expectation that interment service preferences are unaffected by community changes, price or accessibility changes, or renewable tenure.
Scenario 2: Starts from aggregated 2014–15 Sydney & H-CC-I cremation & occupancy rates, +0.5% pa to each from 2015 through 2056	Use of aggregate data for metropolitan Sydney and Hunter, Central Coast and Illawarra, as per Scenario 1. Cremation and occupancy rates are projected to rise incrementally at +0.5% per year, in expectation that pricing, accessibility and renewable tenure factors influence interment service preferences.
Scenario 3: Starts from aggregated 2014–15 Sydney & H-CC-I cremation & occupancy rates, minus 0.5% pa to each from 2015 through 2056	Use of aggregate data for metropolitan Sydney and Hunter, Central Coast and Illawarra, as per Scenario 1. Cremation and grave occupancy rates are projected to incrementally decrease at -0.5% per year over the term from 2015 to 2056, reflecting continued community orientation to traditional perpetual burial arrangements.
Scenario 4: Starts from differentiated 2014–15 metropolitan Sydney as versus H-CC-I cremation & occupancy rates; no change to these rates from 2015 through 2056	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as differentiated from Hunter, Central Coast and Illawarra rates, reflecting the lower cremation rate in Sydney compared with proximate but less diverse regions. Cremation and occupancy rates are projected to remain steady, in the absence of trend data justifying changes, and in expectation that interment service preferences are unaffected by community changes, price or accessibility changes, or renewable tenure.
Scenario 5: Starts from differentiated 2014–15 metropolitan Sydney as versus H-CC-I cremation & occupancy rates; +0.25% pa to each rate from 2015 through 2056	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as per Scenario 4. Cremation and occupancy rates are projected to rise incrementally at +0.25% per year, in expectation that pricing, accessibility and renewable tenure factors influence interment service preferences.
Scenario 6: Starts from differentiated 2014–15 metropolitan Sydney as versus H-CC-I cremation & occupancy rates; +0.5% pa from 2015 through 2056	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as per Scenario 4. Cremation and occupancy rates are projected to increase steadily at +0.5% per year, in expectation that pricing, accessibility and renewable tenure factors strongly influence interment service preferences.
Scenario 7: Starts from differentiated 2014–15 metropolitan Sydney as versus H-CC-I cremation & occupancy rates; -0.5% pa to cremation and +0.5 to grave occupancy from 2015 through 2056	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as per Scenario 4. Cremation rate is projected to incrementally decrease at -0.5% per year over the term from 2015 to 2056, reflecting continued community orientation to burial arrangements. Grave occupancy is projected to increase at +0.5% per year to reflect the use of double-depth perpetual burials and the take-up of renewable tenure burial arrangements.
Scenario 8: Starts from differentiated 2014–15 metropolitan Sydney as versus H-CC-I cremation & occupancy rates; -0.5% pa (cremation) & -0.5% pa (grave occupancy) from 2015 through 2056	Commences from metropolitan Sydney cremation and occupancy rates as at 2014–15, as per Scenario 4. Cremation and grave occupancy rates are projected to incrementally decrease at -0.5% per year over the term from 2015 to 2056, reflecting continued community orientation to traditional perpetual burial arrangements.

Table 4.4 Eight cremation and occupancy rate scenarios provided in the capacity analysis

30 CCNSW 2014–15 and 2015–16 Activity Reports are accessible at www.crownland.nsw.gov.au/crown_land/cemeteries/planning-and-reporting. Commentary on cremation and grave occupancy rates is provided in the 2014–15 Activity Report at Table 4.8. Number and distribution of services and cremation rate in NSW by region (page 36) and Table 4.11. NSW 2014–15 Second interments and grave occupancy rates 41 (page 44).

31 Cremation rates reported in this paragraph for comparable jurisdictions are drawn from Wikipedia, unless otherwise referenced; see Wikipedia, List of countries by cremation rate; last revised: 25 August 2017; Date retrieved: 30 August 2017 00:58 UTC; Permanent link: en.wikipedia.org/w/index.php?title=List_of_countries_by_cremation_rate&oldid=797178638.

32 Federation of Cremation and Burial Authorities (United Kingdom), Report of the Executive Committee 2016/17, 31 August 2017, page 2.

33 Department of Human Services (Victoria), Victorian Cremation Industry Viability, 2004, a report prepared by Marsden Jacob Associates in conjunction with Spatial Vision and Cumpston Sarjeant Truslove, accessible at www2.health.vic.gov.au/about/publications/researchandreports/victorian-cremation-industry-viability-report, viewed 24 Aug 2017. It is probable that the actual rate is higher, given identified arrangements by which Victorian funeral businesses to transport remains for cremation in adjoining jurisdictions. See articles Benjamin Preiss, "Funeral industry in fight for cremations as bodies sent interstate", The Age September 25 2016, accessible at www.theage.com.au/victoria/funeral-industry-in-fight-for-cremations-as-bodies-sent-interstate-20160923-grnh41.html, viewed 24 Aug 2017; Andrew Jefferson, "Hundreds of Victorians cremated in New South Wales as cost-saving measure", July 5, 2016, accessible at www.heraldsun.com.au/news/victoria/hundreds-of-victorians-cremated-in-new-south-wales-as-cost-saving-measure/news-story/4730924deaf1b80d3134fc6fb5f21625, viewed 24 Aug 2017.

34 The abbreviation H-CC-I is used (where necessary for space reasons) to refer to the Hunter, Central Coast and Illawarra regions.

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These scenarios reflect potential outcomes over the period to 2056, in the absence of reliable trend information in respect of cremation and grave occupancy rates. The CCNSW 2014–15 Activity Report identifies that the cremation rate for Sydney likely reflects the greater diversity of the metropolitan Sydney community, and a persisting orientation to burial for significant cultural and religious communities. Cremation rates for the Hunter, Central Coast and Illawarra regions are higher, potentially correlating with census information identifying higher rates of Anglo-Saxon heritage in those populations.

Consequently, while scenarios 1 to 3 provide analysis that aggregates the cremation and occupancy rates for metropolitan Sydney with those regions, this analysis considers it is not probable that the higher aggregate rate will be realised for the metropolitan Sydney community.

Scenarios 4 and 5, which commence from the cremation rate current for metropolitan Sydney, are considered more likely to reflect future performance. Scenario 4 is conservative, anticipating persistence of current rates of cremation and occupancy, whereas scenario 5 projects incremental increases in those rates.

Scenario 6 projects more aggressive increases in cremation and occupancy rates. Scenarios 7 and 8 project outcomes taking account of potential community resistance to increased cremation and or occupancy rates. The implementation of Part 4 of the *Cemeteries and Crematoria Act 2013*, including the option for renewable tenure, should, in principle, enable higher rates of grave occupancy in future. Under Part 4 renewable tenure arrangements, there is potential for development of 'family plots', where succeeding generations of a family may be interred in grave plots in a non-exhaustive manner. However, in the event implementation of Part 4 does not achieve significant take-up of renewable tenure, or does not establish community confidence in new interment practices, lower cremation and occupancy rates are not impossible.

Note regarding renewable interment rights

CCNSW is responsible for coordinating implementation of the *Cemeteries and Crematoria Act 2013*, which provides for strategic oversight and regulation of the interment industry for the first time in NSW. Provisions of Part 4 include standard statutory rights in respect of perpetual interments of mortal remains, and commence a statutory regime of renewable interment rights for interments of mortal remains³⁵.

The CCNSW Strategic Plan includes priority work streams to ensure that all people in NSW have access to a range of interment services that preserve dignity and respect and support cultural diversity, and that sufficient and suitable land is available to meet future demand for interment services.

Supporting increasing efficiency of the use of cemetery land, including through renewable interments and double or second interments, will be a priority for CCNSW. Renewable rights interments may reasonably be expected, over time, to increase the number of interments that are undertaken for each grave plot. The minimum period for any renewable rights interment is twenty-five years, with processes specified in the Act to be undertaken before a grave may be used for subsequent interments.

The term of projections provided in this study is forty years. It is reasonable to consider that toward the end of the forty year term of projections, increased numbers of burials per grave plot may reduce the land area required for an aggregate amount of burials. However, in the absence of evidence about the take-up of renewable rights interments, no such assumptions have been made, and no increases modelled accordingly.

Development of materials to support implementation of the interment rights regime detailed at Part 4 of the *Cemeteries and Crematoria Act 2013* is proceeding at the time of publication of this report.

STEP 7—PROJECT THE NUMBER OF CREMATIONS AND BURIALS IN METROPOLITAN SYDNEY TO 2056

Comparable studies of cemetery capacity and future community requirements identified by this study are consistent in use of an approach to future needs that commences with projection of future death volumes, and application of projected cremation rates to identify numbers of burials in future periods³⁶.

The following steps have been undertaken in projection of the number of cremations and burials in metropolitan Sydney to 2056:

7.1 Evidentiary basis for projection of cremation and grave occupancy rates

7.2 Summary of cremation and occupancy rates for each scenario

7.3 Cremation and occupancy rates for each period for scenarios 4 and 5

35 Part 4 Interment rights of the *Cemeteries and Crematoria Act 2013* may be viewed at www.legislation.nsw.gov.au/#/view/act/2013/105/part4.

36 See An Audit of London Burial Provision by Julie Rugg and Nicholas Pleace, Cemetery Research Group, University of York 2013; see www.london.gov.uk/file/5284/download?token=sLOljOSB. Department of Health (Victoria), Estimation of the remaining capacity of Victorian cemeteries 2012, see www2.health.vic.gov.au/about/publications/researchandreports/Estimation%20of%20the%20remaining%20capacity%20of%20Victorian%20cemeteries; Davies and Bennett, Planning, provision and perpetuity of deathscapes 2016; see www.researchgate.net/publication/300369447_Planning_provision_and_perpetuity_of_deathscapes-Past_and_future_trends_and_the_impact_for_city_planners. Carlton Basmajian and Christopher Coutts, Planning for the disposal of the dead 2010, see [dx.doi.org/10.1080/01944361003791913](https://doi.org/10.1080/01944361003791913).

7.4 Projection of the numbers of deaths, cremations, burials and first burials (scenario 4)

7.5 Projected consumption of new grave plots by first burials 2015–16 (scenario 4)

7.6 Remaining balance of new grave plots as at key dates 2036 and 2056 (scenario 4)

7.7 Projected outcomes of the analysis for all scenarios

7.8 Projected outcomes for Sydney’s regions

Information on each step is provided in the sections below.

STEP 7.1—EVIDENTIARY BASIS FOR PROJECTION OF CREMATION AND GRAVE OCCUPANCY RATES

CCNSW was established by the *Cemeteries and Crematoria Act 2013*, and commenced operation in November 2014. CCNSW established a register of NSW cemeteries and crematoria, and undertook a pilot survey of burial and cremation activity in NSW for the calendar year 2013. In 2015 CCNSW initiated a formal annual process for collection of burial and cremation activity information, as detailed in the CCNSW 2014–15 Activity Report.

The 2014–15 report, analyses burial, cremation and ash interment activity completed in NSW in 2014–15. The report was based on information provided by cemetery and crematorium operators throughout NSW. A supplement reporting on cremation, burial and ash interment activity conducted in NSW in 2015–16 has also been published.³⁷

Activity information sourced from cemetery operators for the reports includes number of:

- interments of bodily remains in new perpetual interments sites (i.e. gravesites that had no previous interments)
- interments of bodily remains in perpetual interment sites in which one or more previous interments had taken place (ie where an existing grave was re-opened)
- interments of bodily remains in interment sites under renewable rights terms
- interments of cremated remains—below ground or in a niche wall/columbarium
- cremated remains scattered within cemetery grounds.

Information received in relation to these parameters over time will allow tracking of burial and cremation trends, take-up of renewable interment rights, efficiency of grave plot usage, trends in the disposition

of cremated remains, and further analysis and projection of future cemetery land requirements.

Burial and cremation activity volumes, and cremation and grave occupancy rate information for metropolitan Sydney, as presented in the 2015–16 activity report, shown in tables 4.5 and 4.6.

Burials

TOTAL NO. OF BODILY REMAINS INTERMENTS	2014–15	2015–16	% VARIANCE
Whole of NSW	17833	18079	1.4%
Metropolitan Sydney	8730	9058	3.8%
Rural & Regional NSW	9103	9021	-0.9%
Central Coast, Hunter & Illawarra ⁴	2497	2720	8.9%

Cremations

NO. OF CREMATIONS	2014–15	2015–16	% VARIANCE
Whole of NSW	36112	36257	0.4%
Metropolitan Sydney	17208	17153	-0.3%
Rural & Regional NSW	18904	19104	1.1%
Central Coast, Hunter & Illawarra	9269	9828	6.0%

Table 4.5 Summary burial and cremation volume information, CCNSW 2015–16 Activity Report

Cremation rate

CREMATION RATE FOR THE TERM	2014–15	2015–16	% VARIANCE
Whole of NSW	66.9%	66.7%	-0.3%
Metropolitan Sydney	66.3%	65.4%	-1.4%
Rural & Regional NSW	67.5%	67.9%	0.6%
Central Coast, Hunter & Illawarra	78.8%	78.3%	-0.6%

Grave occupancy rate

GRAVE OCCUPANCY RATE FOR THE TERM	2014–15	2015–16	% VARIANCE
Whole of NSW	1.4	1.35	-3.2%
Metropolitan Sydney	1.45	1.38	-4.7%
Rural & Regional NSW	1.36	1.33	-2.3%
Central Coast, Hunter & Illawarra	1.56	1.32	-15.4%

Table 4.6 Summary cremation and grave occupancy rate information, CCNSW 2015–16 Activity Report

Points of interest arising from the activity information for burial land use projection purposes include

- The number and rate of burials is broadly consistent between metropolitan Sydney and rural and regional NSW, burials representing around 35% of deaths in Sydney and 32% of deaths in rural and regional NSW.

37 Cemeteries and Crematoria Activity Reports, accessible at www.crownland.nsw.gov.au/crown_lands/cemeteries/planning-and-reporting.

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- The cremation rate is largely consistent between metropolitan Sydney and rural and regional NSW, around 66%, but a much higher level of cremation is current in the Central Coast, Hunter and Illawarra regions³⁸ (78.3% for 2015–16),
- Data on grave occupancy is known to be incomplete³⁹, but for metropolitan Sydney appears around the level of 1.4 (i.e. at the current rate of second or subsequent interments, 1.4 burials are being undertaken per grave plot). The Sydney rate is higher than in other areas, likely reflecting price, availability and accessibility constraints.

STEP 7.2—SUMMARY OF CREMATION AND OCCUPANCY RATES FOR EACH SCENARIO

The eight scenarios provided in the analysis include different ‘commencing’ rates, and different approaches to changes in future periods.

For the eight scenarios, Table 4.7 illustrates the commencing rates, range and average for cremation and grave occupancy for the periods through to 2056.

The material on rates and associated workings consumes too much space for ready inclusion of workings for all scenarios in this report. Nonetheless, to make clear the approach, the workings for Scenarios 4 and 5, the scenarios in which CCNSW holds most confidence at the time of publication of this report, are provided at steps 7.3, 7.4 and 7.5 (scenario 4), and at Attachments E, F and G (scenario 5).

An MSEXcel download of the spreadsheet in which the

numbers of deaths, cremations, burials and second burials for each scenario is modelled is available from CCNSW at www.crownland.nsw.gov.au/crown_land/cemeteries/planning-and-reporting.

STEP 7.3—CREMATION AND OCCUPANCY RATES FOR EACH PERIOD FOR SCENARIOS 4 AND 5

Of the eight scenarios provided in the analysis, CCNSW holds most confidence in scenarios 4 and 5, which commence from cremation and occupancy rates current as at 2014–15, and assume either no change, or a gradual positive change to these rates through time.

Scenario 4 starts from differentiated 2014–15 metropolitan Sydney versus aggregate Hunter - Central Coast - Illawarra cremation and occupancy rates, and projects no change to these rates through 2056. The rates applied to the numbers of deaths for each period, to determine cremation and burial volumes, are shown in Table 4.7. The rates applied for second or subsequent burial for each period, to determine the number of burials that will be undertaken in new grave plots, are shown in Table 4.7.

SCENARIO	CREMATION RATE RANGE	OCCUPANCY RATE RANGE	CREMATION RATE AVERAGE	OCCUPANCY RATE AVERAGE
Scenario 1: Starts from aggregate 2014–15 Sydney & H-CC-I ³⁸ cremation & occupancy rates, no change to cremation & occupancy rates	0.704	1.473	0.704	1.473
Scenario 2: Starts from aggregate 2014–15 Sydney & H-CC-I cremation & occupancy rates, +0.5% pa to each through 2056	0.704–0.858	1.473–1.795	0.781	1.634
Scenario 3: Starts from aggregate 2014–15 Sydney & H-CC-I cremation & occupancy rates, -0.5% pa to each through 2056	0.704–0.575	1.473–1.203	0.64	1.338
Scenario 4: Starts from differentiated 2014–15 Sydney & H-CC-I rates, no change to cremation & occupancy rates	0.663	1.45	0.663	1.45
Scenario 5: Starts from differentiated 2014–15 Sydney & H-CC-I rates, +0.25% pa change to cremation & occupancy rates, applied in 5 year bundles	0.663–0.732	1.45–1.602	0.696	1.526
Scenario 6: Starts from differentiated 2014–15 Sydney & H-CC-I cremation and occupancy rates; +0.5%pa change to cremation & occupancy rates, applied in 5 year bundles	0.663–0.808	1.45–1.767	0.736	1.609
Scenario 7: Starts from differentiated 2014–15 Sydney & H-CC-I cremation and occupancy rates, -0.5% pa change to cremation rate, and +0.5% pa change to occupancy pa, applied in 5 year bundles	0.663–0.541	1.45–1.767	0.602	1.609
Scenario 8: Starts from differentiated 2014–15 Sydney & H-CC-I cremation and occupancy rates, -0.5% pa change to cremation rate, and -0.5% pa change to occupancy rate, applied in 5 year bundles	0.663–0.541	1.45–1.184	0.602	1.317

Table 4.7 Cremation and occupancy rate ranges and averages

³⁸ Region-specific cremation volumes and rates are provided at Table 4.9.

³⁹ ‘Grave occupancy rate’ is an inferred ongoing rate for the number of interments per grave plot, at the current rate of second interment. The figure is derived by dividing the number of burials completed in the term by the number of burials in new plots completed for the term. Figures must be used with caution, as not all cemetery operators are able to accurately differentiate first from second or subsequent burials for reporting purposes; and at cemetery-specific level, as a cemetery facility nears exhaustion of capacity, only second or subsequent interments may be completed, and the apparent occupancy rate may exceed 2 per grave. CCNSW considers that grave occupancy rate is of value at the regional level, where variations between facilities net out, and where facility-specific anomalies may be excluded from analysis.

⁴⁰ The abbreviation H-CC-I is used (where necessary for space reasons) to refer to the Hunter, Central Coast and Illawarra regions.

Cremation & occupancy rates for scenario 4

	2015-16	2017-21	2022-26	2027-31	2032-36	2037-41	2042-46	2047-51	2052-56
Cremation	0.663	0.663	0.663	0.663	0.663	0.663	0.663	0.663	0.663
Occupancy	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45

Table 4.8 Scenario 4—Cremation and occupancy rates for each period 2015-2056

It is accepted that it is unlikely that cremation and occupancy rates would remain stable year-on-year through to 2056. Nonetheless, there is insufficient data available as at 2017 to be confident of trends in rates. Scenario 4 modelling projects outcomes where cremation and occupancy rates may vary up and down through time, but over the term to 2056 average to the rates current at 2014-15.

Scenario 5 similarly starts from differentiated cremation and occupancy rates and projects an increase to each rate of +0.25% pa through 2056. The rates are applied to the numbers of deaths for each period, to determine cremation and burial volumes; and to the rates applied for second or subsequent burial for each period, to determine the number of burials which will be undertaken in new grave plots, are in the Table 4.9.

Cremation & occupancy rates for scenario 5

	2015-16	2017-21	2022-26	2027-31	2032-36	2037-41	2042-46	2047-51	2052-56
Cremation	0.663	0.671	0.680	0.688	0.697	0.706	0.715	0.724	0.733
Occupancy	1.45	1.468	1.487	1.505	1.524	1.543	1.563	1.582	1.602

Table 4.9 Scenario 5—Cremation and occupancy rates for each period 2015-2056

Scenario 5 necessarily assumes that a range of factors take effect that change the choices that were being made by metropolitan Sydney families and communities as at 2014-15. Factors that may influence increases to the cremation rate include price, service availability, cemetery location and accessibility, in addition to religious and cultural preferences and requirements. In addition to those factors, the grave occupancy rate may be influenced by the take up of renewable tenure under Part 4 of the *Cemeteries and Crematoria Act 2013*, expected to commence in 2018⁴¹.

Selected data for Scenarios 4 and 5 is included in the body of this report to make clear the methodology of the analysis, and to foreground the findings of the analysis.

STEP 7.4—PROJECTION OF THE NUMBERS OF DEATHS, CREMATIONS, BURIALS AND FIRST BURIALS (SCENARIO 4)

For Scenario 4, projection of the numbers of deaths, cremations, burials and first burials in each region for each period from 2015 is provided in Table 4.10.

Metropolitan Sydney's districts (or planning regions) are listed in column A.

The number of deaths projected for each region and period is provided in column B.

Column C contains the cremation rate for the period, which is applied to the number of deaths to calculate a number of persons projected to be cremated for each period (column D).

The number of burials for the period is calculated in column E, by subtracting the number of cremations from the projected number of deaths.

Column F contains the grave occupancy rate for the period, which is applied to the number of burials to calculate a number of new grave plots expected to be opened for each period.

The number of new grave plots used for each period is taken forward into the subsequent table (Table 4.11), which projects the consumption of new grave plots in each region by first burials for each period.

41 Many cemeteries in NSW allow double-depth perpetual interments as at 2015, i.e. a first burial at an increased depth, and a subsequent burial above the initial burial in the same grave plot. As a result there is already an 'occupancy rate' of interments per grave which is higher than 1.

4.0 Methodology and Analysis

Scenario 4 Projection of deaths, cremations, burials, 2nd or subsequent burials and new grave plots used from 2016 through 2056

2015–16

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	9040	0.663	5994	3046	1.45	945	2101
West Central	10680	0.663	7081	3599	1.45	1117	2482
North	11400	0.663	7558	3842	1.45	1192	2650
West	3400	0.663	2254	1146	1.45	356	790
South West	6180	0.663	4097	2083	1.45	646	1436
South	7980	0.663	5291	2689	1.45	835	1855
Metro Sydney total	48680		32275	16405		5091	11314

2017–21

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	23650	0.663	15680	7970	1.45	2473	5497
West Central	29250	0.663	19393	9857	1.45	3059	6798
North	29750	0.663	19724	10026	1.45	3111	6914
West	9550	0.663	6332	3218	1.45	999	2220
South West	17750	0.663	11768	5982	1.45	1856	4125
South	20700	0.663	13724	6976	1.45	2165	4811
Metro Sydney total	130650		86621	44029		13664	30365

2022–26

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	24900	0.663	16509	8391	1.45	2604	5787
West Central	31900	0.663	21150	10750	1.45	3336	7414
North	31150	0.663	20652	10498	1.45	3258	7240
West	10800	0.663	7160	3640	1.45	1130	2510
South West	20200	0.663	13393	6807	1.45	2113	4695
South	21450	0.663	14221	7229	1.45	2243	4985
Metro Sydney total	140400		93085	47315		14684	32631

2027–31

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	26700	0.663	17702	8998	1.45	2792	6205
West Central	35200	0.663	23338	11862	1.45	3681	8181
North	33000	0.663	21879	11121	1.45	3451	7670
West	12200	0.663	8089	4111	1.45	1276	2835
South West	23050	0.663	15282	7768	1.45	2411	5357
South	22750	0.663	15083	7667	1.45	2379	5287
Metro Sydney total	152900		101373	51527		15991	35536

2032–36

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	29100	0.663	19293	9807	1.45	3043	6763
West Central	39500	0.663	26189	13312	1.45	4131	9180
North	35950	0.663	23835	12115	1.45	3760	8355
West	13900	0.663	9216	4684	1.45	1454	3231
South West	26450	0.663	17536	8914	1.45	2766	6147
South	24650	0.663	16343	8307	1.45	2578	5729
Metro Sydney total	169550		112412	57138		17733	39406

Table 4.10 (this page and next) Scenario 4—Projection of deaths, cremations, burials, 2nd or subsequent burials and new grave plots used from 2016 through 2056

2037–41

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	31800	0.663	21083	10717	1.45	3326	7391
West Central	44350	0.663	29404	14946	1.45	4638	10308
North	39400	0.663	26122	13278	1.45	4121	9157
West	15650	0.663	10376	5274	1.45	1637	3637
South West	30350	0.663	20122	10228	1.45	3174	7054
South	26950	0.663	17868	9082	1.45	2819	6264
Metro Sydney total	188500		124976	63525		19715	43810

2042–46

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	31950	0.663	21183	10767	1.45	3342	7426
West Central	50100	0.663	33216	16884	1.45	5240	11644
North	45950	0.663	30465	15485	1.45	4806	10679
West	17400	0.663	11536	5864	1.45	1820	4044
South West	38650	0.663	25625	13025	1.45	4042	8983
South	29250	0.663	19393	9857	1.45	3059	6798
Metro Sydney total	213300		141418	71882		22308	49574

2047–51

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	34500	0.663	22873.5	11627	1.45	3608	8018
West Central	55050	0.663	36498	18552	1.45	5757	12794
North	49550	0.663	32852	16698	1.45	5182	11516
West	19150	0.663	12696	6454	1.45	2003	4451
South West	43650	0.663	28940	14710	1.45	4565	10145
South	31550	0.663	20918	10632	1.45	3300	7333
Metro Sydney total	233450		154777	78673		24416	54257

2052–56

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	37050	0.663	24564	12486	1.45	3875	8611
West Central	59900	0.663	39714	20186	1.45	6265	13922
North	53150	0.663	35238	17912	1.45	5559	12353
West	20900	0.663	13857	7043	1.45	2186	4857
South West	48650	0.663	32255	16395	1.45	5088	11307
South	33850	0.663	22443	11407	1.45	3540	7867
Metro Sydney total	253500		168071	85430		26513	58917

Table 4.10 (continued from previous page) Scenario 4—Projection of deaths, cremations, burials, 2nd or subsequent burials and new grave plots used from 2016 through 2056

4.0 Methodology and Analysis

Data for Scenario 4 is included in the body of this report to make clear the methodology of the analysis, and to foreground the findings of the analysis.

The equivalent projections of the numbers of deaths, cremations, burials and first burials and analysis for scenario 5 is appended to this report at Attachments E, F and G.

For scenario 4, the table of deaths, cremations, burials and first burials in each region for each period from 2015 identifies that with a continued cremation rate around 66.3%, the number of burials to be undertaken in metropolitan Sydney each year rises from 8,203 burials in 2015 and 2016, to 11,432 burials per year in 2036, and further to 17,086 burials per year in 2056.

At the projected rate of second or subsequent burials of 1.45, the number of new burial plots consumed by burials in metropolitan Sydney each year rises from 5,657 plots in each of 2015 and 2016, to 7,881 plots per year in 2036, and further to 11,783 plots per year in 2056.

At a standard yield of 2,800 new grave plots per hectare, by 2056 4.7 hectares of burial land within a cemetery would be consumed per year.

STEP 7.5—PROJECTED CONSUMPTION OF NEW GRAVE PLOTS BY FIRST BURIALS 2015–56 (SCENARIO 4)

Projection of the consumption of new grave plots in each region by first burials for each period for scenario 4 is provided in Table 4.11.

Metropolitan Sydney's districts (or planning regions) are listed in column A.

The number of new grave plots available in each region as at 1 January 2015 is provided in column B.

Column C contains the projected number of new grave plots to be consumed in the period 2015–16 for each region, taking forward the 'plots used' figures detailed for that period in Table 4.10.

Column D calculates a remaining balance of plots available as at the end of the period. Column E then takes forward the 'plots used' figures detailed for the subsequent period in Table 4.10. Column F provides the remaining balance as at 2021.

Column G is a column of 'workings' data, necessitated by the exhaustion of capacity in some regions. For scenario 4, all plots available as at 1 January 2015 in the Central and South planning regions are exhausted by 2021, and the number of plots required in those regions for the period 2017–21 that must transfer to another region to access available capacity is provided at Column G.

From 2021 onwards, each period then carries three columns of data; the 'plots used' figure for each period and region (from Table 4.10); the remaining balance of plots available as at the end of the period; and for regions where capacity is exhausted, the number of plots required in those regions that must transfer to another region to access available capacity.

Where 'plots used' data from any region is assigned to another region, and deducted from that other region's previous balance for the applicable period, a note is provided in the spreadsheet identifying to which region and row that volume has been assigned.

For example, in scenario 4 for the period 2017–21, available capacity in the Central and South planning regions is exhausted and some volume from the 2017–21 period must be assigned to another region. The methodology adopted is to assign those volumes to the most proximate region with remaining capacity. For scenario 4 for the period 2017–21, the note identifies that outstanding 2017–21 and subsequent Central volumes are applied to West Central; and outstanding 2017–21 and subsequent South volumes are applied to South West. Calculation of remaining balances for the West-Central and South-West regions takes into account the assignment of 'overflow' volumes from Central and South regions to those regions⁴².

For scenario 4, the table of projected consumption of new grave plots by first burials 2015–56 identifies that a starting 'available capacity' of 301,157 plots was present as at 1 January 2015.

Taking forward the volumes of new grave plots consumed from Table 4.10 by 2036 only 151,906 plots are projected to be available for subsequent periods, and by 2056 an aggregate deficit of 54,623 plots is projected for metropolitan Sydney.

At a standard yield of 2,800 new grave plots per hectare, the deficit is around 20 hectares of burial land.

⁴² The approach to re-assignment of 'overflow' volumes is consistently applied for each scenario, in the MSeExcel download from CCNSW at www.crownland.nsw.gov.au/crown_lands/cemeteries/planning-and-reporting.

Note regarding 'overflow' volumes that cannot be re-assigned

For scenario 4, the table illustrates that by 2046 there are only two regions with any remaining capacity: South West and West Central.

In the following period to 2051, capacity in West-Central region is also exhausted, and a nominal volume of capacity remains in the South-West region. Consequently, the 'workings' column for the 2052-56 period identifies volumes for all regions which cannot be assigned within the metropolitan Sydney area, with an aggregate deficiency of 54,652 plots in the metropolitan Sydney area, against projected plots required through to 2056.

Projection of the consumption of new grave plots by first burials over the term 2015-56 in each region for each scenario is provided in an MSEXcel download from CCNSW at www.crownland.nsw.gov.au/crown_lands/cemeteries/planning-and-reporting. Of the eight scenarios provided in the analysis, metropolitan Sydney cemetery capacity is exhausted prior to 2056 for scenarios 1, 3, 4, 7 and 8, with the projected deficiency of capacity in each case identified in Table 4.11.

While scenario 4 modelling projects exhaustion of Central and South region capacity in the near term, the analysis in this report applies averaged burial, cremation and occupancy rates to all regions of metropolitan Sydney. So exhaustion rates are indicative only and not specifically applicable to individual cemetery facilities within a region.

Scenario 4 Plots available 1 Jan 2015, and projected consumption through to 2036

SYDNEY REGION	PLOTS AVAILABLE 1 JAN 2015	VOLUME USED 2015-16	BALANCE 2016	VOLUME USED 2017-21	BALANCE 2021	VOLUME t/f TO OTHER REGION	VOLUME USED 2022-26	BALANCE 2026	VOLUME t/f TO OTHER REGION	VOLUME USED 2027-31	BALANCE 2031	VOLUME t/f TO OTHER REGION	VOLUME USED 2032-36	BALANCE 2036	VOLUME t/f TO OTHER REGION
Central	6,600	2101	4,499	5,497	0	998	5,787	0	5,787	6,205	0	6,205	6,763	0	6,763
West Central	144,009	2482	141,527	6,798	133,731		7,414	120,530		8,181	106,144		9,180	88,681	
North	31,309	2650	28,659	6,914	21,745		7,240	14,505		7,670	6,836		8,355	0	1,519
West	18,420	790	17,630	2,220	15,410		2,510	12,900		2,835	10,065		3,231	6,834	
South West	94,319	1436	92,883	4,125	88,592		4,695	78,912		5,357	68,267		6,147	56,391	
South	6,500	1855	4,645	4,811	0	166	4,985	0	4,985	5,287	0	5,287	5,729	0	5,729
TOTAL	301,157	11,314	289,843	30,365	259,478	1,163	32,631	226,847	10,772	35,536	191,311	11,493	39,406	151,906	14,012
				Note 1									Note 2		

Scenario 4 Projected consumption 2037 through to 2056

SYDNEY REGION	VOLUME USED 2037-41	BALANCE 2041	VOLUME t/f TO OTHER REGION	VOLUME USED 2042-46	BALANCE 2046	VOLUME t/f TO OTHER REGION	VOLUME USED 2047-51	BALANCE 2051	VOLUME t/f TO OTHER REGION	VOLUME USED 2052-56	BALANCE 2056	VOLUME t/f TO OTHER REGION	TOTAL USED	FROM STARTING BALANCE
Central	7,391	0	7,391	7,426	0	7,426	8,018	0	8,018	8,611	0	8,611	57,799	-51,199
West Central	10,308	61,825		11,644	31,229		12,794	0	5,550	13,922	0	13,922	82,723	61,286
North	9,157	0	9,157	10,679	0	10,679	11,516	0	11,516	12,353	0	12,353	76,534	-45,225
West	3,637	3,197		4,044	0	847	4,451	0	4,451	4,857	0	4,857	28,575	-10,155
South West	7,054	43,073		8,983	27,293		10,145	4,265		11,307	0	7,042	59,249	35,070
South	6,264	0	6,264	6,798	0	6,798	7,333	0	7,333	7,867	0	7,867	50,929	-44,429
TOTAL	43,810	108,096	22,811	49,574	58,522	25,750	54,257	4,265	36,868	58,917	0	54,652	355,809	-54,652
			Note 3				Note 4				Note 5			

Table 4.11 Scenario 4 projected consumption of new grave plots by first burials 2015-56

Note 1: Outstanding 2017-21 and subsequent Central volumes applied to West-Central; and outstanding 2017-21 and subsequent South volumes applied to South-West

Note 2: Outstanding 2032-36 and subsequent North region volumes applied to West-Central

Note 3: Outstanding 2042-46 West region volumes applied to West-Central

Note 4: West-Central region exhausted in period; all traffic directs to South-West, immediately exhausted in 2052

Note 5: All 1 Jan 2015 Sydney Metro stock exhausted 2052

Note 6: Notional balance of West-Central Region consumed by other region activity

Note 7: Notional balance of South-West Region consumed by other region activity

Note 8: Aggregate deficiency of 54,652 for metropolitan Sydney planning regions as at 2056

4.0 Methodology and Analysis

STEP 7.6—REMAINING BALANCE OF NEW GRAVE PLOTS AS AT KEY DATES 2036 AND 2056 (SCENARIO 4)

Calculation of the remaining balance of new grave plots in each region as at key dates 2036 and 2056 for scenario 4 is provided in Table 4.12.

Metropolitan Sydney's districts (or planning regions) are listed in column A.

The number of new grave plots available in each region as at 1 January 2015 is provided in column B.

Column C contains the projected number of new grave plots to be consumed in the period 2015–36 for each region, taking forward the 'plots used' figures detailed for that period in Table 4.11.

Column D calculates a remaining balance of plots available as at 2036.

Column E identifies the volumes for each region where cemetery capacity is exhausted by 2036, which must be transferred to another region by 2036.

Column F then takes forward the 'plots used' figures detailed above for the period 2037–56.

Column G provides the remaining balance for each region as at 2056.

Column H identifies for each region where cemetery capacity is exhausted by 2056, the volumes between 2036 and 2056 which must be transferred to another region by 2056.

For scenario 4, Table 4.12 identifies that where cremation and occupancy rates current at 2015 continue through to 2056:

- a total of 301,157 new grave plots were projected as being available as at 1 January 2015
- by 2036, 149,251 burials in new grave plots are projected to be undertaken
- of those burials undertaken by 2036, some 37,440 burials would have overflowed from a region in which capacity is exhausted, to the next most proximate region with remaining cemetery capacity
- by 2056, a further 206,558 burials in new grave plots are projected to be undertaken
- of those further burials undertaken by 2056, a further 54,652 burials would have overflowed from a region in which capacity is exhausted, to the next most proximate region with remaining cemetery capacity
- between 2015 and 2056, an aggregate of 355,809 new grave plots are projected to be required
- by 2056, a deficiency of 54,652 new grave plots applies for the metropolitan Sydney region⁴³.

Scenario 4 Remaining balance of new grave plots as at key dates 2036 and 2056

SYDNEY REGION	PLOTS AVAILABLE 1 JAN 2015	VOLUME USED 2015 TO 2036	BALANCE 2036	VOLUME TRANSFERRED TO ANOTHER REGION BY 2036	VOLUME USED 2037 TO 2056	BALANCE 2056	VOLUME TRANSFERRED TO ANOTHER REGION 2036–56	
Central	6,600	26,353	0	19,753	31,446	0	31,446	NB, outstanding 2017–21 and subsequent Central volumes applied to West Central
West Central	144,009	34,056	88,681	0	48,667	0	19,472	NB, West Central receives overflow from Central, West and North regions until exhausted in 2046–51 period
North	31,309	32,828	0	1,519	43,705	0	43,705	NB, outstanding 2032–36 and forward North volumes applied to West Central
West	18,420	11,586	6,834	0	16,989	0	10,155	NB, outstanding 2042–46 and forward West volumes applied to West Central
South West	94,319	21,761	56,391	0	37,488	0	7,042	NB, South West receives overflow from South region until exhausted in 2052–56 period
South	6,500	22,667	0	16,167	28,262	0	28,262	NB, outstanding 2017–21 and forward South volumes applied to South West
TOTAL	301,157	149,251	151,906	37,440	206,558	-54,652	140,082	Aggregate overflow traffic from region of death to most proximate available cemetery capacity (figure includes the negative stock balance of 54,652)

Table 4.12 Scenario 4 Remaining balance of new grave plots as at key dates 2036 and 2056

⁴³ Data for scenario 4 is included in the body of this report to make clear the methodology of the analysis, and to foreground the findings of the analysis. Projection of the consumption of new grave plots by first burials over the term 2015–56 in each region and for each scenario is provided in an MSEXcel download from CCNSW at www.crownland.nsw.gov.au/crown_land/cemeteries/planning-and-reporting.

STEP 7.7—PROJECTED CONSUMPTION OF NEW GRAVE PLOTS FOR ALL SCENARIOS

CCNSW holds most confidence in scenarios 4 and 5, which commence from cremation and occupancy rates current as at 2015–16, and assume either no change, or a gradual positive change to these rates through time, on the grounds that there is insufficient data on trends for those rates to be confident whether in recent years the rates have been rising or falling.

The CCNSW 2014–15 Activity Report references the estimation of remaining cemetery capacity in metropolitan Sydney was undertaken in 2002–05, with reliance upon cremation and grave occupancy rate estimates provided by industry participants. The study assumed a cremation rate around 70%, and a grave occupancy rate of 1.4. In the case those figures for 2002–05 were accurate, activity information of 2015–16 suggests that there has been a fall in the metropolitan cremation rate. Grave occupancy data reported for 2014–15 and 2015–16 is around the 1.4 figure, which, if accurate in 2002–05, would suggest the rate is reasonably stable. There is insufficient data available to be confident of trends for either rate as at 2017.

Continued collection of NSW cemetery and crematoria activity information by CCNSW for 2016–17 and 2017–18 can be expected to inform more reliable projection of current trends by late 2018.

Given potential that other scenarios may better reflect future rates, summary results for each scenario are provided here.

Cremation and occupancy rate ranges and averages are provided at Table 4.7 and Table 1.1.

Table 4.13 summarises the outcomes as at 2036 and 2056 for each scenario.

Capacity Survey Scenario results at 2036 and 2056 – Metropolitan Sydney planning regions

VALUE / SCENARIO	AGGREGATE RATES			DIFFERENTIATED RATES (i.e. Metro Sydney separate from Hunter etc)				
	Sc.1 RATES STEADY	Sc.2 RATES UP	Sc.3 RATES DOWN	Sc.4 RATES STEADY	Sc.5 UP SLOW	Sc.6 UP FAST	Sc.7 1 UP, 1 DOWN	Sc.8 RATES DOWN
Cremation rate (range)	0.704	0.704–0.859	0.704–0.576	0.663	0.663–0.733	0.663–0.809	0.663–0.543	0.663–0.543
Cremation rate (average)	0.704	0.7815	0.64	0.663	0.698	0.736	0.603	0.603
Grave occupancy rate (range)	1.473	1.473–1.798	1.473–1.205	1.45	1.45–1.602	1.45–1.77	1.45–1.77	1.45–1.187
Grave occupancy rate (average)	1.473	1.6355	1.339	1.45	1.526	1.61	1.61	1.3185
Plots available 1 Jan 2015	301,157	301,157	301,157	301,157	301,157	301,157	301,157	301,157
Plots used to 2036	129,046	103,757	156,357	149,251	136,216	123,482	156,321	176,958
Plots available 2036	172,111	197,400	144,800	151,906	164,941	177,675	144,836	124,199
Burials displaced to 2036	29,284	21,109	41,087	37,440	31,708	27,590	41,258	52,381
Plots used 2036 to 2056	178,595	87,057	287,733	206,558	157,788	113,577	227,548	317,424
Plots available 2056	-6,484	110,343	-142,934	-54,652	7,153	64,098	-82,711	-193,225
Burials displaced 2036 to 2056	99,259	35,345	208,617	140,082	85,860	53,421	171,630	247,300

Table 4.13 Capacity Survey Scenario results at 2036 and 2056—Metropolitan Sydney planning regions

4.0 Methodology and Analysis

Chart 4.3 presents outcomes for each scenario, in terms of projected years of capacity from 2015.

Projected years of capacity from 2015

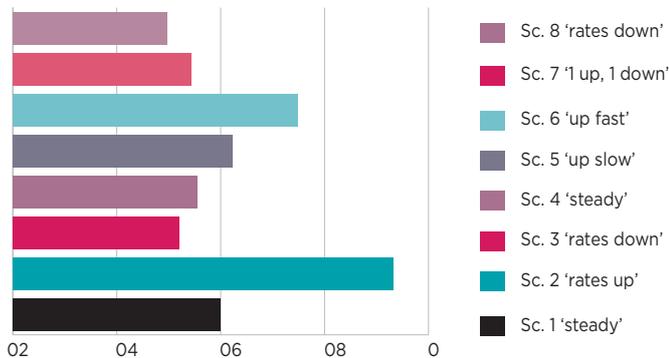


Chart 4.3 Projected years of capacity for each scenario from 2015

Detailed workings for each scenario, including the cremation and occupancy rates for each scenario, projected numbers of deaths, cremations, burials and second burials for each scenario, projected consumption of new grave plots by first burials 2015–56, and remaining balance of new grave plots as at key dates 2036 and 2056, is available from CCNSW at www.crownland.nsw.gov.au/crown_land/cemeteries/planning-and-reporting.

This report foregrounds the outcomes for scenarios 4 and 5.

Scenarios 1 to 3 rely on aggregated cremation and occupancy rates for metropolitan Sydney and the adjoining Hunter, Central Coast and Illawarra regions. Scenarios 4 to 8 differentiate Sydney from the other regions, and therefore commence with cremation and occupancy rates for metropolitan Sydney that were current for 2014–15.

For scenario 4, where cremation and occupancy rates remain averaged to rates current at 2014–15, a deficiency of 54,652 grave plots exists by 2056, and 140,082 burials would have been displaced from the region of origin (i.e., region of death of the deceased person) to another region in which grave plots remained available.

Similarly, for scenario 5, by which cremation and occupancy rates rise incrementally through to 2056, a negligible capacity would remain by 2056, and 85,860 burials would have been displaced from the region of origin, to another region in which capacity remained available.

Only scenarios 2 and 6 project a reasonable remaining capacity of grave plots by 2056.

Scenario 2 assumes a starting cremation rate for metropolitan Sydney of 70.4%, based on aggregated rates for Sydney and adjoining regions, well above the 2014–15 rate for metropolitan Sydney of 66.3%. Scenario 2 also projects incremental increases in both rates through time, with the Sydney cremation rate rising to 85.9%. The rate is not infeasible, but there is insufficient cremation trend information to have confidence in a scenario 2 outcome.

Scenario 6 commences with the 2014–15 cremation rate for metropolitan Sydney of 66.3%, but assumes the rate rises steadily through time to 80.9% by 2056. Scenario 6 similarly projects rises in grave occupancy from 1.45 in 2015 to 1.77 in 2056. Such outcomes are not infeasible, but there is insufficient trend information for cremation and occupancy to have confidence in a scenario 6 outcome.

Scenarios 1, 3, 4, 7 and 8 project deficiencies of grave plot supply before 2056.

Scenario 1 conservatively projects no change to current rates, but uses a starting cremation rate for metropolitan Sydney of 70.4%, based on aggregated rate data for Sydney and adjoining regions, well above the actual 2014–15 rate for metropolitan Sydney of 66.3%. The scenario identifies that a downward trend in the cremation rate through the period has more impact on results over the term than does a limited period where the rate is high.

Scenario 3 similarly commences with cremation rates and occupancy rates for metropolitan Sydney based on aggregated rate data for Sydney and adjoining regions, but projects incremental falls in those rates through to 2056. The scenario clearly illustrates that falls in cremation and occupancy rates over the period would drive demand for a great number of additional grave plots, projecting a deficiency of 142,934 grave plots by 2056, and 208,617 burials would have been displaced from the region or origin, to another region in which capacity remained available.

Scenario 7 commences with cremation rate and occupancy rates current for metropolitan Sydney in 2014-15, but projects incremental falls in the cremation rate through to 2056, somewhat offset by incremental increases in the grave occupancy rate. The scenario clearly illustrates that falls in cremation rates are more material to the number of grave plots required, than increases in occupancy rates. The declining cremation rate over the period would sustain demand for additional grave plots, projecting a deficiency of 82,711 grave plots by 2056, and 171,630 burials would have been displaced from the region or origin, to another region in which capacity remained available.

Scenario 8 commences with cremation rate and occupancy rates current for metropolitan Sydney in 2014-15, but projects incremental falls in both rates through to 2056. The scenario clearly illustrates that falls in cremation and occupancy rates would drive sustained demand for additional grave plots, projecting a deficiency of 193,225 grave plots by 2056, and 247,300 burials would have been displaced from the region or origin, to another region in which capacity remained available. Under scenario 8, an additional 140,000 grave plots (or 50 hectares of burial land) would be required compared with scenario 4, where current cremation and occupancy rates persist.

KEY FINDINGS

- If there is no change to existing cremation and grave occupancy rates, cemetery capacity in metropolitan Sydney would be exhausted by 2051.
- Unavailability of 'at-need' grave plots can be expected well in advance of that period.
- Pre-sale of grave plots is likely to mean that graves may become unavailable for 'at-need' purchasers; unavailability can be anticipated in some regions from around 2026, and generally from around 2036.
- Unavailability of grave plots in 'at-need' circumstances will particularly disadvantage:
 - families with insufficient resources to pre-purchase
 - communities with cultural and religious commitments to burial rather than cremation.
- Urgent action is required to provide for the future burial needs of the Sydney community.

STEP 7.8—PROJECTED OUTCOMES FOR SYDNEY'S REGIONS

Outcomes in terms of grave plot availability will not be even across the regions of Sydney, with various consequences for those regions for which capacity is exhausted.

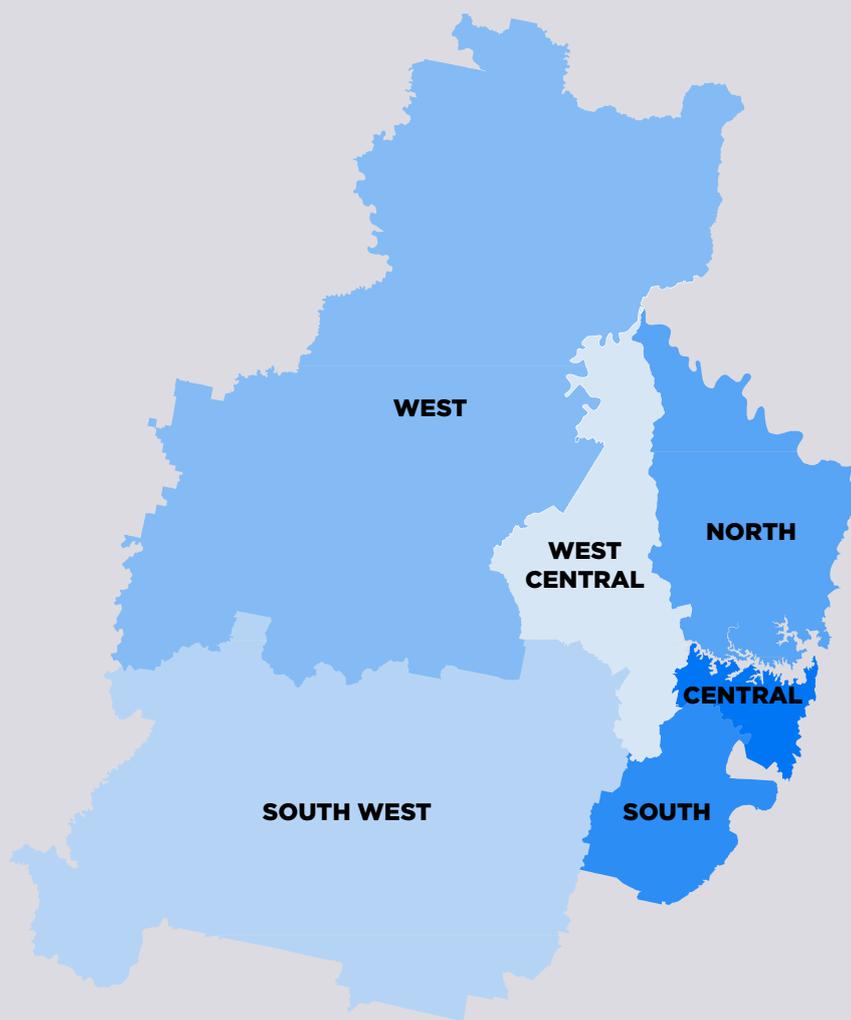
Table 9.6, Summary table of outcomes for metropolitan Sydney, all scenarios, provided at Attachment H details the outcomes per region of Sydney in respect of plots used, burials displaced, balance remaining, years of capacity remaining and per-year rate of inventory consumption over ten year intervals from 2016.

As identified in Table 4.12, scenario 4 projects that the Central, North and South regions of Sydney would be exhausted of grave plot capacity before 2036. Central region would be exhausted of capacity by around 2020, South region by around 2021, and North region by around 2034. For these regions, the analysis assigns burial volumes to the next most proximate regions with remaining burial capacity. Where each of the regions abutting the coastline is exhausted, the next most proximate regions are unavoidably the West-Central, West and South-West regions.

Funeral and memorial service arrangements for persons who pass away are generally undertaken in the location associated with the life of a deceased person. It is also generally the case that the family and social networks for deceased persons are proximate to the location of the deceased's life. Where a burial is by necessity undertaken in a region remote from the location of the life of the deceased, additional travel time is involved in the transfer to the site for burial, and on an ongoing basis for visitation by family and friends.

The scenario 4 projections identify that from the Central, South and North regions, some 37,440 burials would by necessity be forced to be undertaken in the next most proximate region by 2036. The projections are significantly worse for the period from 2037 to 2056, with 140,000 burials across the regions of metropolitan Sydney displaced from the region of the deceased's death to another region where burial capacity remains.

Chart 4.4 illustrates the ratio between the number of projected deaths in each region over the period 2015-56, and the number of grave plots projected to be available over the same period.



Ratio between grave plots available and projected deaths, 2015-56

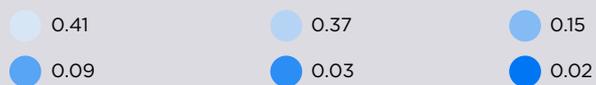


Chart 4.4 Ratio of grave plots available to projected deaths in each region over the period 2015-56

The heat-map in Chart 4.4 illustrates the ratio of deaths to grave plots available in each region over the period 2015–56 for the metropolitan Sydney regions. Capacity in the Central, South and North regions carry very low numbers of available grave plots in proportion to the number of deaths projected for those regions through to 2056.

Only the West-Central and South-West regions are well served for capacity in proportion to the number of persons projected to die in each region.

Central, North and South regions are disadvantaged in terms of current capacity, and would be subject to future disadvantage through displacement of burials from the home region of the deceased to another region, and negative effects to burial costs and ongoing cemetery and grave visitation.

While commentary in this report focuses on outcomes for scenarios 4 and 5, under any of the scenarios of the analysis, grave plot capacity for the Central, South and North regions of Sydney is greatly out of proportion to population and projected deaths for those regions.

It is infeasible to expect that material land areas may be committed to cemetery use in central Sydney, given population density and competing requirements in respect of public open space.

It is feasible that material land areas in the North and South regions may be identified and committed to cemetery land use. Provision of capacity in the North and South regions would benefit all regions of Sydney, providing capacity for the North and South region communities, and opportunity for the Central region community to choose between facilities in the north, south and west directions.

Provision of capacity in the North and South regions would sustain the desirable distribution of cemetery infrastructure across the planning regions of Sydney, maintain reasonable equitability of access to cemeteries for the communities of the Central, North and South regions, and provide for burials close to the region of the life and social networks of deceased persons. This outcome would also sustain positive effects in respect of costs and visitation for those communities, as compared with an outcome where limited land availability and affordability require the direction of burial activity from all the regions of metropolitan Sydney toward Western Sydney.

The Plan for Growing Sydney, and cemetery requirements

From its formation in 2014, CCNSW has actively engaged with Sydney planning authorities to promote awareness of capacity issues, and the need to plan for cemetery needs of coming decades.

The Plan for Growing Sydney developed by the Greater Sydney Commission from 2014⁴⁴ includes an action item to deliver long-term planning for cemeteries and crematoria infrastructure. The plan commits that the government will facilitate market delivery of sufficient space for cemeteries to meet future local and regional demand by:

- considering evidence-based benchmarks for cemetery space that take into account population growth and density, mortality rates, cultural composition and interment trends
- providing guidance on appropriate locations for new cemeteries
- ensuring appropriate land use controls and zoning to facilitate cemetery development⁴⁵.

The Plan for Growing Sydney is supported by district plans for each of the districts or planning regions used in this report. The Draft North District Plan and equivalent Draft South District Plan of November 2016 include 'liveability priorities', to respond to people's need for services to support planning for cemeteries and crematoria.

The item identifies that cemeteries and crematoria are important infrastructure, as all cities require land for burial or cremation and associated facilities such as chapels, reception centres and car parking; and that contemporary facilities incorporate gardens, bushland settings and open space areas reflecting society's changing preferences, and meeting requirements in respect of public open space and recreation⁴⁶.

44 Greater Sydney Commission, A Plan for Growing Sydney, December 2014, accessible at www.greater.sydney/greater-sydney-regional-plan.

45 A Plan for Growing Sydney, December 2014; page 61.

46 Plans for the planning districts of metropolitan Sydney can be accessed from the Greater Sydney Commission at www.greater.sydney/district-plans; see Draft North District Plan, November 2016, pages 6, 73, 80, 121; and Draft South District Plan, November 2016, pages 6, 75, 107.

4.0 Methodology and Analysis

The plan notes that CCNSW will provide guidance on the appropriate location and development consent conditions for new cemeteries and appropriate land use controls and zoning; and that relevant planning authorities should give consideration to the need and locational requirements of cemeteries and crematoria, with information as to how these matters have been taken into account to be demonstrated in any relevant planning proposal.

This Metropolitan Sydney Cemetery Capacity Report provides evidence of the looming exhaustion of cemetery capacity for Central, North and South regions, and informs further action by CCNSW to engage with planning authorities, cemetery operators and landholders, with the view to identifying sites suited to cemetery land use, and progressing action to commission additional cemetery for the North, South and Central region communities.

Key findings

Under scenarios 4 or 5:

- the Central, North and South regions of Sydney are projected to be exhausted of grave plot capacity before 2036
- pre-sale of grave plots is likely to mean that graves become unavailable for 'at-need' purchasers from around 2026
- urgent action is required in North and South regions to provide for the future burial needs of the Central, North and South region communities.



5.0 FINDINGS

The numerical outcomes for the eight scenarios of the capacity analysis for metropolitan Sydney are detailed in the table below. Scenarios 4 and 5 are highlighted, as these projections are considered most probable on the basis of currently available information.

SCENARIO	OUTCOME		
Scenario 1, no change to aggregate Sydney & H-CC-I cremation & occupancy rates	All Sydney metro cemetery capacity exhausted approx. 2054 Approx 10,000 plots required per annum at 2056 Deficit of approx. 6,500 Sydney metro plots present at 2056 Central region capacity exhausted approx. 2021 South region capacity exhausted approx. 2021 North region capacity exhausted approx. 2038 West region capacity exhausted approx. 2048 West-Central and South-West regions capacity exhausted approx. 2054	Cremation and Occupancy rates for combined Greater Sydney region, including Hunter, central Coast and Illawarra regions	Metro cemeteries exhausted 2054 Deficit of 6,500 plots for Metro Sydney by 2056
Scenario 2, incremental increases to aggregate Sydney & H-CC-I cremation & occupancy rates	Approx 110,000 Sydney metro plots remain available as at 2056 Approx 4,000 plots consumed per annum at 2056 Per annum rate of stock consumption as at 2056 approx 3.7% Central region capacity exhausted approx. 2021 South region capacity exhausted approx. 2022 North region capacity exhausted approx. 2044	Cremation and Occupancy rates for combined Greater Sydney region	Approx 110,000 Metro cemetery plots available at 2056
Scenario 3, incremental decreases to aggregate Sydney & H-CC-I cremation & occupancy rates	All Sydney metro cemetery capacity exhausted approx. 2048 Approx 18,000 plots required per annum at 2056 Deficit of approx. 143,000 Sydney metro plots present at 2056 Central region capacity exhausted approx. 2020 South region capacity exhausted approx. 2021 North region capacity exhausted approx. 2034 West region capacity exhausted approx. 2044 West-Central and South-West regions capacity exhausted approx. 2048	Cremation and Occupancy rates for combined Greater Sydney region	Metro cemeteries exhausted 2048 Deficit of 143,000 plots for Metro Sydney by 2056
Scenario 4, no change to Sydney Metro cremation & occupancy rates	All Sydney metro cemetery capacity exhausted approx. 2051 Approx 12,000 plots required per annum for Sydney metro at 2056 Deficit of approx. 55,000 Sydney metro plots present at 2056 Central region capacity exhausted approx. 2020 South region capacity exhausted approx. 2021 North region capacity exhausted approx. 2034 West region capacity exhausted approx. 2044 West-Central and South-West regions capacity exhausted approx. 2052	Rates specific to Metro Sydney region	Metro cemeteries exhausted 2051 Deficit of 55,000 plots for Metro Sydney by 2056
Scenario 5, incremental increases to Sydney Metro cremation & occupancy rates	Approx. 7,000 Sydney metro plots remain available as at 2056 Approx. 8,500 Sydney metro plots required per annum at 2056 Approx. 1 year of Sydney metro stock available at 2056 rate of consumption Central region capacity exhausted approx. 2020 South region capacity exhausted approx. 2021 North region capacity exhausted approx. 2037 West region capacity exhausted approx. 2048	Rates specific to Metro Sydney region	Metro cemeteries exhausted -2056 Deficit of 55,000 plots for Metro Sydney by 2056
Scenario 6, material increases to Sydney Metro cremation & occupancy rates	Approx. 64,000 Sydney metro plots remain available as at 2056 Approx. 5,500 Sydney metro plots required per annum at 2056 Per annum rate of Sydney metro stock consumption as at 2056 approx 9% Central region capacity exhausted approx. 2021 South region capacity exhausted approx. 2022 North region capacity exhausted approx. 2039	Rates specific to Metro Sydney region	Approx 64,000 Metro cemetery plots available at 2056
Scenario 7, incremental decrease to the Sydney Metro cremation rate, but incremental increase to occupancy rate	All Sydney metro cemetery capacity exhausted approx. 2048 Approx. 13,000 Sydney metro plots required per annum at 2056 Deficit of approx. 83,000 Sydney metro plots present at 2056 Central region capacity exhausted approx. 2020 South region capacity exhausted approx. 2020 North region capacity exhausted approx. 2034 West region capacity exhausted approx. 2044 West-Central and South-West regions capacity exhausted approx. 2048	Rates specific to Metro Sydney region	Metro cemeteries exhausted -2048 Deficit of 83,000 plots for Metro Sydney by 2056
Scenario 8, incremental decreases to Sydney Metro cremation & occupancy rates	All Sydney metro cemetery capacity exhausted approx. 2046 Approx. 20,000 Sydney metro plots required per annum at 2056 Deficit of approx. 195,000 Sydney metro plots present at 2056 Central region capacity exhausted approx. 2020 South region capacity exhausted approx. 2020 North region capacity exhausted approx. 2033 West region capacity exhausted approx. 2041 West-Central and South-West regions capacity exhausted approx. 2046	Rates specific to Metro Sydney region	Metro cemeteries exhausted -2046 Deficit of 195,000 plots for Metro Sydney by 2056

Table 5.1 Summary outcomes for the eight scenarios, metropolitan Sydney cemetery capacity analysis

5.0 Findings

A graphic representation of the balance of plots by 2056 under the eight scenarios is shown in Chart 1.5 below.

Balance of plots by 2056, all scenarios

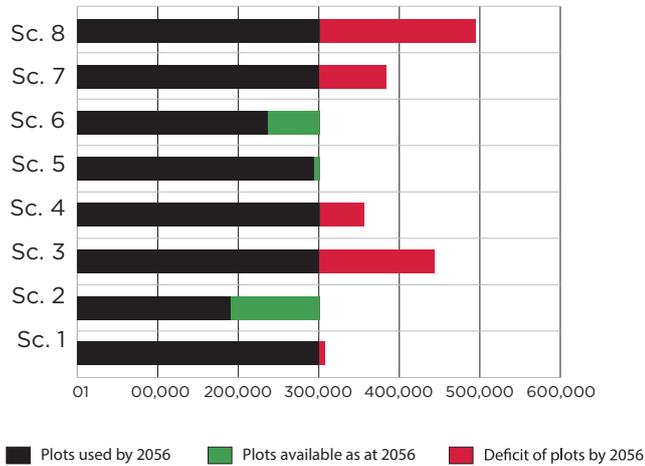


Chart 1.5 Balance of metropolitan Sydney new grave plots remaining by 2056 for all scenarios

Scenarios 4 and 5 are informed by currently available cremation and grave occupancy information, and best estimations of foreseeable trends.

Under either scenario 4 or 5, if there is no material change to cremation and occupancy rates, cemetery capacity in metropolitan Sydney will be exhausted between 2051 and 2057. CCNSW holds most confidence in the projections of scenario 4, by which all metropolitan Sydney cemetery capacity is exhausted by 2051, and a deficit of approximately 55,000 burial plots is projected for the term to 2056.

The effect of pre-sales will mean that grave plots required ‘at-need’ (i.e. in circumstances where no pre-purchase has been made) will be unavailable well in advance of 2051—potentially more than ten years in advance. Plots would be unavailable other than in the western areas of Sydney from around 2036, and unavailable in ‘at-need’ scenarios potentially from

around 2026.

Only scenarios 2 and 6, which assume cremation rates materially higher than those current in metropolitan Sydney, project the availability of grave plot capacity as at 2056. There is no trend information available as at 2016 which would provide confidence that the cremation rates of scenarios 2 and 6 may be realised.

Even in the event the cremation rate current in metropolitan Sydney does increase significantly over the period to 2056, cemetery capacity is projected to become exhausted around 10 years following 2056.

In any environment of apprehended exhaustion of capacity, such capacity as remains may be very concentrated by location and operator, with the majority of the Sydney population lacking proximate access to burial space, and potential that significant communities will be lacking access to at-need, culturally appropriate or feasibly priced burial capacity.

Given the time required to identify, acquire, gain planning approval for, and commence operation of new greenfield cemetery sites, and the already intense competition between land uses for affordable greenfields land extents in western Sydney, **urgent action is required to provide for the future burial needs of the Sydney community.**

Key findings

- Capacity for around 301,000 grave plots was available in metropolitan Sydney cemeteries as at 1 January 2015; with a prevailing cremation rate around 66%, and a grave occupancy rate around 1.4.
- There is insufficient trend information to be confident of cremation and grave occupancy rates in future periods.⁴⁷
- Over 1.5 million persons are projected to require burial or cremation in metropolitan Sydney between 2015 and 2056, with over 355,000 grave plots projected to be required from 2015 to 2056.
- By 2056, around 11,800 new grave plots would be consumed in metropolitan Sydney per annum, requiring around 4 hectares of cemetery burial land.
- If there is no change to existing cremation and grave occupancy rates, cemetery capacity in metropolitan Sydney would be exhausted by 2051 if not before; unavailability of 'at-need' grave plots can be expected well in advance of that period.
- Pre-sale of grave plots is likely to mean that graves may become unavailable for 'at-need' purchasers; unavailability can be anticipated in some regions from around 2026, and generally from around 2036
- Unavailability of grave plots in 'at-need' circumstances will particularly disadvantage:
 - families with insufficient resources to pre-purchase
 - communities with cultural and religious commitments to burial rather than cremation
- Even in the event incremental increases in cremation and grave occupancy persist from 2015 through to 2056 (scenario 5), capacity would be exhausted by 2057
- Under scenarios 4 or 5, such capacity as remained by 2046 would be very concentrated by location and operator, with the majority of the Sydney population lacking proximate access to burial space, and potential that significant communities lack access to at-need, culturally appropriate or feasibly priced burial capacity.
- Under any scenario of apprehended exhaustion, adverse outcomes may be expected well in advance, with community awareness of shortages driving demand for the pre-purchase of available stock, and negative effects to equitable, timely, proximate, or affordable access for many communities.
- Negative outcomes would be concentrated by geography and cultural orientation, disproportionately affecting the communities of the Central, North and South regions.
- Under either scenarios 4 (persistence of current cremation and occupancy rates), or scenario 5 (these rates increase incrementally from 2015 through to 2056):
 - the Central, North and South regions of Sydney are projected to be exhausted of capacity before 2036
 - pre-sale of grave plots is likely to mean that graves become unavailable for 'at-need' purchasers in the North and South regions from around 2026
 - urgent action is required in North and South regions to provide for the future burial needs of the Central, North and South region communities.

⁴⁷ The CCNSW 2015–16 Activity Report is available at under publication at the time of compilation of this report. The cremation rate for metropolitan Sydney for 2015–16 is marginally down on the 2014–15 year, but an insufficient number of years of activity data has been collected to be confident whether the variation is standard deviation, or an ongoing trend. See above, Table 4.6 Summary cremation and grave occupancy rate information, CCNSW 2015–16 Activity Report.

6.0 LOOKING BEYOND 2056

In 2015 the Catholic Metropolitan Cemeteries Trust acquired land at Varroville, near Campbelltown, for future development as a major regional cemetery. The expected development is among those potential Western Sydney cemetery developments referenced at Step 1 in section 4 of this report. Capacity expected to be made available at the site is quantified in Attachment B.

The proposed Macarthur Memorial Park development at Varroville is projected to make available approximately 136,000 burial places on land areas suitable for burial use of approximately 50 hectares within the total site area of 113 hectares.

The capacity scenarios in this report in which most confidence is held (scenario 4, which assumes no change to current cremation and occupancy rates; and scenario 5, with incremental increases to rates) have either a deficit or effectively a zero metropolitan cemetery capacity balance by 2056.

The analysis in this report identifies that by 2056, around 11,800 new grave plots would be consumed in Sydney each year, requiring around four hectares of cemetery burial land.

If the capacity of the proposed cemetery at Varroville is included in projections, between zero and 13 years cemetery capacity would be remaining at 2056.

Table 6.1 shows the projections if the rates current for scenarios 4 or 5 persist for periods beyond 2016.

If the number of deaths per annum in metropolitan Sydney were to remain at the 2056 level for following years and decades, and the cremation and occupancy rates of scenarios 4 or 5 also persist at 2056 levels, metropolitan Sydney would require capacity equivalent to that of the Macarthur Memorial Park development approximately every 15–20 years, or six major regional cemetery developments to provide capacity through to 2116, being a horizon of 100 years from the time of the analysis.

Competition between land uses in the metropolitan area may not be expected to decrease while the population continues to increase. The time horizon for which cemetery capacity should be planned should arguably be longer (e.g. 100 years) rather than shorter (e.g. 50 years).

This projection does not factor in the ‘non-exhaustive’ (renewable) burial practices enabled upon commencement of Part 4 of the *Cemeteries and Crematoria Act 2013*. The volume of land required for burial use in future decades may be moderated by the take-up of renewable tenure burial arrangements.

SCENARIO 4	SCENARIO 5
Deaths PA as at 2056: 50,600	Deaths PA as at 2056: 50,600
Cremation rate @ 2056: 0.663	Cremation rate @ 2056: 0.732
Burials PA @ 2056: 17,086	Burials PA @ 2056: 13,588
Occupancy rate @ 2056: 1.45	Occupancy rate @ 2056: 1.602
Grave plots used PA @ 2056: 11,783	Grave plots used PA @ 2056: 8,482
Burial land hectares used PA @ 2056: approx. 4.2 HA	Burial land hectares used PA @ 2056: approx. 3 HA
Total cemetery land hectares used PA @ 2056: approx. 6–8 HA	Total cemetery land hectares used PA @ 2056: approx. 4.5–6 HA
Additional cemetery land required : a development similar to Macarthur Memorial Park every 14.3 years	Additional cemetery land required : a development similar to Macarthur Memorial Park every 20 years

Table 6.1 Projected metropolitan Sydney requirement for burial land per year from 2056, scenarios 4 and 5

7.0 SUPPLEMENTARY INFORMATION

How to update the Cemeteries and Crematoria Register

You can access the Cemeteries and Crematoria Register at www.crownland.nsw.gov.au/crown_lands/cemeteries/register.

If you are unable to find a cemetery on the register that you consider should be listed, contact us at ccnsw.register@cemeteries.nsw.gov.au.

A form for facility operators for providing updates or additions to the register can be provided on request. Contact ccnsw.register@cemeteries.nsw.gov.au for a copy of the form.

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This schedule lists all the charts and data tables referenced in the report, and the data tables provided in the data supplement to be released in conjunction with the report.

Charts and tables included in the document

8.0 SCHEDULE OF CHARTS AND TABLES

Table 1.1 Eight cremation and occupancy rate scenarios provided in the capacity analysis

Chart 1.1 Scenario 3, cremation and grave occupancy rate trend lines 2015–56

Chart 1.2 Scenario 4, cremation and grave occupancy rate trend lines 2015–56

Chart 1.3 Scenario 5, cremation and grave occupancy rate trend lines 2015–56

Chart 1.4 Scenario 7, cremation and grave occupancy rate trend lines 2015–56

Chart 1.5 Balance of metropolitan Sydney new grave plots remaining by 2056 for all scenarios

Chart 1.6 Projected year of exhaustion of metropolitan Sydney cemetery capacity for all scenarios

Table 2.1 Data sourcing and treatment arrangements for key variables in the analysis

Table 3.1 Greater Sydney region planning regions and Local Government Areas, at the time of report compilation

Chart 3.1, Greater Sydney districts (or planning regions) for metropolitan Sydney

Table 4.1 No. of operational Cemetery and Crematorium facilities within metropolitan Sydney, by district

Chart 4.1, Cemeteries and Crematoria in metropolitan Sydney

Table 4.2 Land area available for future burial use in each planning region

Chart 4.2 No. of plots available per region 2015–56

Table 4.3 No of deaths projected for each planning region 2015–41

Table 4.4 Eight cremation and occupancy rate scenarios provided in the capacity analysis

Table 4.5 Summary burial and cremation volume information, CCNSW 2015–16 Activity Report

Table 4.6 Summary cremation and grave occupancy rate information, CCNSW 2015–16 Activity Report

Table 4.7 Cremation and occupancy rate ranges and averages

Table 4.8 Scenario 4 Cremation and occupancy rates for each period 2015–56

Table 4.9 Scenario 5 Cremation and occupancy rates for each period 2015–56

Table 4.10 Scenario 4 Projection of deaths, cremations, burials, second or subsequent burials and new grave plots used from 2016 through 2056

Table 4.11 Scenario 4 projected consumption of new grave plots by first burials 2015–56

Table 4.12 Scenario 4 Remaining balance of new grave plots as at key dates 2036 and 2056

Table 4.13 Capacity Survey Scenario results at 2036 and 2056—Metropolitan Sydney planning regions

Chart 4.3 Projected years of capacity for each scenario from 2015

Chart 4.4 Ratio of grave plots available to projected deaths in each region over the period 2015–56

Table 5.1 Summary outcomes for the eight scenarios, metropolitan Sydney cemetery capacity analysis

Chart 1.5 Balance of metropolitan Sydney new grave plots remaining by 2056 for all scenarios (reprinted from section 1)

Table 6.1 Projected metropolitan Sydney requirement for burial land per year from 2056, Scenarios 4 and 5

Tables provided as attachments

Table 9.1 Cemeteries included in the CCNSW metropolitan Sydney cemetery capacity survey (Attachment A)

Table 9.2 Potential cemetery developments in western Sydney (Attachment B)

Table 9.3 Projected deaths per planning region from 2015 through to 2056 (Attachment D)

Table 9.4 Scenario 5 Projection of deaths, cremations, burials, 2nd or subsequent burials and new grave plots used from 2016 through 2056 (Attachment E)

Table 9.5 Scenario 5 Projected consumption of new grave plots by first burials 2015–56 (Attachment F)

Table 9.6 Scenario 5 Remaining balance of new grave plots as at key dates 2036 and 2056 (Attachment G)

Table 9.7, Summary table of outcomes for metropolitan Sydney, all scenarios (Attachment H)

Tables included in the CCNSW metropolitan Sydney cemetery capacity data supplement

Worksheet '1. Metadata' provides information about this file, and the spreadsheets included in the data supplement file

Worksheet '2. Scenarios' identifies the eight scenarios included in the analysis, the ranges and averages for cremation rates and grave occupancy rates for each scenario, and projected outcomes for the eight scenarios

Worksheet '3. Metro Sydney results' provides summary result information for each scenario, including per year volumes for Deaths, Cremations, Burials, Second burials, Plots consumed, Displaced burials and Balance remaining, at each ten-year interval from 2016 to 2056

Worksheet '4. Sydney region results' provides summary result information for each scenario and each Sydney planning region, including per year volumes for Deaths, Cremations, Burials, Second burials, Plots consumed, Displaced burials and Balance remaining, at each ten-year interval from 2016 to 2056

Worksheet '5. HCCI region results' provides summary result information for each scenario for the Hunter, Central Coast and Illawarra planning regions, including per year volumes for Deaths, Cremations, Burials, Second burials, Plots consumed, Displaced burials and Balance remaining, at each ten-year interval from 2016 to 2056

Worksheet '6. Capacity 1Jan2015' identifies the remaining capacity of cemeteries in each planning region, in hectares and in grave plots, as adjusted by CCNSW following review of capacity survey response information received from operators

Worksheet '7. Projected deaths' provides the projected number of deaths for each period and each planning region for the term

Worksheet '8. Scenario rates' provides the calculated cremation and occupancy rates for each scenario and period

Worksheet '9. S1 DCBP' provides projected Deaths, Cremations, Burials and Plots Consumed data for Scenario 1 over the term

Worksheet '10. S2 DCBP' provides projected Deaths, Cremations, Burials and Plots Consumed data for Scenario 2 over the term

Worksheet '11. S3 DCBP' provides projected Deaths, Cremations, Burials and Plots Consumed data for Scenario 3 over the term

Worksheet '12. S4 DCBP' provides projected Deaths, Cremations, Burials and Plots Consumed data for Scenario 4 over the term

Worksheet '13. S5 DCBP' provides projected Deaths, Cremations, Burials and Plots Consumed data for Scenario 5 over the term

Worksheet '14. S6 DCBP' provides projected Deaths, Cremations, Burials and Plots Consumed data for Scenario 6 over the term

Worksheet '15. S7 DCBP' provides projected Deaths, Cremations, Burials and Plots Consumed data for Scenario 7 over the term

Worksheet '16. S8 DCBP' provides projected Deaths, Cremations, Burials and Plots Consumed data for Scenario 8 over the term

Worksheet '17. S1 PC' provides projected Burial Plots Consumed data and remaining balance for each region for Scenario 1 over the term

Worksheet '18. S2 PC' provides projected Burial Plots Consumed data and remaining balance for each region for Scenario 2 over the term

Worksheet '19. S3 PC' provides projected Burial Plots Consumed data and remaining balance for each region for Scenario 3 over the term

Worksheet '20. S4 PC' provides projected Burial Plots Consumed data and remaining balance for each region for Scenario 4 over the term

Worksheet '21. S5 PC' provides projected Burial Plots Consumed data and remaining balance for each region for Scenario 5 over the term

Worksheet '22. S6 PC' provides projected Burial Plots Consumed data and remaining balance for each region for Scenario 6 over the term

Worksheet '23. S7 PC' provides projected Burial Plots Consumed data and remaining balance for each region for Scenario 7 over the term

Worksheet '24. S8 PC' provides projected Burial Plots Consumed data and remaining balance for each region for Scenario 8 over the term

9.0 ATTACHMENTS



In Loving Memory
of

GEORGE.
DEARLY BELOVED HUSBAND OF
ANNA BENTON

Attachment A: Cemeteries included in the CCNSW metropolitan Sydney cemetery capacity survey

The cemeteries in the metropolitan Sydney region listed in Table 9.1 following contributed cemetery land area, burial and available capacity information for the CCNSW metropolitan Sydney cemetery capacity survey.

Cemetery Name	Operator Name	LGA	Planning Region	Sydney Sub Region
South Head General Cemetery	Waverley Council	Waverley	Metropolitan Sydney	Central
Waverley Cemetery	Waverley Council	Waverley	Metropolitan Sydney	Central
Eastern Suburbs Memorial Park	Southern Metropolitan Cemeteries Trust	Randwick	Metropolitan Sydney	Central
Gore Hill Memorial Cemetery	Northern Metropolitan Cemeteries Trust	Willoughby	Metropolitan Sydney	North
Mays Hill Cemetery	Holroyd City Council	Holroyd	Metropolitan Sydney	North
Mona Vale General Cemetery	Pittwater Council	Pittwater	Metropolitan Sydney	North
Field of Mars Cemetery	Northern Metropolitan Cemeteries Trust	Ryde	Metropolitan Sydney	North
Northern Suburbs Memorial Park	InvoCare Australia Pty Ltd	Ryde	Metropolitan Sydney	North
Macquarie Park Cemetery & Crematorium	Northern Metropolitan Cemeteries Trust	Ryde	Metropolitan Sydney	North
Frenchs Forest Bushland Cemetery	Northern Metropolitan Cemeteries Trust	Warringah	Metropolitan Sydney	North
Woronora General Cemetery & Crematorium	Southern Metropolitan Cemeteries Trust	Sutherland	Metropolitan Sydney	South
Picton Cemetery	Wollondilly Shire Council	Wollondilly	Metropolitan Sydney	South West
Couridjah Cemetery	Wollondilly Shire Council	Wollondilly	Metropolitan Sydney	South West
Yerranderie Cemetery	Wollondilly Shire Council	Wollondilly	Metropolitan Sydney	South West
Liverpool Cemetery	Catholic Metropolitan Cemeteries Trust	Liverpool	Metropolitan Sydney	South West
Camden General Cemetery	The Council of Camden	Camden	Metropolitan Sydney	South West
Bargo Cemetery	Wollondilly Shire Council	Wollondilly	Metropolitan Sydney	South West
Greendale Catholic Cemetery	Catholic Cemeteries Board	Liverpool	Metropolitan Sydney	South West
Thirlmere Cemetery	Wollondilly Shire Council	Wollondilly	Metropolitan Sydney	South West
Kemps Creek Cemetery	Catholic Metropolitan Cemeteries Trust	Liverpool	Metropolitan Sydney	South West
Forest Lawn Memorial Park	InvoCare Australia Pty Ltd	Liverpool	Metropolitan Sydney	South West
Faulconbridge Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	West
McGraths Hill Methodist Cemetery	Hawkesbury City Council	Hawkesbury	Metropolitan Sydney	West
Richmond Presbyterian Cemetery	Hawkesbury City Council	Hawkesbury	Metropolitan Sydney	West
Sackville Reach Cemetery	Hawkesbury City Council	Hawkesbury	Metropolitan Sydney	West
Mount Irvine Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	West
Blackheath Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	West
Lower Portland Cemetery	Hawkesbury City Council	Hawkesbury	Metropolitan Sydney	West
Springwood Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	West
Megalong Valley General Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	Westw
Mount Victoria Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	West
Lawson General Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	West
Bilpin Cemetery	Hawkesbury City Council	Hawkesbury	Metropolitan Sydney	West
Wentworth Falls Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	West
Katoomba Cemetery	Blue Mountains City Council	Blue Mountains	Metropolitan Sydney	West
Rookwood Memorial Gardens	InvoCare Australia Pty Ltd	Auburn	Metropolitan Sydney	West Central
St Bartholomew's Cemetery	Blacktown City Council	Blacktown	Metropolitan Sydney	West Central
St Marys General Cemetery	Penrith City Council	Penrith	Metropolitan Sydney	West Central
Emu Plains General Cemetery	Penrith City Council	Penrith	Metropolitan Sydney	West Central
St Stephens Anglican Cemetery	Penrith City Council	Penrith	Metropolitan Sydney	West Central
Castlereagh Anglican Cemetery	Penrith City Council	Penrith	Metropolitan Sydney	West Central
North Rocks Catholic Cemetery	Catholic Cemeteries Board	Parramatta	Metropolitan Sydney	West Central
Penrith General Cemetery	Penrith City Council	Penrith	Metropolitan Sydney	West Central
Riverstone Cemetery	Blacktown City Council	Blacktown	Metropolitan Sydney	West Central
Rookwood Catholic Cemetery	Catholic Metropolitan Cemeteries Trust	Auburn	Metropolitan Sydney	West Central
Pinegrove Memorial Park	InvoCare Australia Pty Ltd	Blacktown	Metropolitan Sydney	West Central
Rookwood Cemetery	Rookwood General Cemeteries Reserve Trust	Auburn	Metropolitan Sydney	West Central
Castlebrook Memorial Park	InvoCare Australia Pty Ltd	Blacktown	Metropolitan Sydney	West Central

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Attachment B: Potential cemetery developments in western Sydney

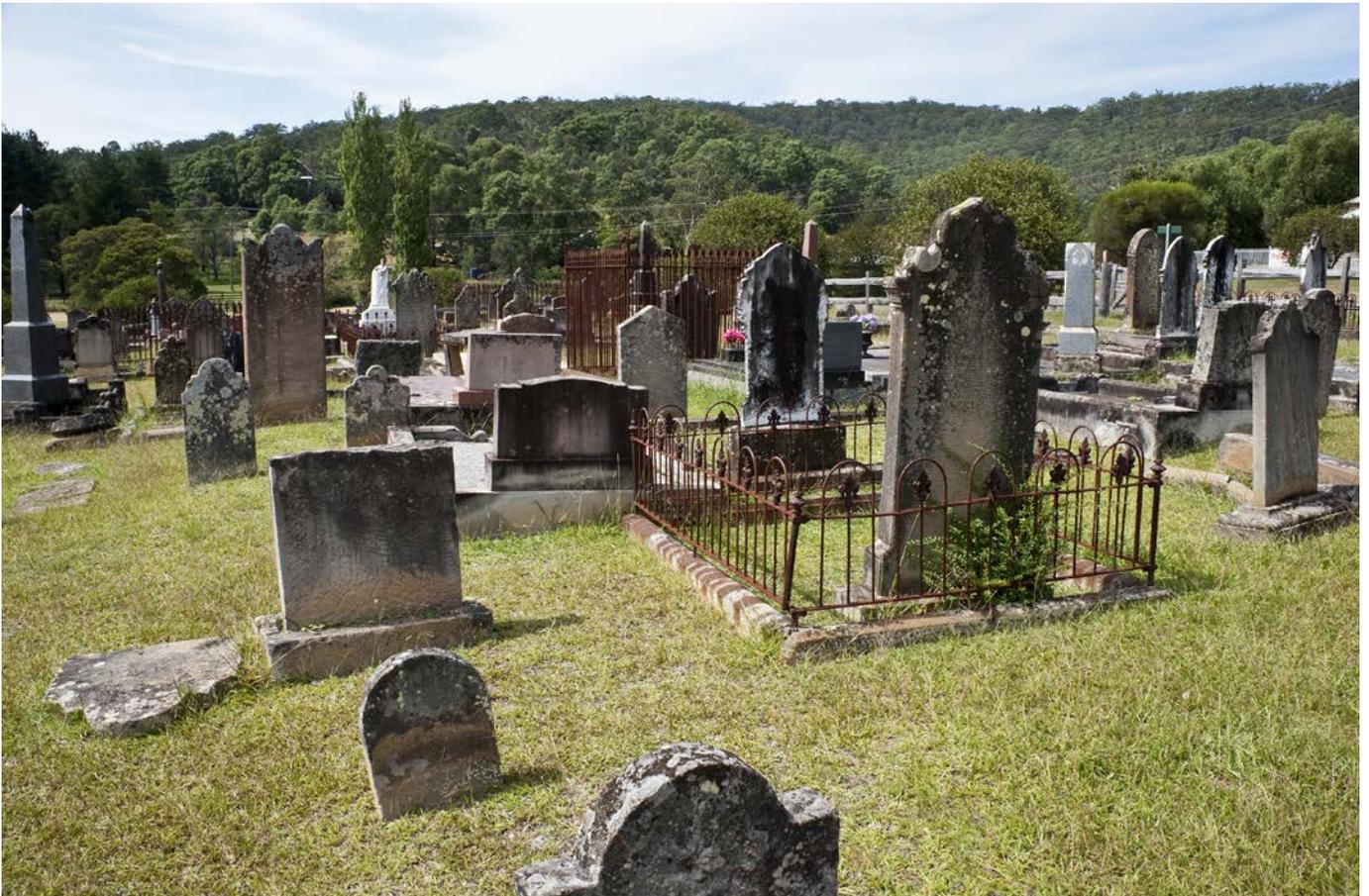
The cemetery capacity survey has necessarily focussed on land available in operational cemeteries as at 1 January 2015. Land that is part of a development application (DA) or other planning proposal having potential to become operational cemetery land in future, but not operational as cemetery land at the date of capacity assessment or at the time of compilation of this report, is not included in the analysis.

CCNSW is also aware of investigations by various existing facilities with the view to adding incremental additional land to current major metropolitan cemeteries by gaining access to adjoining parcels. From information available at the time of compilation of this report, none of those investigations has progressed to the point where potential capacity could reasonably be quantified with the view to reliance on that capacity being available for community use.

The rationale for not including the potential burial capacity of these undeveloped sites in the survey is as follows:

- On approval of a development application (DA), it is up to a landholder to proceed with the form of land use permitted by the DA consent. Whether a landholder proceeds with that form of land use is a discretionary commercial decision for the landholder.

- Where a DA consent has been achieved for cemetery land use at a site, it is permissible for the landholder to develop a cemetery, but whether a cemetery is developed at the site is a separate, subsequent matter. Cemeteries are a non-standard type of commercial development, where significant capital is expended up-front, and revenue returns are derived only over the long term.
- Cemeteries are a non-standard type of commercial development, where significant capital is expended up-front, and revenue returns are derived only over the long term.
- Sites for which a DA consent has been achieved, but which have not been developed for cemetery land use, cannot be relied upon in terms of future cemetery capacity for the metropolitan Sydney community.



Attachment C: Note regarding grave yields per hectare

This analysis has used a standard figure of 2,800 grave sites per hectare in projecting the carrying capacity of burial areas with capacity remaining as at 1 Jan 2015. Considerations relevant to determination of a standard carrying capacity per hectare include:

- general standards for cemetery design, including carrying capacity
- metropolitan cemetery land use information, as collected from cemetery operators during the capacity survey undertaken by CCNSW
- contemporaneous cemetery designs and plans.

There is no Australian Standard or equivalent regulation that sets a maximum figure for the number of grave sites that may be developed per hectare. A review of international literature identifies a general rule of thumb for the burial capacity of cemetery land areas of 1,000 plots per acre⁴⁸, which equates to 2,470 plots per hectare.

Generally speaking, the number of grave sites that may be allowed for development within the land area of a cemetery in NSW is determined by the relevant planning authority, or by council through

the development application consent conditions. In considering cemetery development applications, councils consider (among other issues) the visual impact of design (including monumentation), curtiledges and set-backs from property boundaries and watercourses, access, parking, built facilities, etc.

By way of illustration, the planning proposal for a major cemetery at Varroville, prepared for the Catholic Metropolitan Cemeteries Trust in 2015, proposes that the large greenfields site be committed to a range of land uses, including heritage and environment preservation areas, burial areas, and park, sculpture park and open space areas⁴⁹. The design proposes 136,000 burial places; approximately 35% of land area is excluded from burial precinct use⁵⁰, and assuming further land area commitment to curtiledges and set-backs, CCNSW estimates a grave plot density of approximately 2,040 graves per hectare for burial land areas of approximately 67 hectares.

The yield of grave plots that may be realised per hectare for cemetery land use generally depends on various factors, most particularly site-specific constraints (e.g. watercourses, curtiledges, ground conditions, etc.) and design approaches.

48 Relevant references in cemetery design and analysis literature include the following:

"Forecasting capacity: assume that 1 acre can contain 1,000 gravesites (a rule of thumb is that between 800 and 1,200 gravesites will fit on an acre)" (p 1); equivalent to 2,470 graves per hectare; Valerie Capels & Wayne Senville; Planning for Cemeteries; Planning Commissioners Journal 64, 2006; plannersweb.com/wp-content/uploads/2006/10/230.pdf

"S. 6.3 Plot size, assumed 2,222 plots per HA within burial precincts" (p 19), equivalent to 900 graves per acre; Department of Health (Victoria) 2012; Estimation of the remaining capacity of Victorian cemeteries; www2.health.vic.gov.au/public-health/cemeteries-and-crematoria/guidelines-policies-reports/cemetery-land-development/cemeteries-remaining-capacity-victoria.

"2.24 With respect to as yet unused burial space, cemetery managers generally expect to achieve c.4,000-5,000 grave spaces per hectare, dependent on soil type, the size of the graves, the mix of purchased and unpurchased graves, and on the capacity of the burial authority to dig for deepest depth where there is an unpurchased grave"; equivalent to 1,820 graves per acre; Julie Rugg and Nicholas Pleace, 2011; An Audit of London Burial Provision; A report for the Greater London Authority, Cemetery Research Group, University of York; www.london.gov.uk/file/5284/download?token=sLOljOSB. (The figures are understood to refer to "grave spaces", including more than one "grave space" per grave plot, with depth being a relevant factor. i.e. 4,000-5,000 burials may be completed per hectare, rather than that 4-5,000 single depth grave plots may be realised per hectare).

"A.2.1.1 for cemeteries only, minimum burial plot size shall be 1.6 meters by 3.00 meters inside dimensions" (p 16); equivalent to 2083 plots per hectare, or 843 graves per acre; Housing and Land Use Regulatory Board (Philippines) 2004; Rules and Regulations for memorial Parks/Cemeteries; hlurb.gov.ph/wp-content/uploads/laws-issuances/board-resolutions/R681s2000.pdf.

"Rate of burials per acre, 1,000" (p 5); Mustaffa Anjang Ahmad, Noralfishah Sulaiman, Munzilah Md Rohani, Harliana Halim, Kamillah Ahmad, Roshartini Omar, Haidaliza Masram, Habibah Awang, Shakila Ahmad, Shamsaadal Sholeh Saad, Kamaluddin Bilal, 2015; Conceptual Design of the Islamic Cemetery with Technology with Park Concept; Conference Paper, International Conference on Knowledge Transfer, Dec 2015; www.researchgate.net/publication/293377190_CONCEPTUAL_DESIGN_OF_THE_ISLAMIC_CEMETERY_WITH_TECHNOLOGY_PARK_CONCEPT.

49 MacArthur Memorial Park Planning Proposal (166-176 St Andrews Road, Varroville), Urbis / Catholic Metropolitan Cemeteries Trust, October 2015; document published by the Sydney West Joint Regional Planning Panel.

50 MacArthur Memorial Park Planning Proposal; the no. of burial places identified at Executive Summary, page i; land area for various land uses identified at Figure 8 - Staging Plan, p 13; total site area identified at 2.6 Dimensions and site area, p 17.

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Where a minimum grave site is adopted for all graves, and no allowance is made for walking or machinery pathways, or for watercourses etc., around 4,500 graves can be realised per hectare. Data collected for this report included data on the number of interments completed to January 2015 in all major metropolitan cemeteries, and data in respect of burial land hectares buried out to that date. The data identifies that no major metropolitan cemetery has achieved a grave plot density higher than 4,000 graves per hectare, with an average for buried out areas of metropolitan cemeteries being 2,489 graves per hectare.

Contemporaneous approaches to burial precinct design include lawn cemetery models, where the avoidance of kerbing, adoption of surface level monumentation, and optional commitment of land to pathways, allows for higher grave plot density than traditional monumental design approaches.

However, in Sydney cemeteries that have implemented these principles, land areas are also committed to lower density burial precincts, with a strong market for more spacious plots, and premiums that may be realised for plot or licence fees.

Analysis of available hectareage in metropolitan cemeteries necessarily requires a standardised approach, which avoids assumption of specific designs, and allows for variations in consumer preferences. The report has adopted a maximum grave yield per hectare, for greenfields burial areas, of 2,800 plots per hectare. The figure is above the historical average, but below the theoretical maximum, balancing higher-density design approaches with continued community interest in differentiated product lines.

Attachment D: Projected deaths per planning region from 2015 through to 2056⁵¹

	2015-16	2017-21	2022-26	2027-31	2032-36	2037-41	2042-46	2046-51	2052-56
Region	Deaths	Deaths	Deaths	Deaths	Deaths	Deaths	Deaths	Deaths	Deaths
Metro Sydney—Central	9040	21700	22900	24600	26850	31800	31950	34500	37050
Metro Sydney—West Central	10680	29250	31900	35200	39500	44350	50100	55050	59900
Metro Sydney—North	11400	31700	33150	35100	38200	39400	45950	49550	53150
Metro Sydney—West	3400	9550	10800	12200	13900	15650	17400	19150	20900
Metro Sydney—South West	6160	17750	20200	23050	26450	30350	38650	43650	48650
Metro Sydney—South	7980	20700	21450	22750	24650	26950	29250	31550	33850
Total	48660	130650	140400	152900	169550	188500	213300	233450	253500

Table 9.3 Projected deaths per planning region from 2015 through to 2056

⁵¹ NSW Planning and Environment, Demography Team, bespoke research (2016). Data provided is based on bespoke research conducted for CCNSW. It is based on current assumptions used for NSW population projections. However, the time horizon has been extended to 2041 on request. The numbers presented are indicative of overall trends and should be treated as such.

Projected data provided by DPE extends only to 2041. To provide a longer horizon of per-annum mortality volumes than is available from the DPE projections, following discussion with DPE, CCNSW projected the same numerical increase for each five-year period after 2041, as was projected by DPE for the period 2036–2041. Figures used for the period 2041 to 2056 are considered as likely to be conservative, given underlying factors including total population, and total aged population, applicable during those terms. However, other factors including rate of mortality, health service accessibility and standards, environmental conditions, etc, are not known beyond 2036 and are assumed to be consistent with the period 2036–2041.

Attachment E: Scenario 5 Projection of deaths, cremations, burials, second or subsequent burials and new grave plots used from 2016 through 2056

2015–16

SYDNEY REGION	DEATHS	CREM RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	9040	0.663	5994	3046	1.45	945	2101
West Central	10680	0.663	7081	3599	1.45	1117	2482
North	11400	0.663	7558	3842	1.45	1192	2650
West	3400	0.663	2254	1146	1.45	356	790
South West	6180	0.663	4097	2083	1.45	646	1436
South	7980	0.663	5291	2689	1.45	835	1855
Metro Sydney total	48,680		32275	16405		5091	11314

2017–21

SYDNEY REGION	DEATHS	CREM RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	23650	0.671	15869	7781	1.468	2481	5300
West Central	29250	0.671	19627	9623	1.468	3068	6555
North	29750	0.671	19962	9788	1.468	3120	6667
West	9550	0.671	6408	3142	1.468	1002	2140
South West	17750	0.671	11910	5840	1.468	1862	3978
South	20700	0.671	13890	6810	1.468	2171	4639
Metro Sydney total	130,650		87666	42984		13703	29281

2022–26

SYDNEY REGION	DEATHS	CREM RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	24900	0.68	16932	7968	1.487	2610	5358
West Central	31900	0.68	21692	10208	1.487	3343	6865
North	31150	0.68	21182	9968	1.487	3265	6703
West	10800	0.68	7344	3456	1.487	1132	2324
South West	20200	0.68	13736	6464	1.487	2117	4347
South	21450	0.68	14586	6864	1.487	2248	4616
Metro Sydney total	140,400		95472	44928		14714	30214

2027–31

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	26700	0.688	18370	8330	1.505	2795	5535
West Central	35200	0.688	24218	10982	1.505	3685	7297
North	33000	0.688	22704	10296	1.505	3455	6841
West	12200	0.688	8394	3806	1.505	1277	2529
South West	23050	0.688	15858	7192	1.505	2413	4778
South	22750	0.688	15652	7098	1.505	2382	4716
Metro Sydney total	152,900		105195	47705		16007	31698

Table 9.4 Scenario 5 Projection of deaths, cremations, burials, 2nd or subsequent burials and new grave plots used from 2016 through 2056

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2032–36

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	29100	0.697	20283	8817	1.524	3032	5786
West Central	39500	0.697	27532	11969	1.524	4115	7853
North	35950	0.697	25057	10893	1.524	3745	7148
West	13900	0.697	9688	4212	1.524	1448	2764
South West	26450	0.697	18436	8014	1.524	2756	5259
South	24650	0.697	17181	7469	1.524	2568	4901
Metro Sydney total	169,550		118176	51374		17664	33710

2037–41

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	31800	0.706	22451	9349	1.543	3290	6059
West Central	44350	0.706	31311	13039	1.543	4589	8450
North	39400	0.706	27816	11584	1.543	4076	7507
West	15650	0.706	11049	4601	1.543	1619	2982
South West	30350	0.706	21427	8923	1.543	3140	5783
South	26950	0.706	19027	7923	1.543	2788	5135
Metro Sydney total	188,500		133081	55419		19503	35916

2042–46

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	31950	0.715	22844	9106	1.563	3280	5826
West Central	50100	0.715	35822	14279	1.563	5143	9135
North	45950	0.715	32854	13096	1.563	4717	8379
West	17400	0.715	12441	4959	1.563	1786	3173
South West	38650	0.715	27635	11015	1.563	3968	7048
South	29250	0.715	20914	8336	1.563	3003	5333
Metro Sydney total	213,300		152510	60791		21897	38893

2047–51

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	34500	0.724	24978	9522	1.582	3503	6019
West Central	55050	0.724	39856	15194	1.582	5590	9604
North	49550	0.724	35874	13676	1.582	5031	8645
West	19150	0.724	13865	5285	1.582	1944	3341
South West	43650	0.724	31603	12047	1.582	4432	7615
South	31550	0.724	22842	8708	1.582	3204	5504
Metro Sydney total	233,450		169018	64432		23704	40728

2052–56

SYDNEY REGION	DEATHS	CREMATION RATE	CREMATIONS	BURIALS	OCC RATE	2ND BURIALS	PLOTS USED
Central	37050	0.733	27158	9892	1.602	3717	6175
West Central	59900	0.733	43907	15993	1.602	6010	9983
North	53150	0.733	38959	14191	1.602	5333	8858
West	20900	0.733	15320	5580	1.602	2097	3483
South West	48650	0.733	35660	12990	1.602	4881	8108
South	33850	0.733	24812	9038	1.602	3396	5642
Metro Sydney total	253,500		185816	67685		25435	42250

Table 9.4 Scenario 5 Projection of deaths, cremations, burials, 2nd or subsequent burials and new grave plots used from 2016 through 2056

Attachment F: Scenario 5 Remaining balance of new grave plots as at key dates 2036 and 2056

Plots available 1 Jan 2015, and projected consumption through to 2056

SYDNEY REGION	PLOTS AVAILABLE 1 JAN 2015	VOLUME USED 2015–16	BALANCE 2016	VOLUME USED 2017–21	BALANCE 2021	VOLUME T/F TO OTHER REGION	VOLUME USED 2022–26	BALANCE 2026	VOLUME t/f TO OTHER REGION	VOLUME USED 2027–31	BALANCE 2031	VOLUME t/f TO OTHER REGION	VOLUME USED 2032–36	BALANCE 2036	VOLUME t/f TO OTHER REGION
Central	6,600	2101	4,499	5,300	0	801	5,358	0	5,358	5,535	0	5,535	5,786	0	5,786
West Central	144,009	2482	141,527	6,555	134,170		6,865	121,947		7,297	109,114		7,853	95,475	
North	31,309	2650	28,659	6,667	21,992		6,703	15,289		6,841	8,447		7,148	1,300	
West	18,420	790	17,630	2,140	15,490		2,324	13,165		2,529	10,636		2,764	7,873	
South West	94,319	1436	92,883	3,978	88,905		4,347	79,948		4,778	70,453		5,259	60,293	
South	6,500	1855	4,645	4,639	6		4,616	0	4,610	4,716	0	4,716	4,901	0	4,901
Total	301,157	11,314	289,843	29,281	260,563	801	30,214	230,349	9,968	31,698	198,651	10,251	33,710	164,941	10,687
				Note 1			Note 2								

SYDNEY REGION	VOLUME USED 2037–41	BALANCE 2041	VOLUME t/f TO OTHER REGION	VOLUME USED 2042–46	BALANCE 2046	VOLUME t/f TO OTHER REGION	VOLUME USED 2047–51	BALANCE 2051	VOLUME t/f TO OTHER REGION	w 2052–56	BALANCE 2056	VOLUME t/f TO OTHER REGION	TOTAL USED	FROM STARTING BALANCE
Central	6,059	0	6,059	5,826	0	5,826	6,019	0	6,019	6,175	0	6,175	48,159	-41,559
West Central	8,450	74,759		9,135	51,419		9,604	25,528		9,983		2,972	68,226	75,783
North	7,507	0	6,207	8,379	0	8,379	8,645	0	8,645	8,858	0	8,858	63,398	-32,089
West	2,982	4,891		3,173	1,718		3,341	0	1,623	3,483	0	3,483	23,526	-5,106
South West	5,783	49,376		7,048	36,995		7,615	23,875		8,108	7,153		48,353	45,966
South	5,135	0	5,135	5,333	0	5,333	5,504	0	5,504	5,642	0	5,642	42,341	-35,841
Total	35,916	129,025	17,401	38,893	90,132	19,538	40,728	49,403	21,791	42,250	7,153	27,130	294,004	7,153
	Note 3						Note 4			Note 5				Note 8

Table 9.5 Scenario 5 Projected consumption of new grave plots by first burials 2015–56

Note 1: Outstanding 2017–21 and subsequent Central volumes applied to West-Central
 Note 2: Outstanding 2022–26 and subsequent South volumes applied to South-West
 Note 3: Outstanding 2037–41 and subsequent North region volumes applied to West-Central
 Note 4: Outstanding 2047–51 and subsequent West region volumes applied to West-Central

Note 5: West-Central region exhausted in period 2052–56; balance applied to South-West
 Note 6: Notional balance of West-Central Region consumed by other region activity
 Note 7: Notional balance of South-West Region consumed by other region activity
 Note 8: Negligible balance of 7,153 for Metropolitan Sydney planning regions as at 2056

Attachment G: Scenario 5 Remaining balance of new grave plots as at key dates 2036 and 2056

Scenario 5 Remaining balance of new grave plots as at key dates 1 Jan 2036 and 1 Jan 2056

SYDNEY REGION	PLOTS AVAILABLE 1 JAN 2015	VOLUME USED TO 2036	BALANCE 2036	VOLUME T/F TO OTHER REGION BY 2036	FURTHER VOLUME USED TO 2056	BALANCE 2056	VOLUME T/F TO OTHER REGION 2036–56	
Central	6,600	24,081	0	17,481	24,079	0	24,079	NB, outstanding 2017–21 and subsequent Central volumes applied to West-Central
West Central	144,009	31,053	95,475	0	37,173	0	2,972	NB, West-Central receives overflow from Central, West and North regions until exhausted in 2046–51 period
North	31,309	30,009	1,300	0	33,389	0	32,089	NB, outstanding 2037–41 and forward North volumes applied to West-Central
West	18,420	10,547	7,873	0	12,979	0	5,106	NB, outstanding 2046–51 and forward West volumes applied to West-Central
South West	94,319	19,799	60,293	0	28,554	7,153	0	NB, South-West receives overflow from South region; South-West region approaching exhaustion by 2056
South	6,500	20,727	0	14,227	21,614	0	21,614	NB, outstanding 2022–26 and forward South volumes applied to South-West
Total	301,157		136,216	164,941	31,708	7,153	85,860	Aggregate overflow traffic from region of death to most proximate available cemetery capacity

Table 9.6 Scenario 5 Remaining balance of new grave plots as at key dates 2036 and 2056

Attachment H: Summary table of outcomes for metropolitan Sydney, all scenarios

cremation & occupancy rates	AGGREGATE RATES			DIFFERENTIATED RATES (I.E. METRO SYDNEY VERSUS HCCI)				
	steady	rates up	rates down	steady	up slow	up fast	1 up, 1 down	rates down
Value/ Scenario	Sc.1	Sc.2	Sc.3	Sc.4	Sc.5	Sc.6	Sc.7	Sc.8
Cremation rate (range)	0.704	0.704–0.859	0.704–0.576	0.663	0.663–0.733	0.663–0.809	0.663–0.543	0.663–0.543
Cremation rate (average)	0.704	0.7815	0.64	0.663	0.698	0.736	0.603	0.603
Grave occupancy rate (range)	1.473	1.473–1.798	1.473–1.205	1.45	1.45–1.602	1.45–1.77	1.45–1.77	1.45–1.187
Grave occupancy rate (average)	1.473	1.6355	1.339	1.45	1.526	1.61	1.61	1.3185
Plots available 1 Jan 2015	301,157	301,157	301,157	301,157	301,157	301,157	301,157	301,157
Plots used to 2036	129,046	103,757	156,357	149,251	136,216	123,482	156,321	176,958
Plots available 2036	172,111	197,400	144,800	151,906	164,941	177,675	144,836	124,199
Burials displaced to 2036	29,284	21,109	41,087	37,440	31,708	27,590	41,258	52,381
Plots used 2036 to 2056	178,595	87,057	287,733	206,558	157,788	113,577	227,548	317,424
Plots available 2056	-6,484	110,343	-142,934	-54,652	7,153	64,098	-82,711	-193,225
Burials displaced 2036 to 2056	99,259	35,345	208,617	140,082	85,860	53,421	171,630	247,300
Plots used PA at 2056	10,188	3,976	17,840	11,783	8,450	5,471	13,090	19,520
Burials displaced PA at 2056	7,122	1,946	17,840	10,930	5,426	2,769	13,090	19,520
Years of capacity remaining at 2056	-1	28	-8	-5	1	12	-6	-10
Deaths PA at 2016	24,330	24,330	24,330	24,330	24,330	24,330	24,330	24,330
Deaths PA at 2026	28,080	28,080	28,080	28,080	28,080	28,080	28,080	28,080
Deaths PA at 2036	33,910	33,910	33,910	33,910	33,910	33,910	33,910	33,910
Deaths PA at 2046	42,660	42,660	42,660	42,660	42,660	42,660	42,660	42,660
Deaths PA at 2056	50,700	50,700	50,700	50,700	50,700	50,700	50,700	50,700
Cremations PA at 2016	17,135	17,135	17,135	16,137	16,137	16,137	16,137	16,137
Cremations PA at 2026	19,768	20,779	18,814	18,617	19,094	19,572	17,718	17,718
Cremations PA at 2036	23,873	26,382	21,601	22,482	23,635	24,856	20,346	20,346
Cremations PA at 2046	30,033	34,896	25,852	28,284	30,502	32,848	24,316	24,316
Cremations PA at 2056	35,693	43,551	29,203	33,614	37,163	41,016	27,530	27,530
Burial vol. PA at 2016	7,205	7,205	7,205	8,203	8,203	8,203	8,203	8,203
Burial vol. PA at 2026	8,312	7,301	9,266	9,463	8,986	8,508	10,362	10,362
Burial vol. PA at 2036	10,037	7,528	12,309	11,428	10,275	9,054	13,564	13,564
Burial vol. PA at 2046	12,627	7,764	16,808	14,376	12,158	9,812	18,344	18,344
Burial vol. PA at 2056	15,007	7,149	21,497	17,086	13,537	9,684	23,170	23,170
2nd burials PA at 2016	2,314	2,314	2,314	2,546	2,546	2,546	2,546	2,546
2nd burials PA at 2026	2,669	2,585	2,652	2,937	2,943	2,925	3,563	2,848
2nd burials PA at 2036	3,223	2,904	3,068	3,547	3,533	3,402	5,097	3,226
2nd burials PA at 2046	4,055	3,226	3,542	4,462	4,379	3,985	7,451	3,645
2nd burials PA at 2056	4,819	3,173	3,657	5,303	5,087	4,213	10,080	3,650

Table 9.7, Summary table of outcomes for metropolitan Sydney, all scenarios

cremation & occupancy rates	AGGREGATE RATES			DIFFERENTIATED RATES (I.E. METRO SYDNEY VERSUS HCCI)				
	steady	rates up	rates down	steady	up slow	up fast	1 up, 1 down	rates down
Plots used PA at 2016	4,891	4,891	4,891	5,657	5,657	5,657	5,657	5,657
Plots used PA at 2026	5,643	4,716	6,614	6,526	6,043	5,583	6,799	7,514
Plots used PA at 2036	6,814	4,624	9,241	7,881	6,742	5,652	8,467	10,338
Plots used PA at 2046	8,573	4,538	13,266	9,915	7,779	5,826	10,893	14,699
Plots used PA at 2056	10,188	3,976	17,840	11,783	8,450	5,471	13,090	19,520
Burials displaced* PA at 2016	0	0	0	0	0	0	0	0
Burials displaced PA at 2026	1,709	1,254	2,106	2,154	1,994	1,805	2,245	2,481
Burials displaced PA at 2036	2,160	1,466	3,525	2,802	2,137	1,792	3,294	4,779
Burials displaced PA at 2046	4,306	1,559	7,414	5,150	3,908	2,927	5,897	10,697
Burials displaced PA at 2056	7,122	1,946	17,840	10,930	5,426	2,769	13,090	19,520
* i.e. displaced from the planning region of death, in which there is no available capacity, to a proximate region with remaining capacity								
Value/Scenario	Sc.1	Sc.2	Sc.3	Sc.4	Sc.5	Sc.6	Sc.7	Sc.8
Balance remaining at 2016	291,375	291,375	291,375	289,843	289,843	289,843	289,843	289,843
Balance remaining at 2026	236,907	243,740	229,847	226,847	230,349	233,813	224,834	219,658
Balance remaining at 2036	172,111	197,400	144,800	151,906	164,941	177,675	144,836	124,199
Balance remaining at 2046	91,369	151,784	23,515	58,522	90,132	119,975	42,759	-10,457
Balance remaining at 2056	-6,484	110,343	-142,934	-54,652	7,153	64,098	-82,711	-193,225
PA rate of inventory consumption 2016	1.7%	1.7%	1.7%	2.0%	2.0%	2.0%	2.0%	2.0%
PA rate of inventory consumption 2026	2.4%	1.9%	2.9%	2.9%	2.6%	2.4%	3.0%	3.4%
PA rate of inventory consumption 2036	4.0%	2.3%	6.4%	5.2%	4.1%	3.2%	5.8%	8.3%
PA rate of inventory consumption 2046	9.4%	3.0%	56.4%	16.9%	8.6%	4.9%	25.5%	N/A
PA rate of inventory consumption 2056	N/A	3.6%	N/A	N/A	118.1%	8.5%	N/A	N/A
Years of capacity remaining at 2016	60	60	60	51	51	51	51	51
Years of capacity remaining at 2026	42	52	35	35	38	42	33	29
Years of capacity remaining at 2036	25	43	16	19	24	31	17	12
Years of capacity remaining at 2046	11	33	2	6	12	21	4	-1
Years of capacity remaining at 2056	-1	28	-8	-5	1	12	-6	-10

* i.e. apparent years of capacity remaining at that year, at that year's projected rate of plot consumption for the scenario (to 2056; and where beyond, at the scenario's 2056 rates)

Table 9.7, Summary table of outcomes for metropolitan Sydney, all scenarios

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