Detailed information about proposal and DA submission material

1 Overview

1.1 The application is for an expansion to the existing St Bartholomew's Cemetery into a currently disused part of the site. St Bartholomew's Church and Cemetery occupies 3.17ha of land south of Ponds Road and is zoned SP1 – Cemetery under the Blacktown LEP 2015. The site is owned by the Council, is classified as 'operational land' and is listed as a heritage item of State significance.

1.2 In 2016 the NSW Government transferred 6ha of land to the east of St Bartholomew's Cemetery to Council for additional cemetery use. Another 2ha will be transferred over the next 2-3 years. Rezoning of the land to the east of the site is proceeding with a Planning Proposal currently at Pre-Exhibition stage following Gateway determination. A masterplan for this land will be subject to a separate development application.

1.3 The subject development application, referred to as 'Stage 1A', involves the following works to the north eastern portion of the existing cemetery site:

- A total of 1,020 lawn style grave sites, with some of the grave sites being terraced due to the existing topography and to be consistent with the existing grave sites to the south;
- 2 columbarium walls (2.1m high x 80m long & 1.2m high x 65m long), adjacent to the proposed internal service road, to accommodate 1,927 single or double niches for interment of ashes;
- Access will remain in the same location as the current access points from Ponds Road adjacent to the church building and to the north east of the site. An internal service road will be constructed to lead from the current access driveway to St Bartholomew's Place (which runs along the eastern boundary of the site);
- Formalised car parking in the form of parallel parking located along the internal service road (42 spaces);
- Overflow car parking (26 spaces) within the upgraded St Bartholomew's Place, which will also contain a new turning head;
- Imported soils (approximately 26,400m^3) are required to ensure the proposed grave sites are suitably level for their purpose; and
- On-site detention works that distribute stormwater through the existing pipework to adjoining system (partly located on Lot 21 DP 135886). This will involve reshaping of an existing depression to form OSD in order to accommodate the necessary volume in accordance with the Upper Parramatta River Catchment Trust (UPRCT).

1.4 The development responds to an identified demand for cemetery space both in the Blacktown local government area, and the wider region. A key priority area in the Cemeteries and Crematoria NSW Strategic Plan (2015-2020) is 'land availability', to ensure that there is sufficient and suitable land available to meet future demand for interment services. Strategies to achieve this priority include:

- Ensure that cemeteries and crematoria are considered during land use planning;
- Facilitate new cemetery proposals that deliver strategic additional capacity; and
- Work with stakeholders to allocate sufficient cemetery space to meet the needs of local communities

2 The Site

2.1 The existing St Bartholomew's Church and Cemetery is situated on a parcel of land between the major roads of The Great Western Highway (to the north), the Great Western Motorway, or M4 (to the south) and Prospect Highway to the west. Ponds Road is a minor road running between the site and The Great Western Highway to the north.

2.2 To the east of the site, separating it from the future cemetery site (subject to a current Planning Proposal), is St Bartholomew's Place which is a disused local road.

2.3 The subject site slopes down to the east from a high point where the church is located (on the north-western portion of the site). There is a drop of approximately 20m from the highest to the lowest point.

2.4 The proposed location of the cemetery expansion at the north-east/east of the site will take place on land which does not historically appear to have been used for burials – likely because it is low lying and soggy at low level, and steep in other parts.

2.5 The site is crossed by high tension power cables supported by two double stanchions which are highly visible from the site and surrounds.

2.6 The nearest residential properties are some 300m to the north west, across a large intersection with the Great Western Highway and Prospect Highway, which the dwellings are orientated away from. Other uses surrounding the site are the RE1 zoned land to the east (subject to current Planning Proposal to rezone to cemetery use), B5 – Business Development zoned land to the north, RU4 – Primary Production zoned land to the south east and unzoned land to the south west of the site.

3 Heritage

Site History

3.1 The site is listed under the NSW Heritage Act 1977 and under Blacktown LEP 2015 as a heritage item of State significance. St Bartholomew's Church, which opened in 1841, was the first church to be built in the Prospect area.

3.2 The Church operated until New Year's Eve at the end of 1967, when, due to a second attack of vandalism, it was closed. In 1972 Blacktown Municipal Council took out a fifty-year lease on the property from the Church of England Property Trust, Diocese of Sydney. On 4 November 1989 fire gutted the Church, destroying the 1850s organ and the 1908 furniture. During 2000, restoration work costing $1,374,000 began under the supervision of Graham Edds and Associates, Heritage Architects. This work was funded by Blacktown City Council and the Commonwealth and State governments. In January 2001 Blacktown City Council purchased the property from the Anglican Property Trust. The building is now available for hire for civil wedding services, concerts, exhibitions or any other event that Council considers appropriate.

3.3 No new internment rights have been sold at the cemetery since 1972 but Council has allowed family members to be interred in existing graves. As a result the cemetery has relatively few visitors, aside from historical events and ghost tours.

3.4 Although the existing cemetery is relatively well defined, in the past, clandestine burials have been known to occur in the grounds outside of consecrated cemetery grounds. Ground Penetrating Radar (GPR) surveys have therefore been conducted which have identified anomalies within the current cemetery lands that could be unmarked graves.

Views

3.5 There are numerous views to, from and within the site which have been identified in the Heritage Impact Statement.

3.6 The church and cemetery command a dominant position when viewed between the two main western roadways, as well as from Prospect Highway.

3.7 When viewed from the north eastern corner of the site, the prominence of the church and the graves surrounding it on the northern and eastern slope is evident on the hilltop.

3.8 Other important views to, from and within the site have been identified and highlighted in Figure 1 below.

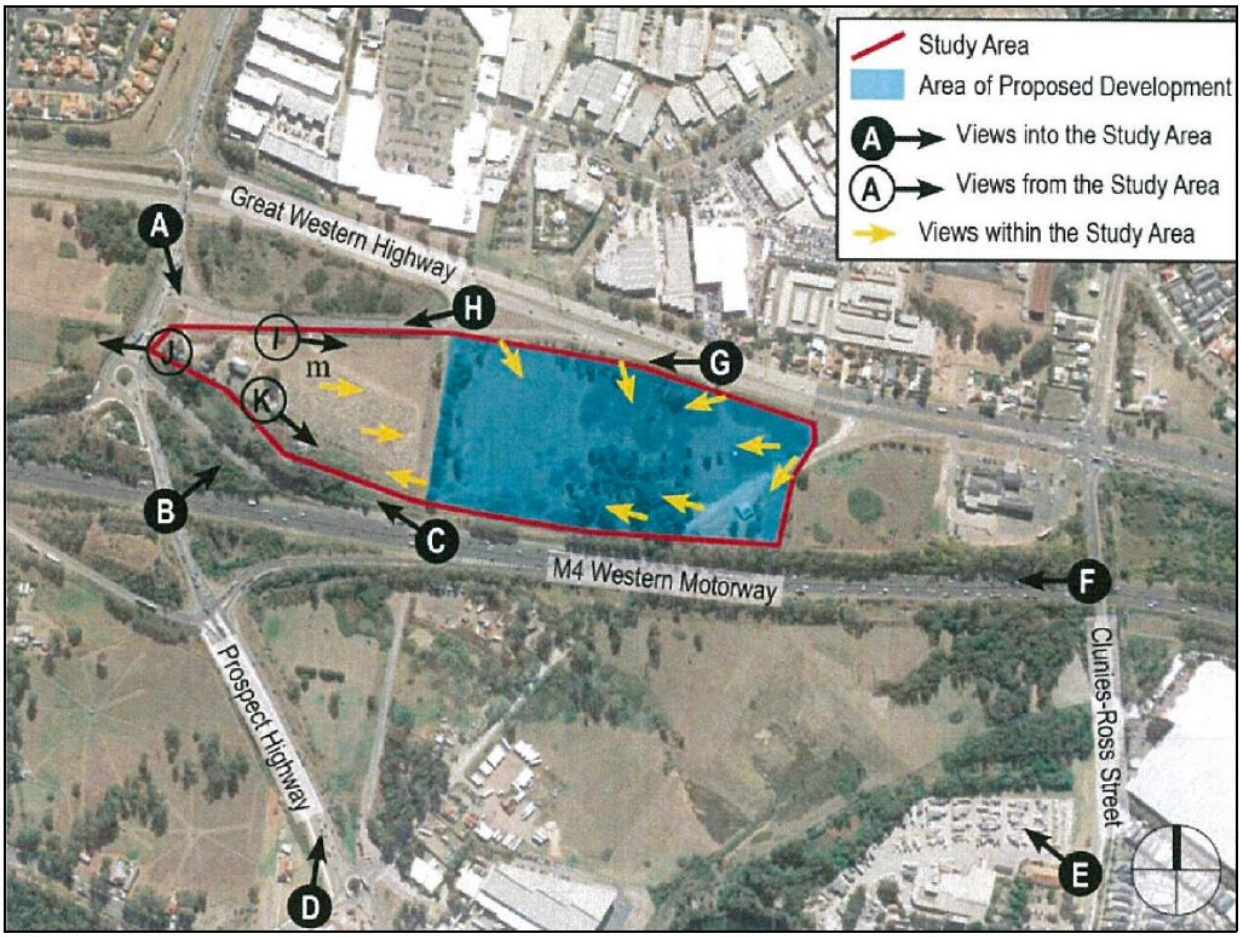

Figure 1: Important views (Source: *Statement of Heritage Impact, December 2018)*

3.9 The Heritage Impact Statement (HIS) acknowledges that the proposed works will have an impact on some of the views into the site from the north and north east due to raising the lower part of the site with fill. The greater impact will be for motorists on Ponds Road, however the present tree planting filters these views. Compensating for this is that the proposal will reactivate St Bartholomew's Place on the eastern edge of the site including the provision of parking areas. Members of the public would then be provided a stationary vista to the historic church and cemetery which is not presently available.

3.10 The impact of the proposed works on views into the site from the south, south-east and east from Tarlington Place or west will be virtually negligible as the site is located on the northern side of a ridge. From the west side of the site, views to the new cemetery area will be obstructed by the historic church buildings, and historic plantings around the forecourt.

3.11 The views from the church into the cemetery will not be obstructed as the terrace has been designed so that it sits below the existing ground level and will not obstruct any views west from the church. In addition, the views from the new point of arrival into the site off Ponds Road have been considered and handrails and balustrades have been reduced so that this view is maintained.

3.12 The impact of the works on views into the site will be principally from the north for motorists travelling in either direction along a section of Ponds Road which borders the site. There will also be filtered views to the works through the trees for west bound

motorists on the Great Western Highway. The views into the site from the above locations are not expansive as they are filtered by existing mature plantings along the property boundary. In any case, they are from fast moving roadways where vehicle occupants may only obtain fleeting views of the site, these roads are not a welcoming environment for pedestrians and do not contain footpaths.

3.13 The drawings indicate that the ground level of the new cemetery to the road level will vary between minimal change at the terraced part, to a 3m increase in height at the north east corner. It is noted that at the western edge of the Stage 1A site, there currently exists a 4 metre level difference between the cemetery boundary and the road level.

3.14 The battering of the edges of the new cemetery will reduce the visual impact of this height difference and move the highpoint of the embankment away from the boundary, which will enlarge the field of view slightly.

3.15 The HIS goes on to conclude that, '*overall, we consider that the moderate loss of views into the site will not have a detrimental impact on the significance of the place and will not impact detrimentally on the vistas out from the Church which are of higher significance to the place. Any moderate loss of views arising from the works, is well offset by the benefits to the management and enhancement to the cultural significance of the place through the extensions to the Cemetery'*.

3.16 The minor view loss from Ponds Road is for vehicle traffic given that it does not contain a footpath pedestrian views are unlikely to be cherished or highly frequented. Vehicle occupants can only expect fleeting views when on a fast flowing road. The minor loss of views for moving vehicles is more than offset by the general improvements to the space and reactivation of the cemetery. Static views from within the site to the church will also be improved and opened up (i.e new view potential from St Bartholomew's Place will be created).

Conservation Management Plan

3.17 The applicable document for managing the Significance of the Place which will guide its future use is the '*St Bartholomew's Anglican Cemetery – Conservation Management Plan*' by Graham Edds and Associates – May 2010.

3.18 In discussions with the NSW Office of Environment and Heritage it was established that the Conservation Management Plan (CMP) did not need to be updated for the Stage 1A works. The CMP has not been produced with a particular intent in mind, and has assessed the heritage values of the place, why the site is heritage listed, and what degree of change is acceptable. None of these have changed significantly in the 9 years following the production of the CMP.

3.19 Notably the CMP makes the following recommendations:

'*Any proposed use of the site should:*

1.1 Recognise that the current property area is the minimum appropriate for the retention of cultural significance and that further subdivision to reduce the property area is unacceptable.

1.2 Recognise that the most appropriate use is for the site to continue to be used for the purpose for which it was established (ie: as a Church/ meeting place and as a cemetery).

1.5 Recognise that further development of the site to allow for further interment, broadening the ash interment options with the construction of columbarium walls and garden ash interment in the vacant eastern portions of the site to meet current and future public demand is permitted. This would continue the site's traditional use and has the potential to provide a continuing income, which could be directed towards the conservation and maintenance of the site. The 1994 CMP stated that "Only part of the undeveloped area is affected by drainage with the majority of this area suitable for

burials". The Cemetery Management Plan suggested the introduction of a water feature to make use of the drainage affected area'.

3.20 The Heritage Impact Statement has considered the proposal against the recommendations of the CMP and concludes it is consistent with the policies of the CMP.

Archaeology

3.21 As noted above, a number of anomalies have been identified through ground penetrating radar surveys which are likely to be clandestine burials.

3.22 These locations have been treated as grave locations during the planning process and may be archaeologically investigated to ascertain if they are graves or the result of a natural process prior to any implementation of the project.

3.23 The locations of these anomalies are shown in Figure 2 below. There is no pattern of dispersal across the site, however there is a large anomaly within the centre of the proposed new lawn grave area.

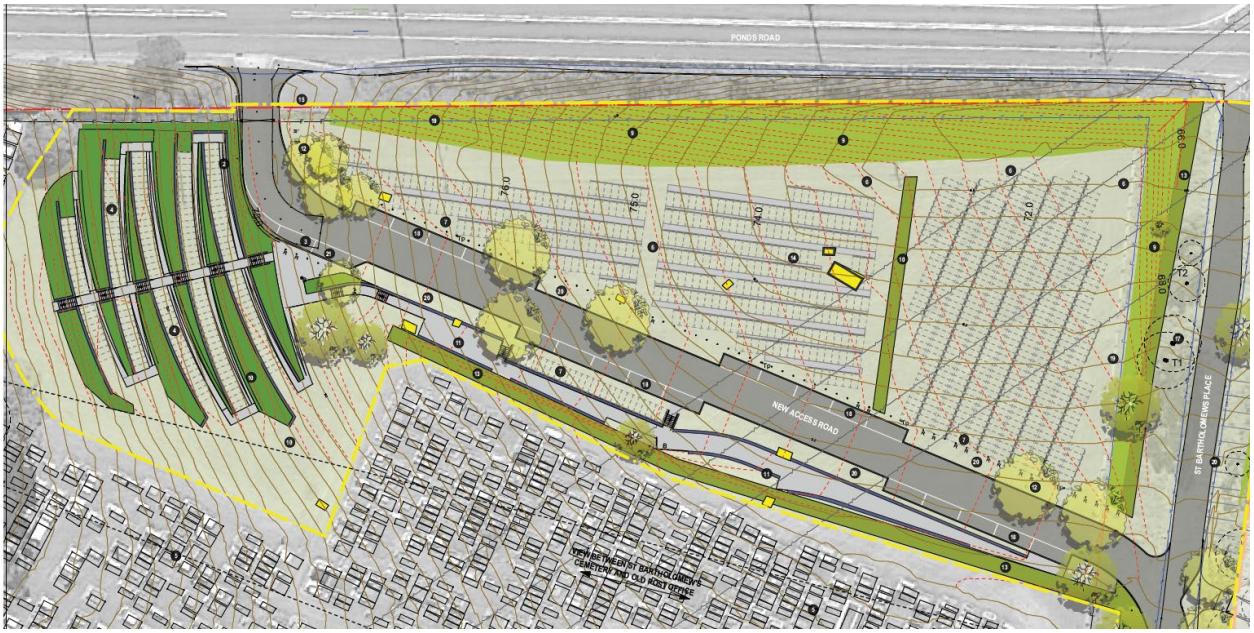

Figure 2: Location of anomalies – coloured yellow (Source: Architectural Drawings).

3.24 No direct impacts will occur to these locations until this confirmation has been gained as to whether they are in fact burials. If any of the locations are found to be graves then no direct impact will occur from new grave locations, roads, columbarium walls and each location will have an on-surface indicator of its location. Fill will be placed over most of the locations. NSW Heritage branch was informed of the placement of fill on these locations in a meeting held on 4 October 2018, no objections were raised.

Overall Heritage Impact

3.25 The Heritage Impact statement concludes that *'The proposed works will not detrimentally impact the heritage significance of St Bartholomew's Church and Cemetery. The proposed works will enhance the significance of the place. The Stage 1A works are consistent with the policies of the Conservation Management Plan for St Bartholomew's Cemetery*'.

4 General design and landscaping

Design and Visual Impact

4.1 The proposal would see approximately 26,400m^3 of fill imported to the site to ensure the proposed grave sites are suitably level for their purpose. The works will involve filling the

north eastern part of the site to raise its level by a maximum of 6.7m to provide for lawn graves and terracing the north western, steepest part of the site nearest the church.

4.2 The terraced area will have five terraces each with single rows of graves. A central stair access and 1:33.5 walkways to the north of each terrace will provide Disability Discrimination Act (DDA) compliant access from the paved gathering space at the base. The existing burial area adjacent to the east will be separated by an open grassed area and planting.

4.3 The lawn cemetery area proposes back to back headstones with flush masonry beams (to act as footings) located to minimise the visual impact of any hard standing. The graves will be aligned perpendicular to the new access road to make efficient use of space and be of a similar alignment to the existing graves to the south.

4.4 Headstones will generally be low in height (below 500mm) with variation in the headstone shape and material to provide a diverse character that is not monotonous, but has elements of consistency. A palette of headstone materials, finishes and shapes will be prepared to ensure the impacts of these built elements are complimentary to the heritage graves, whilst being visually different. It is anticipated that a selection of 3 to 4 headstone options will be prepared.

4.5 In order to make efficient use of level changes across the site which will result from the importation of fill, a series of columbarium walls are proposed. The walls will be located at the southern side of the access road, separating the new and old cemeteries.

4.6 Level access is proposed at the eastern end near St Bartholomew's Place and three stair access points are proposed along the length of the wall to provide additional connections between the access road, the old cemetery and the new cemetery expansion.

4.7 It is anticipated that 4 options of plaque materials will be provided to provide individuality and variation to the appearance of the wall.

4.8 The unidentified burial sites found during ground penetrating radar tests will be interpreted with sandstone edging and brass plaques.

4.9 The proposed design of the cemetery expansion and associated works are considered to be sensitive and respectful of the heritage item and the nature of the site itself. It allows for visual and physical connection between the old and new parts of the cemetery, without attempting to mimic or pastiche the historic elements.

4.10 It is also compliant with the National Cemetery Administration (NCF) Facility Design Guide which aims to respect the important heritage context of the site and provide a complementary setting for St Bartholomew's Church and Cemetery and provide an accessible and operable solution that meets the needs of the Cemetery as a standalone development and an integrated component of the future masterplan for cemetery expansion.

4.11 The Stage 1A development is considered to have its own character which integrates well with the existing site, and will contribute to the future expansion of the cemetery to the east (subject to current Planning Proposal).

4.12 The impact on views to and from the site has been considered above. The overall visual impact is considered to be beneficial as it will reactive the existing graveyard whilst sensitively maintaining existing graves, provide updated and appropriate planting and introduce additional parking in a manner which is appropriate to the setting.

Landscaping

4.13 The proposed planting will respect the historic setting of the place and be responsive to the existing broader context and open space character.

4.14 Generally, the planting proposal for the project will respect the 19th Century period plantings associated with the church and also respond to the existing broader context and open landscape character of the site.

4.15 Scattered native trees will be positioned along the new access road, St Bartholomew's Place and along the northern boundary to maintain an informal and open character and to tie in with the existing landscaping.

4.16 Boundary planting along Ponds Road will include native species of the Cumberland Plane Woodland plant community, including shrubs, grasses, groundcovers as well as scattered native trees.

4.17 Buffer planting between terraces and the existing cemetery will be low level for physical separation without interrupting view lines, yet establishing a clear definition between old and new. Species are proposed to be appropriate to the setting. Low level planting including native grasses and sedges are also proposed within the planted swales within the site.

4.18 The proposed landscaping introduces native species and helps to re-establish Cumberland Plan Woodland on the site. Low level planting helps to soften the appearance of the site, separate old and new, and assist with wayfinding to various paths, roads and ramps.

Trees and Ecology

4.19 The development does not requires the removal of substantial trees and is primarily confined to a cleared area within the subject site. However, given that there are large trees within the immediate vicinity an Arborist Report (prepared by Eco Logical, dated 3 December 2018) has been submitted with the application.

4.20 The report finds that adjacent to the eastern boundary of the site (and partially encroaching onto the site) is an area identified as Cumberland Plain Woodland (CPW). Two native trees are also just outside the western-most corner of the site.

4.21 The report identifies that the development may potentially impact on 2 x Eucalyptus moluccana trees of high retention value. However, these trees are not listed on Blacktown Council's Significant Tree Register. Nonetheless, the development proposes to retain these trees.

4.22 The report confirms that the proposed works do not trigger the threshold for the CPW Biodiversity Offset Scheme or the Biodiversity Assessment Methodology.

4.23 Overall, the report considers that the proposed works are unlikely to have a significant impact on any threatened tree species or on the biodiversity values present within the study area.

4.24 The development has been reviewed by Council's Natural Areas (Ecology) Section who raise no concern with the development subject to conditions of consent to include the above recommendations.

Wayfinding

4.25 It is anticipated that sensitive wayfinding and signage will be coordinated with Council's current signage and branding strategy. Signage will be located so as not to detract from the heritage significance of the place, will generally be at low level or such that it will not interfere with important sightlines.

Accessibility

4.26 The development proposes the following accessibility measures:

- Minimal ramp gradient
- Provision of 2 x disabled car parking spaces. 1 x at the base of the terraced area and 1x at the southern side of the new access road.
- Provision of an accessible path at the eastern end of the new access road for access to the columbariums.
- A maximum distance of 50m from an access road to any grave site.

5 Traffic, Access and Parking

Traffic generation

5.1 The development proposes the construction of an internal road to link the existing access point to the cemetery off Ponds Road (being the driveway adjacent to the church) and St Bartholomew's Road. As part of the development, upgrade works to St Bartholomew's Road will also take place including a new turning head, general road resurfacing works, and kerb replacements to bring it to Australian Standards.

5.2 A Transport Impact Assessment (prepared by GTA Consultants, dated 3 December 2018) is submitted with the application. The report considers the potential impact of the development during construction and the ongoing traffic generation upon completion and operation.

5.3 The Roads and Maritime Guide to Traffic Generating Development (2002) does not include traffic generation rates for cemeteries. Therefore, the assessment makes use of traffic generation based on surveys of a similar cemetery in Liverpool where were used to support the Planning Proposal at the adjoining site.

5.4 Based on this, the development is expected to generate between three to eight vehicle trips per hour in any morning or afternoon peak period. However, peak activity specifically associated with the cemetery is likely to be outside of the standard morning and afternoon peak periods. It is therefore expected that a maximum of 13 vehicle trips per hour can be expected during any peak cemetery period.

5.5 The assessment concludes that the expansion of the cemetery is not expected to adversely affect the surrounding transport network and traffic generation from the development will be low.

Parking rates

5.6 The Roads and Maritime Guide and the DCP do not provide specific parking rates for cemeteries.

5.7 However, as noted above surveys of a similar cemetery in Liverpool have guided the proposed rates for this cemetery.

5.8 Formalised parallel parking will be utilised on the internal service road (42 spaces) with overflow parking available on St Bartholomew's Road (26 spaces). Capacity for a hearse (and other vehicles) plus a drop-off/ pick up space also form part of the development.

5.9 The Transport Impact Assessment submitted with the application indicates that the proposed parking provision will be able to accommodate the anticipated parking demand associated with the application.

Construction traffic

5.10 During construction there will be approximately 44 truck movements per day (5-10 trucks per hour during peak construction times) to import the proposed fill. The Transport Impact Assessment states that construction hours are proposed as follows:

Monday – Friday: 7am-4pm

Saturday: 7am-1pm

Sunday/Public Holiday: No work

5.11 Construction is expected to last for 5 months for bulk earth works, followed by delivery of the project over a number of years.

5.12 Construction vehicles will enter the site from St Bartholomew's Place off Ponds Road from the Great Western Highway. The proposed fill will be taken from another Council project on Warwick Lane in Blacktown CBD. Therefore the majority of truck movements will be between Warwick Lane and the site. Designated routes have been identified which minimise impacts on local roads. Trucks will be restricted to these designated routes.

5.13 For any other origins or destinations aside from Warwick Lane for construction traffic, the site's location between the Great Western Highway and M4 will assist to contain movement to the arterial road network.

5.14 It is anticipated that there will be a maximum of 15-20 workers on-site throughout construction. On-site worker parking is proposed at the southern end of St Bartholomew's Place. Given the construction hours, workers tend to arrive outside of the road network peak hours. Therefore the impact of construction worker movement on the existing road network will be minimal.

6 Site remediation, fill, drainage and hydrology

Remediation

6.1 The application is accompanied by a Preliminary Site Investigation (PSI), a Detailed Site Investigation (DSI) report and a Soil Management Plan (SMP).

6.2 The PSI concluded that there is a low-moderate potential for contamination to exist as a result of current and historical activities. The DSI identified concentrations of zinc and nickel in some samples which were greater than the Adopted Site Criteria, all other results were below the Adopted Site Criteria. However, it was considered that the risk of these concentrations posing a threat to surrounding ecological receptors was low.

6.3 Deposits of asbestos were also identified. However, it was considered that identified contamination does not preclude the proposed site use or the proposed development application, subject to an Asbestos Management Plan with unexpected finds protocol (which will be subject to condition of consent).

Fill

6.4 In order to provide level burial lots on the steeply sloping site approximately 26,400m^3 of imported fill will be required. The fill is proposed to be imported from a Council development site on Warwick Lane, within the Blacktown CBD.

6.5 A Soil Management Plan (prepared by Prensa, dated November 2018) has been prepared to outline the controls and management requirements for the importation of soil from the Warwick Lane Precinct to mitigate the potential human and ecological health risks during construction works. Measures for the management of soil, sediment and erosion, and contaminated soil have been outlined within the plan.

6.6 In accordance with the SMP imported fill material from the Warwick Lane site will be classified as virgin excavated natural material (VENM) or excavated natural material (ENM), and verified at the source and upon importation by a suitably qualified environmental consultant. This will be subject to appropriate conditions of consent and will ensure there is no contamination of imported fill material.

Drainage

6.7 There is no formalised stormwater infrastructure located within the site. Runoff drains overland until it reaches the low point of the site, located in the north eastern corner.

6.8 Currently, the water collects in the low point before leaving the site via a pipe beneath Ponds Rd, where it discharges into a localised depression located between Ponds Rd and the Great Western Highway. The land containing the localized depression is owned by Council. From there, stormwater is discharged via an existing outlet pipe located on the eastern side of the basin.

6.9 A flood study has been prepared for the site, which demonstrates no major collection of floodwater within the site boundary in storm events up to the 100-yr ARI event. It is noted

that the flood study was conducted prior to receiving survey information pertaining to the discharge pipes; therefore, the study acts as an overland flooding model. However, it is not expected that the inclusion of pipes would create new site inundation.

6.10 Blacktown City Council flood maps indicate that the site is located within the Upper Parramatta River Catchment (UPRC), with stormwater collected in tributaries located upstream of the Parramatta River.

6.11 The proposed development will alter the existing levels as imported material will infill sloping areas and depressions for the new cemetery facilities. However, the stormwater catchment boundaries will remain largely the same as the existing conditions, including reusing the same stormwater outlet locations.

6.12 The proposed landform shall generally drain towards eastern boundary of the site. Swales will collect water initiating from burial lawns, while a pit and pipe network will collect water from the new access road. All runoff will be directed to a swale running adjacent to St Bartholomew's Place, which will connect to the existing discharge pipe and will drain beneath of Ponds Rd to a proposed On-Site Detention Basin on the adjoining land between Ponds Road and the Great Western Highway.

6.13 The proposed drainage is designed to accommodate the 5-year ARI storm event, while the combined swale/pipe and overland flow is designed to accommodate the100-year ARI storm event.

6.14 St Bartholomew's Cemetery is located within the Upper Parramatta River Catchment (UPRC); as such, it is subject to the Upper Parramatta River Catchment Trust (UPRCT) OSD requirements as a part of Blacktown City Council requirements. These requirements aim to ensure that reduced flood storage space will not impact negatively upon downstream flows.

6.15 The principles of the existing arrangement, whereby the site drains into the localised depression on adjoining land to the north between Ponds Road and the Great Western Highway. It is therefore proposed to construct an OSD basin on the adjoining land in the localised depression to contain increased flows from the site caused by reduced flood storage space within the application site as a result of the development.

6.16 The proposed OSD basin will meet the UPRCT volume and discharge flow rate requirements. This will improve the existing scenario by constricting flow originating from the site into Council's stormwater network.

6.17 Stormwater is also currently collected upstream of the proposed OSD basin within the land between Ponds Road and the Great Western Highway. These flows are outside of the development site's OSD requirement, therefore they will be diverted away from the proposed OSD basin and into the existing concrete dish drains (located around the edge of the localised depression), before being discharged through the existing stormwater outlet. This will ensure these upstream runoffs, outside of the application site, bypass the proposed OSD tank. In essence this will match the existing site runoff conditions with no significant adverse effects.

6.18 Following discussions with Blacktown City Council's Asset Design Team it was agreed that only the road runoff will be treated for Water Sensitive Urban Design (WSUD).

6.19 WSUD reduction targets will be met through the use of raingardens (bio-retention basin/swales) adjacent to the access roadway, prior to water discharging into the site wide drainage swales. It is intended that a rain garden be located at each of the roadway stormwater collection points, with the specific size of these gardens based upon the roadway area draining to the gardens. The raingardens will be designed in accordance with the Blacktown Council Developer Handbook for Water Sensitive Urban Design

6.20 An erosion and sediment control plan has been submitted with the application which appropriately manages erosion and sediment from the site.

6.21 Diversion banks and channels with rock check dams surround the majority of the site perimeter, directing flows to one sediment basin. The sediment basin will treat eroded soils captured across the site during rainfall events. An intermediate diversion bank shall be placed through the centre of the site to reduce the length of the water flow across the site. Sediment fences will be placed around the development site as a final measure to prevent untreated stormwater from leaving the site.

Hydrology

6.22 A Hydrology Report has been carried out by Arup. The report states that the development is unlikely to be characterised as an activity that will interfere with the aquifer, for the following reasons:

- The surface works will not penetrate the regional aquifer as it is located substantially deeper than the proposed site;
- The fill material proposed to be used on the site has similar properties to the underlying geology. When compacted it is not anticipated that the material wall affect rainfall infiltration into the regional aquifer, regardless of this, the site is not large enough in extent to impact on regional groundwater infiltration. The fill material is unlikely to become a groundwater store that could be described as an aquifer; and
- The fill material has not been characterised as contaminated and the salinity of the soil has been described as moderate. These are similar characteristics to the residual soil on site.

6.23 The hydrology report also identifies there are no foreseen risks to any potential water source users identified or the groundwater environment as a result of the redevelopment.

6.24 The report concludes that the proposed works are not anticipated to impact on the underlying hydrogeological regime beneath the project site or on surrounding assets. The groundwater related risks to the project can be categorised as low.

6.25 A geotechnical Investigation has been prepared by Geotechnique. Results of the investigation indicate that the geotechnical conditions across the site for Stage 1A cemetery expansion do not impose any geotechnical constraints, and the report includes geotechnical recommendations for the proposed fill/ earthworks and design and construction of roads and other structures. It also finds that future excavations for graves will be up to approximately 2.1m deep and excavations will occur predominantly in filled materials. Therefore, groundwater is unlikely to adversely impact on the proposed cemetery expansion works.

Sydney Drinking Water Catchment

6.26 The SEPP (Sydney Drinking Water Catchment) 2011 commenced on 1 March 2011. It has three main aims, which are:

- To provide for healthy water catchments that will deliver high quality water and permit development that is compatible with that goal
- To ensure that consent authorities only allow proposed developments that have a neutral or beneficial effect on water quality
- To support water quality objectives in the Sydney drinking water catchment

6.27 The SEPP contains detailed maps showing the location and boundaries of Sydney's drinking water catchment. The application site is not identified on any of the applicable maps. The Sydney drinking water catchment area, as it pertains to the application site, does extend further east than Warragamba (as shown on map SDWC_13). Warragamba is approximately 30km south west of the application site. The SEPP map SDWC_13 shows a wider context (which is not within the catchment area), but does not display locations eastward beyond Doonside Road, which is approximately 3.7km west of the application site.

6.28 To further support that the site is not within the Sydney drinking water catchment, Water NSW has produced a map showing the catchment area in a broader context, this is shown at Figure 3 below:

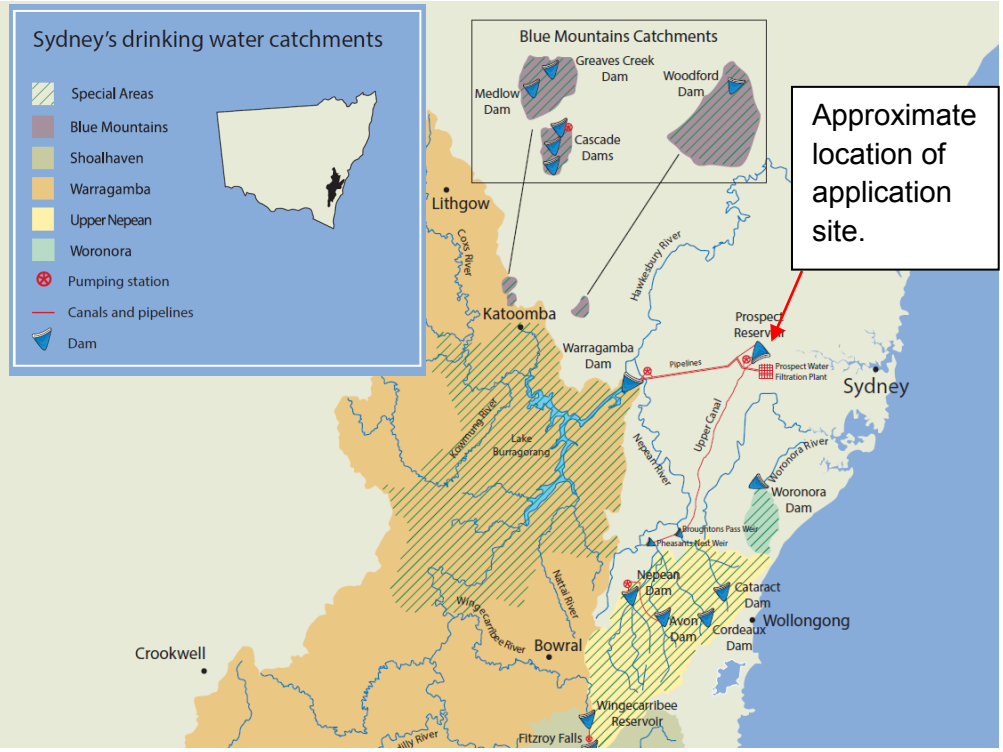

Figure 3: Water NSW Sydney Water Catchment Map (Source: WaterNSW)

6.29 The site is not within any of the identified water catchment zones on the WaterNSW map. Whilst it is near the Prospect Reservoir there is no drainage from the site toward the reservoir.

6.30 There is a ridge demarcated by Reservoir Road which separates the cemetery and the reservoir. The cemetery is approximately 650m away Reservoir Road and it drains away from the reservoir.

World Health Organisation (WHO) – Research Paper on "The Impact of Cemeteries on the Environment and Public Health" 1998

6.31 The World Health Organisation (WHO) has published a research paper on "The impact of cemeteries on the environment and public health". The paper undertook a review of the current state of knowledge regarding the presence or absence of soil and groundwater contamination from cemeteries. The paper identifies key geological and hydro geological properties on sites suitable for development as a cemetery as well as recommending draft requirements which could be used to site and design a future well managed cemetery.

6.32 It is important to highlight that the World Health Organisation document is not endorsed by regulatory authorities in NSW. It should therefore not be given the weight of a statutory planning document or a default set of standards for assessing the potential impact of a cemetery development on groundwater and surface flows. These impacts should be assessed by undertaking site specific detailed assessments of the proposed development. The assessments provided are considered sufficient to demonstrate no adverse impact on the surface water, ground water or other hydrological conditions of the site.

Geological properties of cemeteries

6.33 Geological properties are identified as crucial in preventing contamination of soils and groundwater as a result of decomposing bodies in cemeteries. It is further noted that the

unsaturated soil layer in cemeteries is the most important line of defence against the transport of degradation products into aquifers as the soil acts as both a filter and absorbent. It is postulated that the most useful soil type to maximize retention of degradation products is a clay-sand mix of low porosity, and a small to fine grain texture.

6.34 In consideration of the above, the paper suggests that in selecting a suitable site for a cemetery, the site should have a soil that have strong absorbance characteristics to remove degradation products from seepage water and so to minimise the impact of cemeteries on local ground water.

6.35 The submitted Geotechnical Report indicates that the sub-surface profile across the site comprises a sequence of topsoil/fill and residual soil underlain by bedrock. It states the subsurface materials may generally be described as follows:

- Topsoil/Fill: Silty Clay, low plasticity, brown, with roots
- Residual Soil: Silty Clay, medium to high medium to high plasticity, orange, brown, moisture content lower than or equal to plastic limit, stiff to very stiff up to depth of about 1.0m and hard at depths exceeding about 1.0m, with ironstone at depths exceeding about 1.0m
- Bedrock: Shale, grey extremely weathered to fresh, very low to low strength.

6.36 The report finds that groundwater was not encountered up to test pit termination depth of 1.5m to 2.5m from the existing ground surface. Based on observations from test pits, it is considered that the depth to groundwater level across the site is likely to be in excess of 2.5m from existing ground surface. The Hydrological Report submitted provides more detail stating that the regional water table is likely located at substantial depth (more than 10m below ground level) and other boreholes located more regionally indicate that this is likely true at the project site.

6.37 The Hydrological Report also states that the fill material proposed to be placed on the site is similar in material properties to the underlying geology that is primarily made up of clay with traces of silt, sand and gravel. When the fill material is compacted it is not anticipated the material will affect rainfall infiltration into the regional aquifer, the project site is not large enough in extent regardless to impact on regional groundwater infiltration. The fill material is unlikely to become a groundwater store that could be described as an aquifer.

6.38 The Geological Report concludes that the conditions across the site for the cemetery expansion do not impose any geotechnical constraints. The filled site will be suitable for excavation of up to about 2.1m deep graves. The Hydrological Report concludes that it is not anticipated that the works will impact on the underlying hydrogeological regime beneath the project site or surrounding assets. The groundwater related risks to the project can be categorised as low.

6.39 The idea of providing cemeteries with buffer zones is consistent with well-established planning practices for landfill sites and hazardous industries where the opportunity for off-site migration of pollutants and contaminants is higher.

6.40 The WHO research paper finds that the hydro geological properties of a cemetery should allow for a minimum 1m separation between burial bases and groundwater levels to minimise seepage and allow for a sufficient soil buffer to allow for a natural breakdown and absorption of seepage and contaminants released from deceased bodies.

Recommendations within the WHO paper

6.41 WHO paper concludes that the pollution potential for cemeteries is present but in a well-managed cemetery with suitable soil conditions and drainage arrangements the risk is probably slight. On this basis, the paper provided a number of recommendations that could be used in determining the suitability of the site and the design of a proposed cemetery.

WHO Recommended	Provided	Complies?

Condition		
1. Human or animal remains must not be buried within 250m metres of any well, borehole or spring from which a potable water supply is drawn.	As documented within the hydrogeologist review of the site, the closest well, borehole, or spring is 700m SSE of the project site. Therefore, this recommendation has been satisfied.	Yes
2. The place of interment should be at least 30m away from any other spring or watercourse and at least 10m away from any field drain	No natural springs or formalised watercourses exist on the site. A drainage swale is proposed to the southern side of the roadway between the existing and proposed cemetery. Both existing graves and proposed graves within this area will be within the recommended 10m separation. The proposed graves are separated by approximately 3.5m, while the existing graves are separated by approximately 3.0m.	No, see discussion below
3. All burial pits on the site must maintain a minimum of one metre of subsoil below the bottom of the burial pit (i.e. the base of the burial must be at least one metre above solid rock).	In the area north of the roadway, it is intended to raise site levels by between 2.0 to 6.5m. In this area, the existing rock level is approximately greater than 2.5m below the existing surface; therefore, the proposed site levels will site >4.5m above the beneath rock layer. Because burial plots are expected to be 2.1m deep, a sufficient layer of subsoil will be retained for this area. In the terraced areas to the west of the internal road, the existing rock level is approximately 1.5m beneath the existing surface. The proposed design reduces the site levels by approximately 400mm, leaving 1.1m from ground level to the shale rock below meaning that the one metre separation below the bottom of the burial pit and ground	No, see discussion below

	rock cannot be achieved in this area.	
4. The base of all burial pits on the site must maintain a minimum of one metre clearance above the highest natural water table. (Any variability in the water table should be taken into account.)	The water table beneath the site is >10m deep. Additionally, filling works will occur around the site, which will further increase the depth of the water table. Therefore, this recommendation has been satisfied.	Yes
5. Burial excavations should be backfilled as soon as the remains are interred, providing a minimum of one metre soil cover at the surface.	The timing of backfilling is a function of the cemetery operation plan. As such, this risk shall be mitigated through an operation plan or condition that requires backfilling of graves as soon as possible. Therefore, this recommendation can be satisfied.	Yes, subject to condition

WHO Condition 2 – Discussion

6.42 As noted above, existing and proposed graves are within 10m of a drainage swale.

6.43 It should be recognised that 26 proposed graves are to be separated by two retaining walls. The retaining walls should reduce the flow of groundwater towards the swale. The retaining will act as a barrier and will reduce the flow of groundwater towards the swale. Additionally, the surface flows above these graves will drain towards the roadway and not towards the proposed swale. Thus, the location of these graves is not expected to contaminate the groundwater and surface water flows into the swale.

6.44 Regarding the existing graves, a study by the European Society of Clinical Investigation 2018 indicated that it commonly takes 10 to 12 years for a human body to fully decompose. Within this time up to 50% of contaminants will be exuded in the first year. The remaining half will be exuded in the following 10 years or so.

6.45 The existing graves were first dug in 1840. Internment rights ceased to be sold in 1972 and since then burials have slowed considerably. In the last 3 years no more than 10 burials have taken place across the whole cemetery.

6.46 It is therefore considered that the majority of bodies within the cemetery will have completely decomposed and any potential pollution impacts will have passed.

6.47 As illustrated in the above table the proposal generally complies with the recommendations contained within the WHO paper in relation to site recommendations and cemetery design and layout requirements.

WHO Condition 3 – Discussion

6.47.1 The depth of the bedrock from the base of the grave is likely to be less than the 1m WHO recommendation at the terrace sites as the bedrock is shallow in this location. Nonetheless, the wider suite of information provided in the form of the hydrological and geological report, which are specific to this site, do not identify any concerns with the proposed cemetery expansion and its impact on the groundwater flow or aquifer.

6.47.2 It should be noted that the Geotechnical Report confirms that shale forms the bedrock in this location. The report state that '*localised bedrock, if encountered, is assessed to be*

extremely weathered shale of very low to low strength'. Therefore, it is our assessment that the proposed excavation up to depth of 1.0m can be achieved using conventional earthmoving equipment such as excavators and dozers.

6.47.3 The WHO recommendations are not intended to replace or override site specific detailed reports, rather they provide generalised advice in a global context.

6.47.4 Where any graves are required to be less than the NSW Health Department's burial depth requirements (being generally no less than 900mm between the top of the coffin and the natural ground level) shallow graves are permitted.

6.47.5 Policy Direction (PD2013_045) allows for shallow burials where the distance from the top of the grave liner to the natural ground surface to be reduced to no less than 400mm.

6.47.6 Approval for this must be sought from the Director General or their delegate.

World Health Organisation (WHO) 1998, 'The Impact of Cemeteries on the Environment and Public Health – An Introductory Briefing'

6.48 The above document by the WHO is an introductory briefing. It is not a statutory document, a standard nor a guideline. Its purpose is to discuss the impact of cemeteries on the environment and public health. It does not assess environmental impacts of cemeteries in accordance with any of NSW's relevant legislation or assessment criteria.

6.49 The document suggests topics for future research including desirable minimal thickness of the unsaturated zone beneath cemeteries and the safe distances between aquifers and cemeteries in various geological and hydrological situation across the world.

6.50 It is not designed to replace detailed analysis and expert opinion in a site specific, NSW context. The document public in 1998 cannot be given the same weight as a standard or control within a Local Planning Instrument and it cannot override any NSW State wide policy documents. It can only be used a useful reference in the determination of the proposed cemetery expansion application.

7 Requirements of the NSW Health Department – Burial Depth

7.1 It is anticipated that the majority of graves will comply with the burial depth permitted by clause 64 of the Public Health Regulation 2012. This being the upper surface of the coffin must not be less than 900mm below the natural surface of the soil where it is buried.

7.2 Policy Direction (PD2013_045) allows for shallow burials where the distance from the top of the grave liner to the natural ground surface can be reduced to no less than 400mm.

7.3 Approval for this must be sought from the Director General or their delegate.

7.4 All necessary approvals will be obtained prior to any shallow burials taken place. A condition of consent will be added to this effect.